Full Circle

THE INDEPENDENT MAGAZINE FOR THE UBUNTU LINUX COMMUNITY

Python Special Edition

The Python Collection

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About Full Circle

Full Circle is a free, independent, magazine dedicated to the Ubuntu family of Linux operating systems. Each month, it contains helpful how-to articles and reader-submitted stories.

Full Circle also features a companion podcast, the Full Circle Podcast which covers the magazine, along with other news of interest.

Welcome to another Special Edition of Full Circle Magazine....

The Python Collection...

Here is a reprint of the Python series written by **Greg Walters**, Parts 1-60 from issues #27 through #102.

Please bear in mind the original publication date; current versions of hardware and software may differ from those illustrated, so check your hardware and software versions before attempting to emulate the tutorials in these special editions. You may have later versions of software installed or available in your distributions' repositories.

Enjoy!

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Program In Python - Part 1

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Among the many programming languages currently available, Python is one of the easiest to learn. Python was created in the late 1980's, and has matured greatly since then. It comes pre-installed with most Linux distributions, and is often one of the most overlooked when picking a language to learn. We'll deal with command-line programming in this article. In a future one, we'll play with GUI (Graphical User Interface) programming. Let's jump right in, creating a simple application.

Our First Program

Using a text editor such as gedit, let's type some code. Then we'll see what each line does and go from there.

Type the following 4 lines.

```
#!/usr/bin/env python

print 'Hello.  I am a python program.'

name = raw_input("What is your name? ")

print "Hello there, " + name + "!"
```

That's all there is to it. Save the file as hello.py wherever you would like. I'd suggest putting it in your home directory in a folder named python_examples. This simple example shows how easy it is to code in Python. Before we can run the program, we need to set it to be executable. Do this by typing

```
chmod +x hello.py
```

in the folder where you saved your python file. Now let's run the program.

```
greg@earth:~/python_examples$ ./hello.py

Hello.  I am a python program.

What is your name? Ferd Burphel

Hello there, Ferd Burphel!

greg@earth:~/python_examples$
```

That was simple. Now, let's look at what each line of the program does.

```
#!/usr/bin/env python
```

This line tells the system that this is a python program, and to use the default python interpreter to run the program.

```
print 'Hello. I am a python program.'
```

Simply put, this prints the first line "Hello. I am a python program." on the terminal.

```
name = raw_input("What is your name? ")
```

This one is a bit more complex. There are two parts to this line. The first is name =, and the second is raw_input("What is your name? "). We'll look at the second part first. The command raw_input will print out the prompt in the terminal ("What is your name? "), and then will wait for the user (you) to type something (followed by {Enter}). Now let's look at the first part: name =. This part of the command assigns a variable named "name". What's a variable? Think of a variable as a shoe-box. You can use a shoe-box to store things -- shoes, computer parts, papers, whatever. To the shoe-box, it doesn't really matter what's in there -- it's just stored there. In this case, it stores whatever you type. In the case of my entry, I typed Ferd Burphel. Python, in this instance, simply takes the input and stores it in the "name" shoe-box for use later in the program.

```
print "Hello there, " + name
+ "!"
```

Once again, we are using the print command to display something on the screen -- in this case, "Hello there, ", plus whatever is in the variable "name", and an exclamation point at the end. Here we are concatenating or putting together three pieces of information: "Hello there", information in the variable "name", and the exclamation point.

Now, let's take a moment to discuss things a bit more deeply before we work on our next example. Open a terminal window and type:

```
python
```

You should get something like this:

```
greg@earth:~/python_examples$
python

Python 2.5.2 (r252:60911, Oct
5 2008, 19:24:49)

[GCC 4.3.2] on linux2

Type "help", "copyright",
"credits" or "license" for
more information.

>>>
```

You are now in the python shell. From here, you can do a number of things, but let's see what we got before we go on. The first thing you should notice is the python version -- mine is 2.5.2. Next, you should notice a statement indicating that, for help, you should type "help" at the prompt. I'll let you do that on your own. Now type:

```
print 2+2
```

and press enter. You'll get back

```
>>> print 2+2
4
>>>
```

Notice that we typed the word "print" in lower case. What would happen if we typed "Print 2+2"? The response from the interpreter is this:

```
>>> Print 2+2
  File "<stdin>", line 1
    Print 2+2
            ^
SyntaxError: invalid syntax
>>>
```

That's because the word "print" is a known command, while "Print" is not. Case is very important in Python.

Now let's play with variables a bit more. Type:

```
var = 2+2
```

You'll see that nothing much happens except Python returns the ">>>" prompt. Nothing is wrong. What we told Python to do is create a variable (shoe-box) called var, and to stick into it the sum of "2+2". To see what var now holds, type:

```
print var
```

and press enter.

```
>>> print var
4
>>>
```

Now we can use var over and over again as the number 4, like this:

```
>>> print var * 2
8
>>>
```

If we type "print var" again we'll get this:

```
>>> print var
4
>>>
```

var hasn't changed. It's still the sum of 2+2, or 4.

This is, of course, simple programming for this beginner's tutorial. Complexity will increase in subsequent tutorials. But now let's look at some more examples of variables.

In the interpreter type:

```
>>> strng = 'The time has
come for all good men to come
to the aid of the party!'

>>> print strng

The time has come for all
good men to come to the aid
of the party!

>>>
```

You've created a variable named "strng" (short for string) containing the value 'The time has come for all good men to come to the aid of the party!'. From now on (as long as we are in this instance of the interpreter), our strng variable will be the same unless we change it. What happens if we try to multiply this variable by 4?

```
>>> print strng * 4

The time has come for all
good men to come to the aid
of the party!The time has
come for all good men to come
to the aid of the party!The
time has come for all good
men to come to the aid of the
party!The time has come for
all good men to come to the
aid of the party!

>>>
```

Well, that is not exactly what you would expect, is it? It printed the value of strng 4 times. Why? Well, the interpreter knew that strng was a string of characters, not a value. You can't perform math on a string.

What if we had a variable called s that contained '4', as in the following:

```
>>> s = '4'
>>> print s
4
```

It looks as though s contains the integer 4, but it doesn't. Instead it contains a string representation of 4. So, if we type 'print s * 4' we get...

```
>>> print s*4
4444
>>>
```

Once again, the interpreter knows that s is a string, not a numerical value. It knows this because we enclosed the number 4 with single quotes, making it a string.

We can prove this by typing print type(s) to see what the system thinks that variable type is.

```
>>> print type(s)
<type 'str'>
>>>
```

Confirmation. It's a string type. If we want to use this as a numerical value, we could do the following:

```
>>> print int(s) * 4
16
>>>
```

The string (s), which is '4', has now been converted to an integer and then multiplied by 4 to give 16.

You have now been introduced to the print command, the raw_input command, assigning variables, and the difference between strings and integers.

Let's go a bit further. In the Python Interpreter, type quit() to exit back to the command prompt.

Simple For Loop

Now, let's explore a simple programming loop. Go back to the text editor and type the following program.

```
#! /usr/bin/env python

for cntr in range(0,10):

    print cntr
```

Be sure to tab the "print cntr" line. This is important. Python doesn't use parentheses "(" or curly braces "{" as do other programming languages to show code blocks. It uses indentations instead.

Save the program as "for_loop.py". Before we try to run this, let's talk about what a for loop is.

A loop is some code that does a specified instruction, or set of instructions, a number of times. In the case of our program, we loop 10 times, printing the value of the variable cntr (short for counter). So the command in plain English is "assign the variable cntr 0, loop 10 times printing the variable cntr contents, add one to cntr and do it all over again. Seems simple enough. The part of the code "range(0,10)" says start with 0, loop until the value of cntr is 10, and quit.

Now, as before, do a

```
chmod +x for_loop.py
```

and run the program with

```
./for_loop.py
```

in a terminal.

```
greg@earth:~/python_examples$
./for_loop.py
0
1
```

```
2
3
4
5
6
7
8
9
greg@earth:~/python_examples
$
```

Well, that seems to have worked, but why does it count up to only 9 and then stop. Look at the output again. There are 10 numbers printed, starting with 0 and ending with 9. That's what we asked it to do -- print the value of cntr 10 times, adding one to the variable each time, and quit as soon as the value is 10.

Now you can see that, while programming can be simple, it can also be complex, and you have to be sure of what you ask the system to do. If you changed the range statement to be "range(1,10)", it would start counting at 1, but end at 9, since as soon as cntr is 10, the loop quits. So to get it to print "1,2,3,4,5,6,7,8,9,10", we should use range(1,11) - since the for loop quits as soon as the upper range number is reached.

Also notice the syntax of the statement. It is "for variable in range(start value,end value):" The ":" says, we are starting a block of code below that should be indented. It is very important that you remember the colon ":", and to indent the code until the block is finished.

If we modified our program to be like this:

```
#! /usr/bin/env python

for cntr in range(1,11):

    print cntr

print 'All Done'
```

We would get an output of...

```
greg@earth:~/python_examples$
./for_loop.py
1
2
3
4
5
6
7
8
9
10
All Done
greg@earth:~/python_examples$
```

Make sure your indentation is correct. Remember, indentation shows the block formatting. We will get into more block indentation thoughts in our next tutorial.

That's about all for this time. Next time we'll recap and move forward with more python programming instructions. In the meantime, you might want to consider installing a python specific editor like Dr. Python, or SPE (Stani's Python Editor), both of which are available through Synaptic.

Greg Walters is owner of *RainyDay Solutions, LLC*, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family.

Program In Python - Part 2

SEE ALSO:
FCM#27 - Python Part 1

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Correction To Part1
I received an email from David Turner who suggested that using the Tab-key for indentation of code is somewhat misleading as some editors may use more, or less, than four spaces per indent. This is correct. Many Python programmers (myself included) save time by setting the tab key in their editor to four spaces. The problem is, however, that someone else's editor may not have the same setting as yours, which could lead to ugly code and other problems. So, get into the habit of using spaces rather than the Tab-key.

In the last installment, we looked at a simple program using raw_input to get a response from the user, some simple variable types, and a simple loop using the "for" statement. In this installment, we will delve more into variables, and write a few more programs.

LISTS

Let's look at another type of variable called lists. In other languages, a list would be considered an array. Going back to the analogy of shoe-boxes, an array (or list) would be a number of boxes all glued side-by-side holding like items. For example, we could store forks in one box, knives in another, and spoons in another. Let's look at a simple list. An easy one to picture would be a list of month names. We would code it like this...

```
months = ['Jan','Feb','Mar','Apr','May','Jun','Jul','Aug','Sep','Oct','Nov','Dec']
```

To create the list, we bracket all the values with square brackets ('[' and ']'). We have named our list 'months'. To use it, we would say something like print months[0] or months[1] (which would print 'Jan' or 'Feb'). Remember that we always count from zero. To find the length of the list, we can use:

```
print len(months)
```

which returns 12.

Another example of a list would be categories in a cookbook. For example...

```
categories = ['Main dish','Meat','Fish','Soup','Cookies']
```

Then categories[0] would be 'Main dish', and categories[4] would be 'Cookies'. Pretty simple again. I'm sure you can think of many things that you can use a list for.

Up to now, we have created a list using strings as the information. You can also create a list using integers. Looking back at our months list, we could create a list containing the number of days in each one:

```
DaysInMonth = [31,28,31,30,31,30,31,31,30,31,30,31]
```

If we were to print DaysInMonth[1] (for February) we would get back 28, which is an integer. Notice that I made the list name DaysInMonth. Just as easily, I could have used 'daysinmonth' or just 'X'... but that is not quite so easy to read. Good programming practices suggest (and this is subject to interpretation) that the variable names are easy to understand. We'll get into the whys of this later on. We'll play with lists some more in a little while.

Before we get to our next sample program, let's look at a few other things about Python.

More on Strings

We briefly discussed strings in Part 1. Let's look at string a bit closer. A string is a series of characters. Not much more than that. In fact, you can look at a string as an array of characters. For example if we assign the string 'The time has come' to a variable named strng, and then wanted to know what the second character would be, we could type:

```
strng = 'The time has come'
print strng[1]
```

The result would be 'h'. Remember we always count from 0, so the first character would be [0], the second would be [1], the third would be [2], and so on. If we want to find the characters starting at position 4 and going through position 8, we could say:

```
print strng[4:8]
```

which returns 'time'. Like our for loop in part 1, the counting stops at 8, but does not return the 8th character, which would be the space after 'time'.

We can find out how long our string is by using the len() function:

```
print len(strng)
```

which returns 17. If we want to find out where in our string the word 'time' is, we could use

```
pos = strng.find('time')
```

Now, the variable pos (short for position) contains 4, saying that 'time' starts at position 4 in our string. If we asked the find function to find a word or sequence that doesn't exist in the string like this:

```
pos = strng.find('apples')
```

the returned value in pos would be -1.

We can also get each separate word in the string by using the split command. We will split (or break) the string at each space character by using:

```
print strng.split(' ')
```

which returns a list containing ['The', 'time', 'has', 'come']. This is very powerful stuff. There are many other built-in string functions, which we'll be using later on.

Literal Substitution

There is one other thing that I will introduce before we get to our next programming example. When we want to print something that includes literal text as well as variable text, we can use what's called Variable Substitution. To do this is rather simple. If we want to substitute a string, we use '%s' and then tell Python what to substitute. For example, to print a month from our list above, we can use:

```
print 'Month = %s' % month[0]
```

This would print 'Month = Jan'. If we want to substitute an integer, we use '%d'. Look at the example below:

```
Months =
['Jan','Feb','Mar','Apr','May
','Jun','Jul','Aug','Sep','Oc
t','Nov','Dec']
DaysInMonth =
[31,28,31,30,31,30,31,31,30,3
1,30,31]
for cntr in range(0,12):
    print '%s has %d days.'
%
(Months[cntr],DaysInMonth[cnt
r])
```

The result from this code is:

```
Jan has 31 days.
Feb has 28 days.
Mar has 31 days.
Apr has 30 days.
May has 31 days.
Jun has 30 days.
Jul has 31 days.
Aug has 31 days.
Sep has 30 days.
Oct has 31 days.
Nov has 30 days.
Dec has 31 days.
```

Something important to understand here is the use of single quotes and double quotes. If you assign a variable to a string like this:

```
st = 'The time has come'
```

or like this:

```
st = “The time has come”
```

the result is the same. However, if you need to include a single quote in the string like this:

```
st = 'He said he's on his
way'
```

you will get a syntax error. You need to assign it like this:

```
st = "He said he's on his
way"
```

Think of it this way. To define a string, you must enclose it in some kind of quotes ! one at the beginning, and one at the end ! and they must match. If you need to mix quotes, use the outer quotes to be the ones that aren't in the string as above. You might ask, what if I need to define a string like "She said "Don't Worry""? In this case, you could define it this way:

```
st = 'She said "Don\'t
Worry"'
```

Notice the backslash before the single quote in 'Don't'. This is called an escape character, and tells Python to print the (in this case) single-quote ! without considering it as a string delimiter. Other escape character sequences (to show just a few) would be '\n' for new line, and '\t' for tab. We'll deal with these in later sample code.

Assignment verses Equate

We need to learn a few more things to be able to do our next example. First is the difference between assignment and equate. We've used the assignment many times in our samples. When we want to assign a value to a variable, we use the assignment operator or the '=' (equal sign):

```
variable = value
```

However, when we want to evaluate a variable to a value, we must use a comparison operator. Let's say we want to check to see if a variable is equal to a specific value. We would use the '==' (two equal signs):

```
variable == value
```

So, if we have a variable named loop and we want to see if it is equal to, say, 12, we would use:

```
if loop == 12:
```

Don't worry about the if and the colon shown in the example above yet. Just remember we have to use the double-equal sign to do evaluation.

Comments

The next thing we need to discuss is comments. Comments are important for many things. Not only do they give you or someone else an idea of what you are trying to do, but when you come back to your code, say 6 months from now, you can be reminded of what you were trying to do. When you start writing many programs, this will become important. Comments also allow you to make Python ignore certain lines of code. To comment a line you use the '#' sign. For example:

```
# This is a comment
```

You can put comments anywhere on a code line, but remember when you do, Python will ignore anything after the '#'.

If statements

Now we will return to the "if" statement we showed briefly above. When we want to make a decision based on values of things, we can use the if statement:

```
if loop == 12:
```

This will check the variable 'loop', and, if the value is 12, then we do whatever is in the indented block below. Many times this will be sufficient, but, what if we want to say If a variable is something, then do this, otherwise do that. In pseudo code you could say:

```
if x == y then
     do something
else
     do something else
```

and in Python we would say:

```
if x == y:
     do something
else:
     do something else
     more things to do
```

The main things to remember here are:

1. End the if or else statements

with a colon.

2. INDENT your code lines.

Assuming you have more than one thing to check, you can use the if/elif/else format. For example:

```
x = 5
if x == 1:
      print 'X is 1'
elif x < 6:
      print 'X is less than
6'
elif x < 10:
      print 'X is less than
10'
else:
      print 'X is 10 or
greater'
```

Notice that we are using the '<' operator to see if x is LESS THAN certain values - in this case 6 or 10. Other common comparison operators would be greater than '>', less than or equal to '<=', greater than or equal to '>=', and not equal '!='.

While statements

Finally, we'll look at a simple example of the while statement. The while statement allows you to create a loop doing a series of steps over and over, until a specific threshold has been reached. A simple example would be assigning a variable “loop” to 1. Then while the loop variable is less than or equal to 10, print the value of loop, add one to it and continue, until, when loop is greater than 10, quit:

```
loop = 1
while loop <= 10:
      print loop
      loop = loop + 1
```

run in a terminal would produce the following output:

```
1
2
3
4
5
6
7
8
9
10
```

This is exactly what we wanted to see. Fig.1 (above right) is a similar example that is a bit more complicated, but still simple.

```
loop = 1
while loop == 1:
      response = raw_input("Enter something or 'quit' to end => ")
      if response == 'quit':
            print 'quitting'
            loop = 0
      else:
            print 'You typed %s' % response
```

FIG. 1

In this example, we are combining the if statement, while loop, raw_input statement, newline escape sequence, assignment operator, and comparison operator ! all in one 8 line program.

Running this example would produce:

```
Enter something or 'quit' to
end
 => FROG
You typed FROG
Enter something or 'quit' to
end
 => bird
You typed bird
Enter something or 'quit' to
end
 => 42
You typed 42
Enter something or 'quit' to
end
 => QUIT
You typed QUIT
Enter something or 'quit' to
end
 => quit
quitting
```

Notice that when we typed 'QUIT', the program did not stop. That's because we are evaluating the value of the response variable to 'quit' (response == 'quit'). 'QUIT' does NOT equal 'quit'.

One more quick example before we leave for this month. Let's say you want to check to see if a user is allowed to access your program. While this example is not the best way to do this task, it's a good way to show some things that we've already learned. Basically, we will ask the user for their name and a password, compare them with information that we coded inside the program, and then make a decision based on what we find. We will use two lists ! one to hold the allowed users and one to hold the passwords. Then we'll use raw_input to get the information from the user, and finally the if/elif/else statements to check and decide if the user is allowed. Remember, this is not the best way to do this. We'll examine other ways in later articles. Our code is shown in the box to the right.

Save this as 'password_test.py' and run it with various inputs.

The only thing that we haven't discussed yet is in the list checking routine starting with 'if usrname in users:'. What we are doing is checking to see if the user's name that was entered is in the list. If it is, we get the position of the user's name in the list users. Then we use users.index(usrname) to get the position in the users list so we can pull the password, stored at the same position in the passwords list. For example, John is at position 1 in the users list. His password, 'dog' is at position 1 of the passwords list. That way we can match the two. Should be pretty easy to understand at this point.

That's enough for this month. Next time, we'll be learning about functions and modules. Until then, play with what you've already learned and have fun.

```
#-----------------------------------------------
#password_test.py
#    example of if/else, lists, assignments,raw_input,
#    comments and evaluations
#-----------------------------------------------
# Assign the users and passwords
users = ['Fred','John','Steve','Ann','Mary']
passwords = ['access','dog','12345','kids','qwerty']
#-----------------------------------------------
# Get username and password
usrname = raw_input('Enter your username => ')
pwd  = raw_input('Enter your password => ')
#-----------------------------------------------
# Check to see if user is in the list
if usrname in users:
     position = users.index(usrname) #Get the position in the list of the users
     if pwd == passwords[position]:  #Find the password at position
          print 'Hi there, %s.  Access granted.' % usrname
     else:
          print 'Password incorrect.  Access denied.'
else:
     print "Sorry...I don't recognize you.  Access denied."
```

Greg Walters is owner of *RainyDay Solutions, LLC*, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family.

HOW-TO

Written by Greg Walters

Program In Python - Part 3

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In the last article, we learned about lists, literal substitution, comments, equate versus assignment, if statements and while statements. I promised you that in this part we would learn about modules and functions. So let's get started.

Modules

Modules are a way to extend your Python programming. You can create your own, or use those that come with Python, or use modules that others have created. Python itself comes with hundreds of various modules that make your programming easier. A list of the global modules that come with Python can be found at http://docs.python.org/modindex.html. Some modules are operating system specific, but most are totally cross platform (can be used the same way in Linux, Mac and Microsoft Windows). To be able to use an external module, you must import it into your program. One of the modules that comes with Python is called 'random'. This module allows you to generate pseudo-random numbers. We'll use the module shown above right in our first example.

```
#=======================================
# random_example.py
# Module example using the random module
#=======================================
import random
# print 14 random integers
for cntr in range(1,15):
    print random.randint(1,10)
```

Let's examine each line of code. The first four lines are comments. We discussed them in the last article. Line five tells Python to use the random module. We have to explicitly tell Python to do this.

Line seven sets up a 'for' loop to print 14 random numbers. Line eight uses the randint() function to print a random integer between 1 and 10. Notice we must tell Python what module the function comes from. We do this by saying (in this case) random.randint. Why even create modules? Well, if every possible function were included directly into Python, not only would Python become absolutely huge and slow, but bug fixing would be a nightmare. By using modules, we can segment the code into groups that are specific to a certain need. If, for example, you have no need to use database functionality, you don't need to know that there is a module for SQLite. However, when you need it, it's already there. (In fact, we'll be using database modules later on in this series.)

Once you really get started in Python programming, you will probably make your own modules so you can use the code you've already written over and over again, without having to re-type it. If you need to change something in that group of code, you can, with very little risk of breaking the code in your main program. There are limits to this and we will delve into this later on. Now, when we used the 'import random' statement earlier, we were telling Python to give us access to every function within the random module. If, however, we only needed to use the randint() function, we can re-work the import statement like this:

```
from random import randint
```

Now when we call our function, we don't have to use the 'random.' identifier. So, our code changes to

```
from random import randint
# print 14 random integers
for cntr in range(1,15):
     print randint(1,10)
```

Functions

When we imported the random module, we used the randint() function. A function is a block of code that is designed to be called, usually more than once, which makes it easier to maintain, and to keep us from typing the same code over and over and over. As a very general and gross statement, any time you have to write the same code more than once or twice, that code is a good candidate for a function. While the following two examples are silly, they make good statements about using functions. Let's say we wanted to take two numbers, add them, then multiply them, and then subtract them, displaying the numbers and results each time. To make matters worse, we have to do that three times with three sets of numbers. Our silly example would then look like the text shown right.

```
#silly example
print 'Adding the two numbers %d and %d = %d ' % (1,2,1+2)
print 'Multiplying the two numbers %d and %d = %d ' % (1,2,1*2)
print 'Subtracting the two numbers %d and %d = %d ' % (1,2,1-2)
print '\n'
print 'Adding the two numbers %d and %d = %d ' % (1,4,1+4)
print 'Multiplying the two numbers %d and %d = %d ' % (1,4,1*4)
print 'Subtracting the two numbers %d and %d = %d ' % (1,4,1-4)
print '\n'
print 'Adding the two numbers %d and %d = %d ' % (10,5,10+5)
print 'Multiplying the two numbers %d and %d = %d ' % (10,5,10*5)
print 'Subtracting the two numbers %d and %d = %d ' % (10,5,10-5)
print '\n'
```

Not only is this a lot of typing, it lends itself to errors, either by typing or having to change something later on. Instead, we are going to create a function called 'DoTwo' that takes the two numbers and does the math, printing the output each time. We start by using the 'def' key word (which says that we are going to define the function). After 'def' we add the name we select for the function, and then a list of parameters (if any) in parentheses. This line is then closed by a colon (:). The code in the function is indented. Our improved silly example (#2) is shown below.

As you can see, there's a lot less typing involved — 8 lines instead of 12 lines. If we need to change something in our function, we can do it without causing too many issues to our main program. We call our function, in this case, by using the function name and putting the parameters after.

Here is another example of a function. Consider the following requirements.

We want to create a

```
#silly example 2...still silly, but better
def DoTwo(num1,num2):
     print 'Adding the two numbers %d and %d = %d ' % (num1,num2,num1+num2)
     print 'Multiplying the two numbers %d and %d = %d ' % (num1,num2,num1*num2)
     print 'Subtracting the two numbers %d and %d = %d ' % (num1,num2,num1-num2)
     print '\n'

DoTwo(1,2)
DoTwo(1,4)
DoTwo(10,5)
```

program that will print out a list of purchased items in a pretty format. It must look something like the text below.

The cost of each item and for the total of all items will be formatted as dollars and cents. The width of the print out must be able to be variable. The values on the left and right must be variable as well. We will use 3 functions to do this task. One prints the top and bottom line, one prints the item detail lines including the total line and one prints the separator line. Luckily, there are a number of things that Python has that will make this very simple. If you recall, we printed a string multiplied by 4, and it returned four copies of the same string. Well we can use that to our benefit. To print our top or bottom line we can take the desired width, subtract two for the two + characters

```
'+===============================+'
'| Item 1                   X.XX |'
'| Item 2                   X.XX |'
'|-------------------------------|'
'| Total                    X.XX |'
'+===============================+'
```

and use " '=' * (width-2)". To make things even easier, we will use variable substitution to put all these items on one line. So our string to print would be coded as 's ('+',('=' * width-2)),'+'). Now we could have the routine print this directly, but we will use the return keyword to send the generated string back to our calling line. We'll call our function 'TopOrBottom' and the code for this function looks like this.

```
def TopOrBottom(width):
    # width is total width of returned line
    return '%s%s%s' % ('+',('=' * (width-2)),'+')
```

We could leave out the comment, but it's nice to be able to tell at a glance what the parameter 'width' is. To call it, we would say 'print TopOrBottom(40)' or whatever width we wish the line to be. Now we have one function that takes care of two of the lines. We can make a new function to take care of the separator line using the same kind of code...OR we could modify the function we just made to include a parameter for the character to use in the middle of the pluses. Let's do that. We can still call it TopOrBottom.

```
def TopOrBottom(character,width):
    # width is total width of returned line
    # character is the character to be placed between the '+' characters
    return '%s%s%s' % ('+',(character * (width-2)),'+')
```

Now, you can see where comments come in handy. Remember, we are returning the generated string, so we have to have something to receive it back when we make the call to it. Instead of assigning it to another string, we'll just print it. Here's the calling line.

```
print TopOrBottom('=',40)
```

So now, not only have we taken care of three of the lines, we've reduced the number of routines that we need from 3 down to 2. So we only have the center part of the print out to deal with.

Let's call the new function 'Fmt'. We'll pass it 4 parameter values as follows:

val1 – the value to print on the left
leftbit – the width of this "column"
val2 – the value to print on the right (which should be a floating value)
rightbit – the width of this "column"

The first task is to format the information for the right side. Since we want to format the value to represent dollars and cents, we can use a special function of variable substitution that says, print the value as a floating point number with n number of places to the right of the decimal point. The command would be '%2.f'. We will assign this to a variable called 'part2'. So our code line would be 'part2 = '%.2f' % val2'. We also can use a set of functions that's built into Python strings called ljust and rjust. Ljust will left justify the string, padding the right side with whatever character you want. Rjust does the same thing, except the padding goes on the left side. Now for the neat bit. Using substitutions we throw together a big string and return that to the calling code. Here is our next line.

```
return 'ss' % ('|
',val1.ljust(leftbit-2,'
'),part2.rjust(rightbit-2,'
'),' |')
```

While this looks rather daunting at first, let's dissect it and see just how easy it is:
Return - We will send back our created string to the calling code.
'ss' - We are going to stick in 4 values in the string. Each %s is a place holder.
% (- Starts the variable list
'| ', - Print these literals
val1.ljust(leftbit-2,' ') - Take the variable val1 that we were passed, left justify it with spaces for (leftbit-2) characters. We subtract 2 to allow the '| ' on the left side.
Part2.rjust(rightbit-2,' ') - Right justify the formatted string of the price rightbit-2 spaces. ' |' - finish the string.

That's all there is to it.

While we should really do some error checking, you can use that as something to play with on your own. So...our Fmt function is really only two lines of code outside of the definition line and any comments. We can call it like this.

```
print Fmt('Item
1',30,item1,10)
```

Again, we could assign the return value to another string, but we can just print it. Notice that we are sending 30 for the width of the left bit and 10 for the width of the right. That equals the 40 that we sent to our TopOrBottom routine earlier. So, fire up your editor and type in the code below.

Save the code as 'pprint1.py' and run it. Your output should look something like the text shown above right.

```
+======================================+
| Item 1                          3.00 |
| Item 2                         15.00 |
```

While this is a very simple example, it should give you a good idea of why and how to use functions. Now, let's extend this out a bit and learn

```
#pprint1.py
#Example of semi-useful functions

def TopOrBottom(character,width):
      # width is total width of returned line
      return '%s%s%s' % ('+',(character * (width-2)),'+')

def Fmt(val1,leftbit,val2,rightbit):
      # prints two values padded with spaces
      # val1 is thing to print on left, val2 is thing to print on right
      # leftbit is width of left portion, rightbit is width of right portion
      part2 = '%.2f' % val2
      return '%s%s%s%s' % ('| ',val1.ljust(leftbit-2,' '),part2.rjust(rightbit-2,' '),' |')
# Define the prices of each item
item1 = 3.00
item2 = 15.00
# Now print everything out...
print TopOrBottom('=',40)
print Fmt('Item 1',30,item1,10)
print Fmt('Item 2',30,item2,10)
print TopOrBottom('-',40)
print Fmt('Total',30,item1+item2,10)
print TopOrBottom('=',40)
```

more about lists. Remember back in part 2 when we first discussed lists? Well one thing that I didn't tell you is that a list can contain just about anything, including lists. Let's define a new list in our program called itms and fill it like this:

```
itms = [['Soda',1.45],['Candy',.75],['Bread',1.95],['Milk',2.59]]
```

If we were to access this as a normal list we would use print itms[0]. However, what we would get back is ['Soda',1.45], which is not really what we were looking for under normal circumstances. We want to access each item in that first list. So we would use 'print itms[0][0]' to get 'Soda' and [0][1] to get the cost or 1.45. So, now we have 4 items that have been purchased and we want to use that information in our pretty print routine. The only thing we have to change is at the bottom of the program. Save the last program as 'pprint2.py', then comment out the two itemx definitions and insert the list we had above. It should look like this now.

```
#item1 = 3.00
#item2 = 15.00
itms = [['Soda',1.45],['Candy',.75],['Bread',1.95],['Milk',2.59]]
```

Next, remove all the lines that call Fmt(). Next add the following lines (with #NEW LINE at the end) to make your code look like the text shown right.

```
itms = [['Soda',1.45],['Candy',.75],['Bread',1.95],['Milk',2.59]]

print TopOrBottom('=',40)

total = 0 #NEW LINE
for cntr in range(0,4): #NEW LINE
      print Fmt(itms[cntr][0],30,itms[cntr][1],10) #NEW LINE
      total += itms[cntr][1] #NEW LINE
print TopOrBottom('-',40)
print Fmt('Total',30,total,10) #CHANGED LINE
print TopOrBottom('=',40)
```

I set up a counter variable for loop that cycles through the list for each item there. Notice that I've also added a variable called total. We set the total to 0 before we go into our for loop. Then as we print each item sold, we add the cost to our total. Finally, we print the total out right after the separator line. Save your program and run it. You should see something like the text shown below.

```
+======================================+
| Soda                            1.45 |
| Candy                           0.75 |
| Bread                           1.95 |
| Milk                            2.59 |
+--------------------------------------+
| Total                           6.74 |
+======================================+
```

If you wanted to get wild and crazy, you could add a line for tax as well. Handle it close to the same way we did the total line, but use (total * .086) as the cost.

```
print Fmt('Tax:',30,total*.086,10)
```

If you would like to, you can add more items to the list and see how it works.

That's it for this time. Next time we'll concentrate on classes. **Enjoy!**

Greg Walters is owner of *RainyDay Solutions, LLC*, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family.

Program In Python - Part 4

SEE ALSO:
FCM#27-29 - Python Parts 1-3

APPLICABLE TO:
ubuntu kubuntu xubuntu

CATEGORIES:
Dev Graphic Internet M/media System

DEVICES:
CD/DVD HDD USB Drive Laptop Wireless

I promised last time that we would discuss classes. So, that's what we'll concentrate on. What are classes and what good are they?

A class is a way of constructing objects. An object is simply a way of handling attributes and behaviors as a group. I know this sounds confusing, but I'll break it down for you. Think of it this way. An object is a way to model something in the real world. A class is a method we use to implement this. For example, we have three dogs at home. A Beagle, a Lab and a German Shepherd/Blue Heeler mix. All three are dogs, but are all different. There are common attributes among the three of them, but each dog has separate attributes as well. For example, the Beagle is short, chubby, brown, and grumpy. The Lab is medium-sized, black, and very laid back. The Shepherd/Heeler mix is tall, skinny, black, and more than a bit crazy. Right away, some attributes are obvious. Short/medium-sized/tall are all attributes of height. Grumpy, laid back, and crazy are all attributes of mood. On the behavior side of things, we can consider eating, sleeping, playing, and other actions.

All three are of the class 'Dog'. Going back to the attributes that we used to describe each above, we have things such as Dog.Name, Dog.Height, Dog.Build (skinny, chubby, etc.), and Dog.Color. We also have behaviors such as Dog.Bark, Dog.Eat, Dog.Sleep, and so on.

As I said before, each of the dogs is a different breed. Each breed would be a sub-class of the class Dog. In a diagram, it would look like this.

```
        /--Beagle
Dog ---|-- Lab
        \--Shepherd/Heeler
```

Each sub-class inherits all of the attributes of the Dog class. Therefore, if we create an instance of Beagle, it gets all of the attributes from its parent class, Dog.

```
Beagle = Dog()
Beagle.Name = 'Archie'
Beagle.Height = 'Short'
Beagle.Build = 'Chubby'
Beagle.Color = 'Brown'
```

Starting to make sense? So, let's create our gross Dog class (shown above). We'll start with the keyword "class" and the name of our class.

```
class Dog():
    def __init__(self,dogname,dogcolor,dogheight,dogbuild,dogmood,dogage):
        #here we setup the attributes of our dog
        self.name = dogname
        self.color = dogcolor
        self.height = dogheight
        self.build = dogbuild
        self.mood = dogmood
        self.age = dogage
        self.Hungry = False
        self.Tired = False
```

Before we go any further in our code, notice the function that we have defined here. The function __init__ (two underscores + 'init' + two underscores) is an initialization function that works with any class. As soon as we call our class in code, this routine is run. In this case, we have set up a number of parameters to set some basic information about our class: we have a name, color, height, build, mood, age, and a couple of variables Hungry and Tired. We'll revisit these in a little bit. Now let's add some more code.

```
Beagle =
Dog('Archie','Brown','Short',
'Chubby','Grumpy',12)
print Beagle.name
print Beagle.color
print Beagle.mood
print Beagle.Hungry
```

This is UNINDENTED code that resides outside of our class, the code that uses our class. The first line creates an instance of our dog class called Beagle. This is called instantiation. When we did this, we also passed certain information to the instance of the class, such as the Beagle's name, color, and so on. The next four lines simply query the Beagle object and get back information in return. Time for more code. Add the code shown in the top right box into the class after the __init__ function.

Now we can call it with Beagle.Eat() or Beagle.Sleep(). Let's add one more method. We'll call it Bark. Its code is shown right.

This one I've made more flexible. Depending on the mood of the dog, the bark will change. Shown on the next page is the full class code so far.

So, when we run this we'll get

```
My name is Archie
My color is Brown
My mood is Grumpy
I am hungry = False
Sniff Sniff...Not Hungry
Yum Yum...Num Num
GRRRRR...Woof Woof
```

Now, that takes care of the grumpy old Beagle. However, I said earlier that I have 3 dogs. Because we coded the class carefully, all we have to do is create two more instances of our dog class.

```
    def Eat(self):
        if self.Hungry:
            print 'Yum Yum...Num Num'
            self.Hungry = False
        else:
            print 'Sniff Sniff...Not Hungry'
    def Sleep(self):
        print 'ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ'
        self.Tired = False
```

```
    def Bark(self):
        if self.mood == 'Grumpy':
            print 'GRRRRR...Woof Woof'
        elif self.mood == 'Laid Back':
            print 'Yawn...ok...Woof'
        elif self.mood == 'Crazy':
            print 'Bark Bark Bark Bark Bark Bark Bark'
        else:
            print 'Woof Woof'
```

```
Lab =
Dog('Nina','Black','Medium','
Heavy','Laid Back',7)
Heeler =
Dog('Bear','Black','Tall','Sk
inny','Crazy',9)
print 'My Name is %s' %
Lab.name
print 'My color is %s' %
Lab.color
print 'My Mood is %s' %
Lab.mood
print 'I am hungry = %s' %
Lab.Hungry
Lab.Bark()
Heeler.Bark()
```

Notice that I created the instances of both of the dogs before I did the print statements. That's not a problem, since I “defined” the instance before I called any of the methods. Here is the full output of our dog class program.

```
My name is Archie
My color is Brown
My mood is Grumpy
I am hungry = False
Sniff Sniff...Not Hungry
Yum Yum...Num Num
GRRRRR...Woof Woof
My Name is Nina
```

```
My color is Black
My Mood is Laid Back
I am hungry = False
Yawn...ok...Woof
Bark Bark Bark Bark Bark Bark
Bark
```

Now that you have the basics, your homework will be to expand our dog class to allow for more methods, such as maybe Play or EncounterStrangeDog or something like this.

Next time, we will start discussing GUI or Graphical User Interface programming. We will be using Boa Constructor for this.

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```
class Dog():
    def __init__(self,dogname,dogcolor,dogheight,dogbuild,dogmood,dogage):
        #here we setup the attributes of our dog
        self.name = dogname
        self.color = dogcolor
        self.height = dogheight
        self.build = dogbuild
        self.mood = dogmood
        self.age = dogage
        self.Hungry = False
        self.Tired = False

    def Eat(self):
        if self.Hungry:
            print 'Yum Yum...Num Num'
            self.Hungry = False
        else:
            print 'Sniff Sniff...Not Hungry'

    def Sleep(self):
        print 'ZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ'
        self.Tired = False

    def Bark(self):
        if self.mood == 'Grumpy':
            print 'GRRRRR...Woof Woof'
        elif self.mood == 'Laid Back':
            print 'Yawn...ok...Woof'
        elif self.mood == 'Crazy':
            print 'Bark Bark Bark Bark Bark Bark Bark'
        else:
            print 'Woof Woof'

Beagle = Dog('Archie','Brown','Short','Chubby','Grumpy',12)
print 'My name is %s' % Beagle.name
print 'My color is %s' % Beagle.color
print 'My mood is %s' % Beagle.mood
print 'I am hungry = %s' % Beagle.Hungry
Beagle.Eat()
Beagle.Hungry = True
Beagle.Eat()
Beagle.Bark()
```

Written by Greg Walters

Program In Python - Part 5

SEE ALSO:
FCM#27-30 - Python Parts 1-4

APPLICABLE TO:
ubuntu kubuntu xubuntu

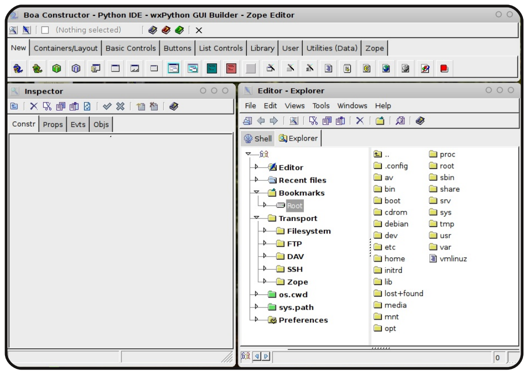
CATEGORIES:
Dev Graphic Internet M/media System

DEVICES:
CD/DVD HDD USB Drive Laptop Wireless

If you are like me, you will HATE the first part of this installation. I HATE it when an author tells me that I have to double read every word in their book/chapter/article, because I just KNOW it will be a snore - even when I know it's for my own good, and I will end up doing it anyway.

Consider yourself warned. PLEASE read the following boring stuff carefully. We'll get to the fun stuff soon, but we need to get some ground work covered before we can really talk about trying to program.

FIRST you need to install Boa Constructor and wxPython. Use Synaptic and select both wxPython and Boa Constructor. Once installed, you should find Boa under Applications|Programming\Boa Constructor. Go ahead and start it up. It will make things a bit easier. Once the application starts, you will see three different windows (or frames): one across the top, and two across the bottom. You might have to resize and move them a bit, but get things to a point where it looks something like this:



The top frame is called the tool frame. The bottom-left frame is the inspector frame, and the bottom-right frame is the editor frame. On the tool frame, you have various tabs (New, Containers/Layout, etc.) that will allow you to start new projects, add frames to existing projects, and add various controls to the frames for your application. The inspector frame will become very important as we start to add controls to our application. The editor frame allows us to edit our code, save our projects, and more. Moving our attention back to the tool frame, let's take a look at each tab - starting with the “New” tab. While there are many options available here, we will discuss only two of them. They are the 5th and 6th buttons from the left: wx.App and wx.Frame. Wx.App allows us to create a complete application beginning with two auto-generated files. One is a frame file and the other is an application file. This is the method I prefer to use. The wx.Frame is used to add more frames to our application and/or create a standalone app from a single source file. We'll discuss this later.

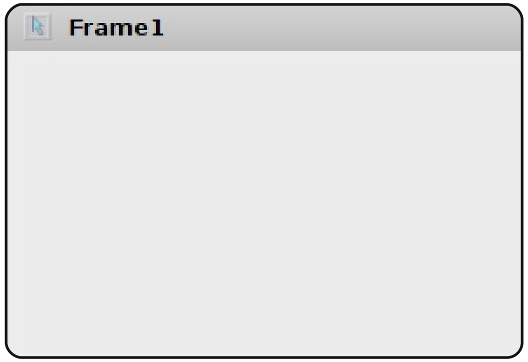
Now look at the Containers/Layout tab. Many goodies here. The ones you'll use most are the wx.Panel (first on the left) and the sizers (2,3,4,5 and 6 from the right). Under Basic Controls, you'll find static text controls (labels), text boxes, check boxes, radio buttons, and more. Under Buttons, you'll find various forms of buttons. List Controls has data grids and other list boxes. Let's jump to Utilities where you'll find timers and menu items.

Here are a few things to remember as we are getting ready for our first app. There are a few bugs in the Linux version. One is that SOME controls won't allow you to move them in the designer. Use the <Ctrl>+Arrow keys to move or tweak the position of your controls. Another one you'll find when you try the tutorials that come with Boa Constructor - when placing a panel control, it's hard to see. Look for the little boxes (I'll show you this soon). You can also use the Objs tab on the Inspector frame and select it that way.

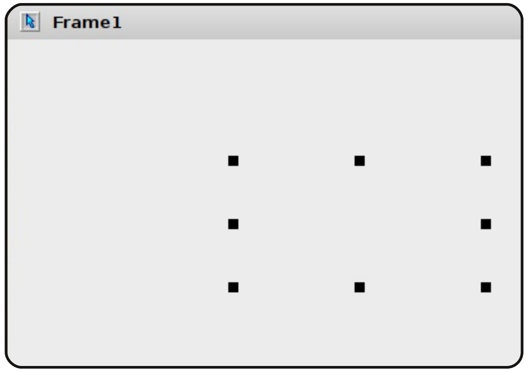
Okay, here we go. Under the 'New' tab of the tool frame, select wx.App (5th button from the left). This will create two new tabs in the editor frame: one named “*(App1)*”, the other named “*(Frame1)*”. Believe it or not, the VERY first thing we want to do is save our two new files, starting with the Frame1 file. The save button is the 5th button from the left in the Editor Frame. A “Save As” frame will pop up asking you where you want to save the file and what you want to call it. Create a folder in your home folder called GuiTests, and save the file as “Frame1.py”. Notice that the “*(Frame1)*” tab now shows as “Frame1”. (The “*(“ says that the file needs to be saved.) Now do the same thing with the App1 tab.

Now let's examine a few of the buttons on the Editor Tool bar. The important ones for now are the Save (5th from the left) and Run (Yellow arrow, 7th from the left). If you are in a frame tab (Frame1 for example) there will be some extra buttons you need to know about. For now it's the Designer button: 

It is an important one. It allows us to design our GUI frame - which is what we'll do now. When you click on it you will be presented with a blank frame.



This is a blank canvas for you to put whatever controls you need to (within reason). The first thing we want to do is place a wx.panel control. Almost everything I have read says not to put controls (other than a wx.panel) directly on a frame. So, click on the Containers/Layout tab in the Tool Frame, then click on the wx.Panel button. Next, move over to the new frame that you are working on and click somewhere on the inside of the frame. You'll know it worked if you see something like this:

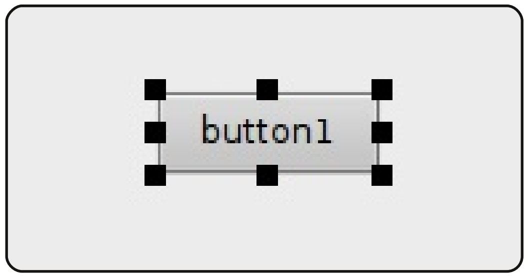


Remember when I warned you about the bugs? Well, this is one of them. Don't worry. See the 8 little black squares? That's the limits of the panel. If you wanted, you could click and drag one of them to resize the panel, but for this project what we want is to make the panel cover the entire frame. Simply resize the FRAME just a little bit at this point. Now we have a panel to put our other controls on. Move the frame you are working on until you can see the tool box for the Editor frame. Two new buttons have appeared: a check and an “X”. The “X” will cause the changes you made to be thrown away.

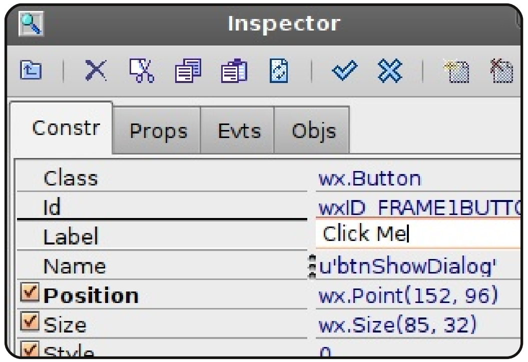
The Check button: 

is called the “Post” button. This will cause your changes to be written into our frame file. You still have to save the frame file, but this will get the new things into the file. So, click on the Post button. There's also a post button on the Inspector frame, but we'll deal with that later. Now save your file.

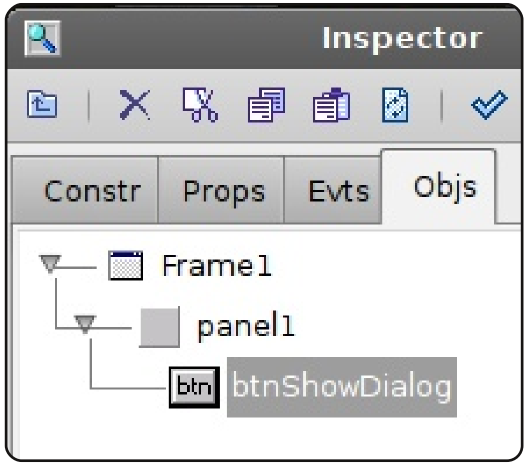
Go back into the Design mode. Click the 'Buttons' tab on the Tool frame and then click the first button on the left, the wx.Button. Then add it somewhere close to the middle of your frame. You'll have something that looks close to this:



Notice that there are 8 small squares around it just like the panel. These are resize handles. It also shows us what control is currently selected. In order to move this closer to the center of the frame, hold down the Control key (Ctrl) and while that's being pressed, use the arrow keys to move it where you want it. Now, let's look at the Inspector frame. There are four tabs. Click on the 'Constr' tab. Here we can change the label, name, position, size and style. For now, let's change the name to 'btnShowDialog' and the Label property to 'Click Me'.

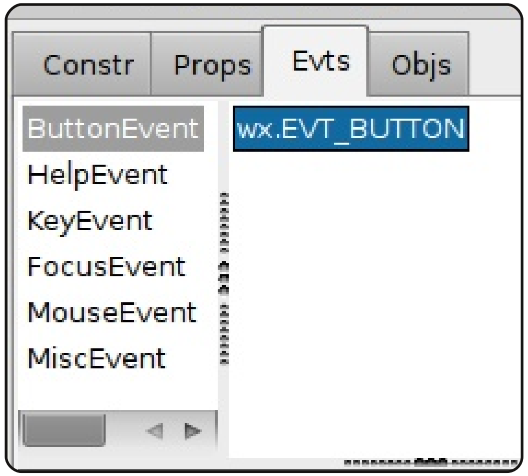


Now, let's skip over all the rest of that tab and go to the Objs tab. This tab shows all the controls you have and their parent/child relationships. As you can see, the button is a child of panel1, which is a child of Frame1.



Post (check button) and save your changes. Go back to the designer once again, and notice that (assuming you still have the 'Objs' tab in the inspector frame selected), Frame1 is now selected. This is good because it's what we want. Go back to the 'Constr' tab, and change the title from 'Frame1' to 'Our First GUI'. Post and save one more time. Now let's run our app. Click the yellow Run button on the Editor frame.

Click all you want on the button, but nothing will happen. Why? Well, we didn't tell the button to do anything. For that, we need to set up an event to happen, or fire, when the user clicks our button. Click on the X in the upper-right corner to finish running the frame. Next, go back to the designer, select the button and go into the 'Evts' tab in the inspector frame. Click on ButtonEvent and then double click on the wx.EVT_BUTTON text that shows up, and notice that in the window below we get a button event called 'OnBtnShowDialogButton'. Post and save.



Before we go any further, let's see what we've got in the way of code (page 24).

The first line is a comment that tells Boa Constructor that this is a boa file. It's ignored by the Python compiler, but not by Boa. The next line imports wxPython. Now jump down to the class definition.

At the top, there's the __init_ctrls method. Notice the comment just under the definition line. Don't edit the code in this section. If you do, you will be sorry. Any place BELOW that routine should be safe. In this routine, you will find the definitions of each control on our frame.

Next, look at the __init__ routine. Here you can put any calls to initializing code. Finally, the OnBtnShowDialogButton routine. This is where we will put our code that will do the work when the user clicks the button. Notice that there is currently an event.Skip() line there. Simply stated, this says just exit when this event fires.

Now, what we are going to do is call a message box to pop up with some text. This is a common thing for programmers to do to allow the user to know about something - an error, or the fact that a process has finished. In this case, we will be calling the wx.MessageBox built in routine. The routine is called with two parameters. The first is the text we wish to send in the message box and the second is the title for the message box. Comment out the line event.Skip() and put in the following line.

```
wx.MessageBox('You Clicked
the button', 'Info')
```

Save and click the Run button (yellow arrow). You should see something like this:

And when you click the button you should see something like this:

Understand here that this is just about the simplest way to call the messagebox routine. You can have more parameters as well.

Here's a quick rundown on how to change the way the icons work on the message box (more next time).

wx.ICON_QUESTION - Show a question icon

wx.ICON_EXCLAMATION - Show an alert icon

wx.ICON_ERROR - Show an error icon

wx.ICON_INFORMATION - Show an info icon

The way to write this would be

```
wx.MessageBox('You Clicked
the button', 'Info',
wx.ICON_INFORMATION)
```

or whatever icon you wanted to use that suited the situation. There are also various button arrangement assignments which we'll talk about next time.

So, until next time, play with some of the various controls, placements, and so on. Have fun!

```
#Boa:Frame:Frame1
import wx
def create(parent):
    return Frame1(parent)
[wxID_FRAME1, wxID_FRAME1BTNSHOWDIALOG, wxID_FRAME1PANEL1,
] = [wx.NewId() for _init_ctrls in range(3)]

class Frame1(wx.Frame):
    def _init_ctrls(self, prnt):
        # generated method, don't edit
        wx.Frame.__init__(self, id=wxID_FRAME1, name='', parent=prnt,
              pos=wx.Point(543, 330), size=wx.Size(458, 253),
              style=wx.DEFAULT_FRAME_STYLE, title=u'Our First GUI')
        self.SetClientSize(wx.Size(458, 253))
        self.panel1 = wx.Panel(id=wxID_FRAME1PANEL1, name='panel1', parent=self,
              pos=wx.Point(0, 0), size=wx.Size(458, 253),
              style=wx.TAB_TRAVERSAL)
        self.btnShowDialog = wx.Button(id=wxID_FRAME1BTNSHOWDIALOG,
              label=u'Click Me', name=u'btnShowDialog', parent=self.panel1,
              pos=wx.Point(185, 99), size=wx.Size(85, 32), style=0)
        self.btnShowDialog.Bind(wx.EVT_BUTTON, self.OnBtnShowDialogButton,
              id=wxID_FRAME1BTNSHOWDIALOG)

    def __init__(self, parent):
        self._init_ctrls(parent)
    def OnBtnShowDialogButton(self, event):
        event.Skip()
```

Greg Walters is owner of *RainyDay Solutions, LLC*, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family.

Program In Python - Part 6

SEE ALSO:
FCM#27-31 - Python Parts 1-5

APPLICABLE TO:
ubuntu kubuntu xubuntu

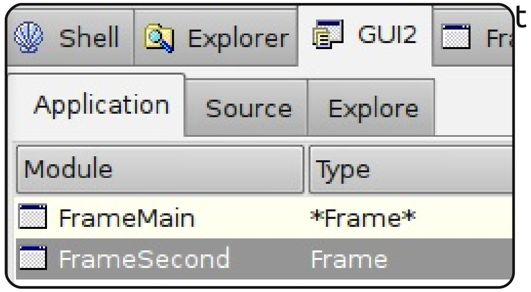
CATEGORIES:
Dev Graphic Internet M/media System

DEVICES:
CD/DVD HDD USB Drive Laptop Wireless

I hope you've been playing with Boa Constructor since our last meeting. First we will have a very simple program that will show one frame, then allow you to click on a button that will pop up another frame. Last time we did a message box. This time we will do a totally separate frame. This can be helpful when doing an application with multiple frames or windows. So... here we go...

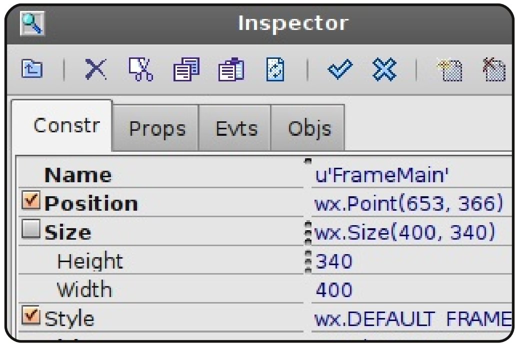
Start up Boa Constructor and close all tabs in the Editor frame with the exception of Shell and Explorer by using the (Ctrl-W) key combination. This ensures that we will be starting totally fresh. Now create a new project by clicking on the wx.App button (see last time's article if needed).

Before you do anything else, save Frame1 as "FrameMain.py" and then save App1 as "Gui2.py". This is important. With the GUI2 tab selected in the Editor frame, move to the Toolbar frame, go back to the New tab, and add another frame to our project by clicking on wx.Frame (which is right next to the wx.App button). Make sure that the Application tab shows both frames under the Module column. Now go back to the new frame and save it as "FrameSecond.py":



Next, open FrameMain in the designer. Add a wx.Panel to the frame. Resize it a bit to make the panel cover the frame. Next we are going to change some properties - we didn't do this last time. In the inspector frame, make sure that the Constr tab is selected and set the title to "Main Frame" and the name to "FrameMain". We'll discuss naming conventions in a bit. Set the size to 400x340 by clicking on the Size check box. This drops down to show height and width. Height should be 400 and width should be 340:

Now click on the Props tab. Click on the Centered property and set it to wx.BOTH. Click the post check-mark and save your work. Now run your application by clicking on the button with the yellow arrow. Our application shows up in the center

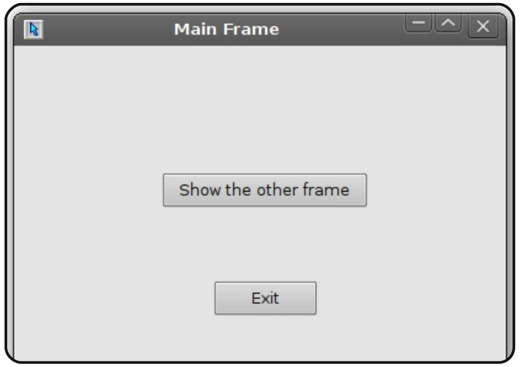


of the screen with the title of "Main Frame". Now close it by clicking on the "X" in the upper right corner of the app.

Bring FrameMain back into the designer. Add two wx.Buttons to the frame, one above the other, and close to the center of the frame. Select the top button, name that "btnShowNew", and set the label to "Show the other frame" in the Constr tab of the Inspector frame. Use the Shift+Arrow combination to resize the button so that all the text is visible, and then use the Ctrl+Arrow combination to move it back to the center of the frame. Select the bottom button, name that "btnExit", and set the label to "Exit".

Post, save, and run to see your changes. Exit our app and go back to the designer. We are going to add button click events. Select the top button, and in the inspector frame, select the Evts tab. Click on ButtonEvent, then double click on wx.Evt_BUTTON. Notice you should have "OnBtnShowNewButton" below. Next, select the btnExit button. Do the same thing, making sure it shows "OnBtnExitButton". Post and save. Next go to the Editor frame and scroll down to the bottom.

Make sure you have the two event methods that we just created. Here's what the frame should look like so far:



Now it's time to deal with our other frame. Open FrameSecond in the designer. Set the name to "FrameSecond", and the title to "Second Frame". Set centering to wx.BOTH. Add a wx.Button, and center it towards the lower part of the frame. Set the name to "btnFSExit", and change the title to "Exit". Set up a button event for it. Next add a wx.StaticText control in the upper portion of the frame close to the middle. Name it "stHiThere", set the label to "Hi there...I'm the second form!", and set the font to Sans, 14 point and weight to wxBOLD. Now reset the position to be centered in the form right and left. You can do this by unchecking the Position attribute and use the X position for right and left, and Y for up and down until you are happy. Post and save:

Now that we have designed our forms, we are going to create the "glue" that will tie all this together.

In the Editor frame, click on the GUI2 tab, then, below that, click on the Source tab. Under the line that says "import FrameMain", add "import FrameSecond". Save your changes. Next, select the "FrameMain" tab. Under the line that says "import wx", add a line that says "import FrameSecond". Next scroll down, and find the line that says "def __init__(self, parent):". Add a line after the "self._init_ctrls(parent)" line that says "self.Fs = FrameSecond.FrameSecond(self)". Now under the "def OnBtnShowNewButton(self, event):" event, comment out "event.Skip()" and add the following two lines:

```
self.Fs.Show()
self.Hide()
```

Finally, under "OnBtnExitButton" method, comment out "event.Skip()", and add a line that says "self.Close()"

What does all this do? OK. The first thing we did was to make sure that the application knew we were going to have two forms in our app. That's why we imported both FrameMain and FrameSecond in the GUI2 file. Next we imported a reference for FrameSecond into FrameMain so we can call it later. We initialized it in the "_init_" method. And in the "OnBtnShowNewButton" event we told it that when the button was clicked, we want to first show the second frame, and to hide the main frame. Finally we have the statement to close the application when the Exit button is clicked.

Now, switch to the code for FrameSecond. The changes here are relatively small. Under the "_init_" method, add a line that says "self.parent = parent" which adds a variable self.parent. Finally, under the click event for FSExitButton, comment out the "event.Skip()" line, and add the following two lines:

```
self.parent.Show()
self.Hide()
```

Remember we hid the main frame when we showed the second frame, so we have to re-show it. Finally we hide the second frame. Save your changes.

Here is all the code for you to verify everything (this page and following page):

Now you can run your application. If everything went right, you will be able to click on btnShownNew, and see the first frame disappear and second frame appear. Clicking on the Exit button on the second frame will cause that frame to disappear and the

GUI2 code:

```
#!/usr/bin/env python
#Boa:App:BoaApp

import wx

import FrameMain
import FrameSecond

modules ={u'FrameMain': [1, 'Main frame of Application',
u'FrameMain.py'],
 u'FrameSecond': [0, '', u'FrameSecond.py']}

class BoaApp(wx.App):
    def OnInit(self):
        self.main = FrameMain.create(None)
        self.main.Show()
        self.SetTopWindow(self.main)
        return True

def main():
    application = BoaApp(0)
    application.MainLoop()

if __name__ == '__main__':
    main()
```

FrameMain code:

```
#Boa:Frame:FrameMain

import wx
import FrameSecond

def create(parent):
    return FrameMain(parent)

[wxID_FRAMEMAIN, wxID_FRAMEMAINBTNEXIT,
wxID_FRAMEMAINBTNSHOWNEW,
 wxID_FRAMEMAINPANEL1,
] = [wx.NewId() for _init_ctrls in range(4)]

class FrameMain(wx.Frame):
    def _init_ctrls(self, prnt):
        # generated method, don't edit
        wx.Frame.__init__(self, id=wxID_FRAMEMAIN,
name=u'FrameMain',
              parent=prnt, pos=wx.Point(846, 177),
size=wx.Size(400, 340),
              style=wx.DEFAULT_FRAME_STYLE, title=u'Main
Frame')
        self.SetClientSize(wx.Size(400, 340))
        self.Center(wx.BOTH)

        self.panel1 = wx.Panel(id=wxID_FRAMEMAINPANEL1,
name='panel1',
              parent=self, pos=wx.Point(0, 0),
size=wx.Size(400, 340),
              style=wx.TAB_TRAVERSAL)

        self.btnShowNew =
wx.Button(id=wxID_FRAMEMAINBTNSHOWNEW,
              label=u'Show the other frame',
name=u'btnShowNew',
              parent=self.panel1, pos=wx.Point(120, 103),
size=wx.Size(168, 29),
              style=0)
        self.btnShowNew.SetBackgroundColour(wx.Colour(25,
175, 23))
        self.btnShowNew.Bind(wx.EVT_BUTTON,
self.OnBtnShowNewButton,
              id=wxID_FRAMEMAINBTNSHOWNEW)
```

FrameMain Code (cont.):

```
        self.btnExit =
wx.Button(id=wxID_FRAMEMAINBTNEXIT, label=u'Exit',
              name=u'btnExit', parent=self.panel1,
pos=wx.Point(162, 191),
              size=wx.Size(85, 29), style=0)
        self.btnExit.SetBackgroundColour(wx.Colour(225,
218, 91))
        self.btnExit.Bind(wx.EVT_BUTTON,
self.OnBtnExitButton,
              id=wxID_FRAMEMAINBTNEXIT)

    def __init__(self, parent):
        self._init_ctrls(parent)
        self.Fs = FrameSecond.FrameSecond(self)

    def OnBtnShowNewButton(self, event):
        #event.Skip()
        self.Fs.Show()
        self.Hide()

    def OnBtnExitButton(self, event):
        #event.Skip()
        self.Close()
```

FrameSecond code:

```
#Boa:Frame:FrameSecond

import wx

def create(parent):
    return FrameSecond(parent)

[wxID_FRAMESECOND, wxID_FRAMESECONDBTNFSEXIT,
wxID_FRAMESECONDPANEL1,
 wxID_FRAMESECONDSTATICTEXT1,
] = [wx.NewId() for _init_ctrls in range(4)]

class FrameSecond(wx.Frame):
    def _init_ctrls(self, prnt):
        # generated method, don't edit
        wx.Frame.__init__(self, id=wxID_FRAMESECOND,
name=u'FrameSecond',
              parent=prnt, pos=wx.Point(849, 457),
size=wx.Size(419, 236),
              style=wx.DEFAULT_FRAME_STYLE, title=u'Second
Frame')
        self.SetClientSize(wx.Size(419, 236))
        self.Center(wx.BOTH)
        self.SetBackgroundStyle(wx.BG_STYLE_COLOUR)

        self.panel1 = wx.Panel(id=wxID_FRAMESECONDPANEL1,
name='panel1',
              parent=self, pos=wx.Point(0, 0),
size=wx.Size(419, 236),
              style=wx.TAB_TRAVERSAL)

        self.btnFSExit =
wx.Button(id=wxID_FRAMESECONDBTNFSEXIT, label=u'Exit',
              name=u'btnFSExit', parent=self.panel1,
pos=wx.Point(174, 180),
              size=wx.Size(85, 29), style=0)
        self.btnFSExit.Bind(wx.EVT_BUTTON,
self.OnBtnFSExitButton,
              id=wxID_FRAMESECONDBTNFSEXIT)

        self.staticText1 =
wx.StaticText(id=wxID_FRAMESECONDSTATICTEXT1,
              label=u"Hi there...I'm the second form!",
name='staticText1',
              parent=self.panel1, pos=wx.Point(45, 49),
size=wx.Size(336, 23),
              style=0)
        self.staticText1.SetFont(wx.Font(14, wx.SWISS,
wx.NORMAL, wx.BOLD,
              False, u'Sans'))

    def __init__(self, parent):
        self._init_ctrls(parent)
        self.parent = parent

    def OnBtnFSExitButton(self, event):
        #event.Skip()
        self.parent.Show()
        self.Hide()
```

main frame to re-appear. Clicking on the Exit button on the main frame will close the application.

I promised you we'd discuss naming conventions. Remember way back, we discussed commenting your code? Well, by using well-formed names for GUI controls, your code is fairly self-documenting. If you just left control names as staticText1 or button1 or whatever, when you are creating a complex frame with many controls, especially if there are a lot of text boxes or buttons, then naming them something that is meaningful is very important. It might not be too important if you are the only one who will ever see the code, but to someone coming behind you later on, the good control names will help them out considerably. Therefore, use something like the following:

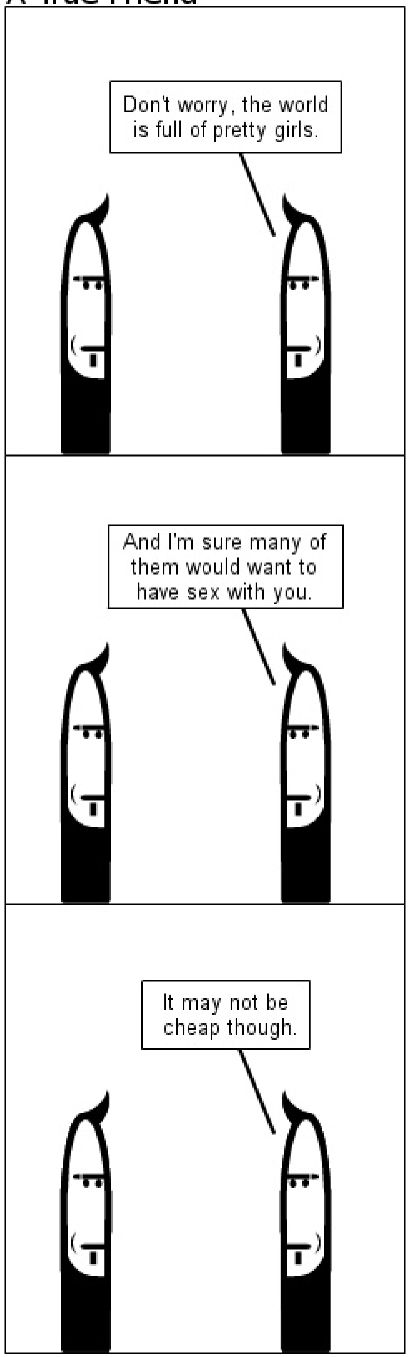
```
Control type - Name prefix
Static text - st_
Button - btn_
Text Box - txt_
Check Box - chk_
Radio Button - rb_
Frame - Frm_ or Frame_
```

You can come up with your own ideas for naming conventions as you grow as a programmer, and in some instances your employer might have conventions already in place.

Next time, we will leave GUI programming aside for a bit and concentrate on database programming. Meanwhile, get *python-apsw* and *python-mysqldb* loaded on your system. You will also need *sqlite* and *sqlitebrowser* for SQLite. If you want to experiment with MySql as well, that's a good idea. All are available via Synaptic.

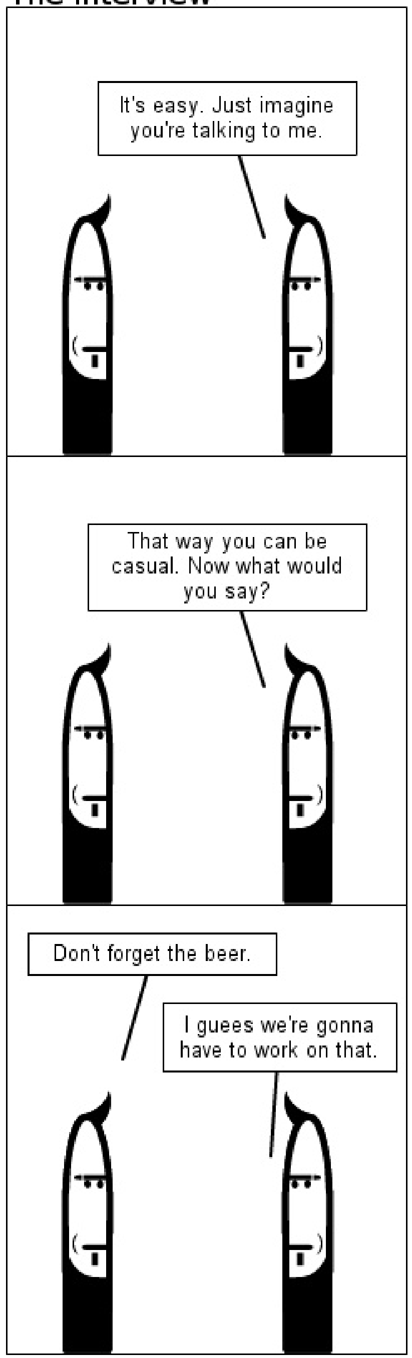
Greg Walters is owner of *RainyDay Solutions, LLC*, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family.

A True Friend



by Richard Redei

The Interview



by Richard Redei

Program In Python - Part 7

SEE ALSO:
FCM#27-32 - Python Parts 1 - 6

APPLICABLE TO:
ubuntu kubuntu xubuntu

CATEGORIES:
Dev Graphic Internet M/media System

DEVICES:
CD/DVD HDD USB Drive Laptop Wireless

Good morning Boys and Girls. It's story time. Everyone get settled and comfy. Ready? Good!

Once upon a time, the world was ruled by paper. Paper, paper everywhere. They had to make special homes for all that paper. They were called filing cabinets, and were big metal things that would take rooms and rooms and rooms at businesses to house all the paper. In each filing cabinet was something called a file folder, which attempted to organize relevant papers together. But after time, they would get over-stuffed, and fall apart when they got old or opened too many times.

Using these filing cabinets properly required a college degree. It could take days to find all the papers that were in the various cabinets. Businesses suffered horribly. It was a very dark time in the history of man- and woman-kind.

Then one day, from the top of a mountain somewhere (I personally think it was Colorado, but I'm not sure), came a lovely fairy. This fairy was blue and silver - with beautiful wings and white hair, and was about 1 foot tall. Her name, believe it or not, was See-Quill. Isn't that a funny name? Anyway, See-Quill said that she could fix everything having to do with all the paper and filing cabinets and wasted time, if only people would believe in computers and her. She called this power a “Database”. She said that the “Database” could replace the entire filing system. Some people did, and soon their lives were very happy. Some didn't, and their lives stayed the same, lost in mountains of paper.

All fairy promises, however, come with some sort of requirement. That requirement was that whoever wanted to use the power of See-Quill needed to learn a bit of a different language. It wouldn't be too difficult a language to learn. In fact, it was much like the one the people already used. It just has a different way of saying things, and you had to think about things very carefully BEFORE you said them - to use the power of See-Quill.

One day, a young boy named, curiously enough, User, came to see See-Quill. He was very impressed with her beauty, and said “See-Quill, Please teach me to use your power.” See-Quill said that she would.

She said, “First, you have to know how your information is laid out. Show me your papers.”

Being a young boy, User had only a few pieces of paper. See-Quill said, “User, right now you could live with papers and file folders. However, I can get glimpses of the future, and you will someday have so many papers that they would, if placed on top of each other, be taller than you by 15 times. We should use my power.”

So, working together, User and See-Quill created a “database thingie” (a fairy technical term), and User lived happily ever after.

The End.

Of course, the story is not

completely true. However, using databases and SQL can make our lives easier. This time, we will learn about some simple SQL queries, and how to use them in a program. Some people might think that this might not be the "correct" way or the "best" way, but it is a reasonable way. So let's begin.

Databases are like the filing cabinets in our story above. Data tables are like the file folders. The individual records in the tables are like the sheets of paper. Each piece of information is called a field. It falls together very nicely, doesn't it? You use SQL (pronounced See-Quill) statements to do things with the data. SQL stands for Structured Query Language, and is basically designed to be an easy way to use databases. In practice, however, it can become very complicated. We will keep things pretty simple for this installment.

We need to create a plan, like starting any construction project. So, think of a recipe card, which is a good thing to think about, since we are going to create a recipe database program. Around my house, recipes come in various forms: 3x5 card, 8x10 pieces of paper, napkins with the recipe scribbled on it, pages from magazines, and even stranger forms. They can be found in books, boxes, binders, and other things. However, they all pretty much have one thing in common: the format. In almost every case, at the top you have the recipe title and maybe how many servings it makes and where it came from. The middle contains the list of ingredients, and the bottom contains the instructions - dealing with the order that things are done in, the cooking time, and so on. We will use this general format as the template of our database project. We will break this up into two parts. We'll create the database this time, and the application to read and update the database next time.

Here's an example. Let's say we have the recipe shown right.

Notice the order we just discussed. Now when we design our database - we could make it very large and have one record for everything in the recipe. That, however, would be clumsy and hard to deal with. Instead, we are going to use the recipe card as a template. One table will handle the top of the card, or the gross information about the recipe; one table will handle the middle of the card, or the ingredients information; and one table will handle the bottom, or the instructions.

Make sure you have installed SQLite and APSW. SQLite is a small database engine that doesn't require you to have a separate database server, which makes it ideal for our little application. Everything you learn here can be used with larger database systems like MySQL and others. The other good thing about SQLite is that it uses limited data types. These types are Text, Numeric, Blob, and Integer Primary Key. As you have learned already, text is pretty much anything. Our

Spanish Rice

Serves: 4

Source: Greg Walters

Ingredients:
1 cup parboiled Rice (uncooked)
1 pound Hamburger
2 cups Water
1 8 oz can Tomato Sauce
1 small Onion chopped
1 clove Garlic chopped
1 tablespoon Ground Cumin
1 teaspoon Ground Oregano
Salt and Pepper to taste
Salsa to taste

Instructions:
Brown hamburger.

Add all other ingredients.

Bring to boil.

Stir, lower to simmer and cover.

Cook for 20 minutes.

Do not look, do not touch.

Stir and serve.

ingredients, instructions, and the title of our recipe are all text types - even though they have numbers in them. Numeric datatypes store numbers. These can be integer values or floating point or real values. Blobs are binary data, and can include things like pictures and other things. Integer Primary Key values are special. The SQLite database engine automatically puts in a guaranteed unique integer value for us. This will be important later on.

APSW stands for Another Python SQLite Wrapper and is a quick way to communicate with SQLite. Now let's go over some of the ways to create our SQL statements.

To obtain records from a database, you would use the SELECT statement. The format would be:

```
SELECT [what] FROM [which
table(s)] WHERE [Constraints]
```

So, if we want to get all the fields from the Recipes table we would use:

```
SELECT * FROM Recipes
```

If you wish to obtain just a record by its primary key, you have to know what that value is (pkID in this instance), and we have to include a WHERE command in the statement. We could use:

```
SELECT * FROM Recipes WHERE
pkID = 2
```

Simple enough...right? Pretty much plain language. Now, suppose we want to just get the name of the recipe and the number of servings it makes - for all recipes. It's easy. All you have to do is include a list of the fields that you want in the SELECT statement:

```
SELECT name, servings FROM
Recipes
```

To insert records, we use the INSERT INTO command. The syntax is

```
INSERT INTO [table name]
(field list) VALUES (values
to insert)
```

So, to insert a recipe into the recipe table the command would be

```
INSERT INTO Recipes
(name,servings,source) VALUES
("Tacos",4,"Greg")
```

To delete a record we can use

```
DELETE FROM Recipes WHERE
pkID = 10
```

There's also an UPDATE statement, but we'll leave that for another time.

More on SELECT

In the case of our database, we have three tables, each can be related together by using recipeID pointing to the pkID of the recipe table. Let's say we want to get all the instructions for a given recipe. We can do it like this:

```
SELECT Recipes.name,
Recipes.servings,
Recipes.source,
Instructions.Instructions
FROM Recipes LEFT JOIN
instructions ON (Recipes.pkid
= Instructions.recipeid)
WHERE Recipes.pkid = 1
```

However, that is a lot of typing and very redundant. We can use a method called aliasing. We can do it like this:

```
SELECT r.name, r.servings,
r.source, i.Instructions FROM
Recipes r LEFT JOIN
instructions i ON (r.pkid =
i.recipeid) WHERE r.pkid = 1
```

It's shorter and still readable. Now we will write a small program that will create our database, create our tables, and put some simple data into the tables to have something to work with. We COULD write this into our full program, but, for this example, we will make a separate program. This is a run-once program - if you try to run it a second time, it will fail at the table creation statements. Again, we could wrap it with a try...catch handler, but we'll do that another time.

We start by importing the APSW wrapper.

```
import apsw
```

The next thing we need to do is create a connection to our database. It will be located in the same directory where we have our application. When we create this connection, SQLite automatically looks to see if the database exists. If so, it opens it. If not, it creates the database for us. Once we have a connection, we need what is called a cursor. This creates a mechanism that we can use to work with the database. So remember, we need both a connection and a cursor. These are created like this:

```
# Opening/creating database

connection=apsw.Connection("cookbook1.db3")
cursor=connection.cursor()
```

Okay - we have our connection and our cursor. Now we need to create our tables. There will be three tables in our application. One to hold the gross recipe information, one for the instructions for each recipe, and one to hold the list of the ingredients. Couldn't we do it with just one table? Well, yes we could, but, as you will see, it will make that one table very large, and will include a bunch of duplicate information.

We can look at the table structure like this. Each column is a separate table as shown above right.

```
RECIPES                          INSTRUCTIONS                      INGREDIENTS
------------                     ----------------------            --------------------
pkID (Integer Primary Key)       pkID(Integer Primary Key)         pkID (Integer Primary Key)
name (Text)                      recipeID (Integer)                recipeID (Integer)
source (Text)                    instructions (Text)               ingredients (Text)
serves (Text)
```

Each table has a field called pkID. This is the primary key that will be unique within the table. This is important so that the data tables never have a completely duplicated record. This is an integer data type, and is automatically assigned by the database engine. Can you do without it? Yes, but you run the risk of accidentally creating a duplicated record id. In the case of the Recipes table, we will use this number as a reference for which instruction and which set of ingredients go with that recipe.

We would first put the information into the database so that the name, source and number served goes into the recipe table. The pkID is automatically assigned. Let's pretend that this is the very first record in our table, so the database engine would assign the value 1 to the pkID. We will use this value to relate the information in the other tables to this recipe. The instructions table is simple. It just holds the long text of the instructions, its own pkID and then a pointer to the recipe in the recipe table. The ingredients table is a bit more complicated in that we have one record for each ingredient as well as its own pkID and the pointer back to our recipe table record.

So in order to create the recipe table, we define a string variable called sql, and assign it the command to create the table:

```
sql = 'CREATE TABLE Recipes (pkID INTEGER PRIMARY KEY, name TEXT, servings TEXT, source TEXT)'
```

Next we have to tell ASPW to actually do the sql command:

```
cursor.execute(sql)
```

Now we create the other tables:

```
sql = 'CREATE TABLE Instructions (pkID INTEGER PRIMARY KEY, instructions TEXT, recipeID NUMERIC)'

cursor.execute(sql)

sql = 'CREATE TABLE Ingredients (pkID INTEGER PRIMARY KEY, ingredients TEXT, recipeID NUMERIC)'

cursor.execute(sql)
```

Once we have the tables created, we will use the INSERT INTO command to enter each set of data into its proper table.

Remember, the pkID is

automatically entered for us, so we don't include that in the list of fields in our insert statement. Since we will be using the field names, they can be in any order, not just the order they were created in. As long as we know the names of the fields, everything will work correctly. The insert statement for our recipe table entry becomes

```
INSERT INTO Recipes (name,
serves, source) VALUES
("Spanish Rice",4,"Greg
Walters")
```

Next we need to find out the value that was assigned to the pkID in the recipe table. We can do this with a simple command:

```
SELECT last_insert_rowid()
```

However, it doesn't just come out as something we can really use. We need to use a series of statements like this:

```
sql = "SELECT
last_insert_rowid()"

cursor.execute(sql)

for x in cursor.execute(sql):
    lastid = x[0]
```

Why is this? Well, when we get data back from ASPW, it comes back as a tuple. This is something we haven't talked about yet. The quick explanation is that a tuple is (if you look at the code above) like a list, but it can't be changed. Many people use tuples rarely; others use them often; it's up to you. The bottom line is that we want to use the first value returned. We use the 'for' loop to get the value into the tuple variable x. Make sense? OK. Let's continue...

Next, we would create the insert statement for the instructions:

```
sql = 'INSERT INTO
Instructions
(recipeID,instructions)
VALUES( %s,"Brown hamburger.
Stir in all other
ingredients. Bring to a boil.
Stir. Lower to simmer. Cover
and cook for 20 minutes or
until all liquid is
absorbed.")' % lastid

cursor.execute(sql)
```

Notice that we are using the variable substitution (%s) to place the pkID of the recipe (lastid) into the sql statement. Finally, we need to put each ingredient into the ingredient table. I'll show you just one for now:

```
sql = 'INSERT INTO
Ingredients
(recipeID,ingredients) VALUES
( %s,"1 cup parboiled Rice
(uncooked)")' % lastid

cursor.execute(sql)
```

It's not too hard to understand at this point. Next time it will get a bit more complicated.

If you would like the full source code, I've placed it on my website. Go to www.thedesignatedgeek.com to download it.

Next time, we will use what we've learned over the series to create a menu-driven front end for our recipe program - it will allow viewing all recipes in a list format, viewing a single recipe, searching for a recipe, and adding and deleting recipes.

I suggest that you spend some time reading up on SQL programming. You'll be happy you did.

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Written by Greg Walters

Program In Python - Part 8

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We will continue programming our recipe database that we started in Part 7. This will be a long one, with a lot of code, so grab on with all your might and don't let go. But remember, keep your hands and feet inside the car at all times. We have already created our database. Now we want to display the contents, add to it and delete from it. So how do we do that? We will start with an application that runs in a terminal, so we need to create a menu. We will also create a class that will hold our database routines. Let's start with a stub of our program shown above right.

Now we will layout our menu. We do that so we can stub our class. Our menu will be a rather big loop that will display a list of options that the user can perform. We'll use a while loop. Change the menu routine to look like the code shown below right.

Next we stub the menu with an if|elif|else structure which is shown at the top of the next page.

Let's take a quick look at our menu routine. We start off by printing the prompts that the user can perform. We set a variable (loop) to True, and then use the while function to continue looping until loop = False. We use the raw_input() command to wait for the user to select an option, and then

```
#!/usr/bin/python
#------------------------------------------------------
# Cookbook.py
# Created for Beginning Programming Using Python #8
# and Full Circle Magazine
#------------------------------------------------------
import apsw
import string
import webbrowser

class Cookbook:

def Menu():
    cbk = Cookbook() # Initialize the class

Menu()
```

```
def Menu():
    cbk = Cookbook() # Initialize the class
    loop = True
    while loop == True:
        print
'==================================================='
        print '                 RECIPE DATABASE'
        print
'==================================================='
        print ' 1 - Show All Recipes'
        print ' 2 - Search for a recipe'
        print ' 3 - Show a Recipe'
        print ' 4 - Delete a recipe'
        print ' 5 - Add a recipe'
        print ' 6 - Print a recipe'
        print ' 0 - Exit'
        print
'==================================================='
        response = raw_input('Enter a selection -> ')
```

```
          if response == '1': # Show all recipes
              pass
          elif response == '2': # Search for a recipe
              pass
          elif response == '3': # Show a single recipe
              pass
          elif response == '4': # Delete Recipe
              pass
          elif response == '5': # Add a recipe
              pass
          elif response == '6': # Print a recipe
              pass
          elif response == '0': # Exit the program
              print 'Goodbye'
              loop = False
          else:
              print 'Unrecognized command.  Try again.'
```

```
/usr/bin/python -u
"/home/greg/python_examples/APSW/cookbook/cookbook_stub.py"
===================================================
                  RECIPE DATABASE
===================================================
1 - Show All Recipes
2 - Search for a recipe
3 - Show a Recipe
4 - Delete a recipe
5 - Add a recipe
6 - Print a recipe
0 - Exit
===================================================
Enter a selection ->
```

our if routine to handle whichever option the user selected. Before we can run this for a test, we need to create a stub inside our class for the __init__ routine:

```
def __init__(self):
    pass
```

Now, save your program where you saved the database you created from the last time, and run it. You should see something like that shown above right.

It should simply print the menu over and over, until you type “0”, and then print “Goodbye” and exit. At this point, we can now start stubs of our routines in the Cookbook class. We will need a routine that will display all the information out of the Recipes data table, one that will allow you to search for a recipe, one that will show the data for a single recipe from all three tables, one that will delete a recipe, one that will allow you to add a recipe, and one that will print the recipe to the default printer. The PrintAllRecipes routine doesn't need a parameter other than the (self) parameter, neither does the SearchforRecipe nor the EnterNew routines. The PrintSingleRecipe, DeleteRecipe and PrintOut routines all need to know what recipe to deal with, so they will need to have a parameter that we'll call “which”. Use the pass command to finish each stub. Under the Cookbook class, create the routine stubs:

```
def PrintAllRecipes(self):
    pass
def SearchForRecipe(self):
    pass
def
PrintSingleRecipe(self,which)
:
    pass
def DeleteRecipe(self,which):
    pass
def EnterNew(self):
    pass
def PrintOut(self,which):
    pass
```

For a number of the menu items, we will want to print out all of the recipes from the Recipe table – so the user can pick from that list. These will be options 1, 3, 4 and 6. So, modify the menu routine for those options, replacing the pass command with cbk.PrintAllRecipes(). Our response check routine will now look like the code at the top of the next page.

One more thing to do is to set up the __init__ routine. Replace the stub with the following lines:

```
def __init__(self):
    global connection
    global cursor
    self.totalcount = 0

connection=apsw.Connection("c
ookbook.db3")
    cursor=connection.cursor()
```

```
        if response == '1': # Show all recipes
            cbk.PrintAllRecipes()
        elif response == '2': # Search for a recipe
            pass
        elif response == '3': # Show a single recipe
            cbk.PrintAllRecipes()
        elif response == '4': # Delete Recipe
            cbk.PrintAllRecipes()
        elif response == '5': # Add a recipe
            pass
        elif response == '6': # Print a recipe
            cbk.PrintAllRecipes()
        elif response == '0': # Exit the program
            print 'Goodbye'
            loop = False
        else:
            print 'Unrecognized command.  Try again.'
```

First we create two global variables for our connection and cursor. We can access them from anywhere within the cookbook class. Next, we create a variable self.totalcount which we use to count the number of recipes. We'll be using this variable later on. Finally we create the connection and the cursor.

The next step will be to flesh out the PrintAllRecipes() routine in the Cookbook class. Since we have the global variables for connection and cursor, we don't need to re-create them in each routine. Next, we will want to do a "pretty print" to the screen for headers for our recipe list. We'll use the "%s" formatting command, and the left justify command, to space out our screen output. We want it to look like this:

```
Item Name    Serves    Source

---------------------------
```

Finally, we need to create our SQL statement, query the database, and display the results. Most of this was covered in the article last time.

```
    sql = 'SELECT * FROM
Recipes'
    cntr = 0
    for x in
cursor.execute(sql):
        cntr += 1
        print '%s %s %s %s'
%(str(x[0]).rjust(5),x[1].lju
st(30),x[2].ljust(20),x[3].lj
ust(30))
    print '--------------'
    self.totalcount = cntr
```

The cntr variable will count the number of recipes we display to the user. Now our routine is done. Shown below is the full code for the routine, just in case you missed something.

Notice that we are using the tuple that is returned from the cursor.execute routine from ASPW. We are printing the pkID as the item for each recipe. This will allow us to select the correct recipe later on. When you run your program, you should see the menu, and when you select option 1, you'll get what's shown at the top of the next page.

That's what we wanted, except if you are running the app in Dr.Python or the like, the program doesn't pause. Let's add a pause until the user presses a key so they can look at the output for a second or two. While we are at it, let's print out the total number of recipes from the variable we set up a moment ago. Add to the bottom of option 1 of the menu:

```
    def PrintAllRecipes(self):
        print '%s %s %s %s'
%('Item'.ljust(5),'Name'.ljust(30),'Serves'.ljust(20),'
Source'.ljust(30))
        print '---------------------------------'
        sql = 'SELECT * FROM Recipes'
        cntr = 0
        for x in cursor.execute(sql):
            cntr += 1
            print '%s %s %s %s'
%(str(x[0]).rjust(5),x[1].ljust(30),x[2].ljust(20),x[3]
.ljust(30))
        print '---------------------------------'
        self.totalcount = cntr
```

```
Enter a selection -> 1
Item  Name                           Serves               Source
--------------------------------------------------------------------------------------------
    1 Spanish Rice                   4                    Greg
    2 Pickled Pepper-Onion Relish    9 half pints         Complete Guide to Home Canning
--------------------------------------------------------------------------------------------
===================================================
               RECIPE DATABASE
===================================================
1 - Show All Recipes
2 - Search for a recipe
3 - Show a Recipe
4 - Delete a recipe
5 - Add a recipe
6 - Print a recipe
0 - Exit
===================================================
Enter a selection ->
```

```
print 'Total Recipes - %s' %cbk.totalcount

print '-------------------------------------------------------------'

res = raw_input('Press A Key -> ')
```

We'll skip option #2 (Search for a recipe) for a moment, and deal with #3 (Show a single recipe). Let's deal with the menu portion first. We'll show the list of recipes, as for option 1, and then ask the user to select one. To make sure we don't get errors due to a bad user input, we'll use the Try|Except structure. We will print the prompt to the user (Select a recipe !), then, if they enter a correct response, we'll call the PrintSingleRecipe() routine in our Cookbook class with the pkID from our Recipe table. If the entry is not a number, it will raise a ValueError exception, which we handle with the except ValueError: catch shown right.

Next, we'll work on our PrintSingleRecipe routine in the Cookbook class. We start with the connection and cursor again, then create our SQL statement. In this case, we use 'SELECT * FROM Recipes WHERE pkID = %s" % str(which)' where which is the value we want to find. Then we "pretty print" the output, again from the tuple returned by ASPW. In this case, we use x as the gross variable, and then each one with bracketed index into the tuple. Since the table layout is pkID/name/servings/source, we can use x[0],x[1],x[2] and x[3] as the detail. Then, we want to select everything from the ingredients table where the recipeID (our key into the recipes data table) is equal to the pkID we just used. We loop through the tuple returned, printing each ingredient, and then finally we get the instructions from the instructions table – just like we did for the ingredients table. Finally, we wait for the user to press a key so they can see the recipe on the screen. The code is shown on the next page.

```
try:
    res = int(raw_input('Select a Recipe -> '))
    if res <= cbk.totalcount:
        cbk.PrintSingleRecipe(res)
    elif res == cbk.totalcount + 1:
        print 'Back To Menu...'
    else:
        print 'Unrecognized command.  Returning to menu.'
except ValueError:
    print 'Not a number...back to menu.'
```

Now, we have two routines

out of the six finished. So, let's deal with the search routine, again starting with the menu. Luckily this time, we just call the search routine in the class, so replace the pass command with:

```
cbk.SearchForRecipe()
```

Now to flesh out our search code. In the Cookbook class, replace our stub for the SearchForRecipe with the code shown on the next page.

There's a lot going on there. After we create our connection and cursor, we display our search menu. We are going to give the user three ways to search, and a way to exit the routine. We can let the user search by a word in the recipe name, a word in the recipe source, or a word in the ingredient list. Because of this, we can't just use the display routine we just created, and will need to create custom printout routines. The first two options use simple SELECT statements with an added twist. We are using the "like" qualifier. If we were using a query browser like SQLite Database Browser, our like statement uses a wildcard character of "%". So, to look for a recipe containing "rice" in the recipe name, our query would be:

```
SELECT * FROM Recipes WHERE
name like '%rice%'
```

However, since the "%" character is also a substitution character in our strings, we have to use %% in our text. To make it worse, we are using the substitution character to insert the word the user is searching for. Therefore, we must make it '%%%s%%'. Sorry if this is as clear as mud. The third query is called a Join statement. Let's look at it a bit closer:

```
sql = "SELECT
r.pkid,r.name,r.servings,r.so
urce,i.ingredients FROM
Recipes r Left Join
ingredients i on (r.pkid =
i.recipeid) WHERE
i.ingredients like '%%%s%%'
GROUP BY r.pkid" %response
```

We are selecting everything from the recipe table, and the ingredients from the ingredients table, joining or relating the ingredient table ON the recipeID being equal to the pkID in the recipe table, then searching for our ingredient using the like statement, and, finally, grouping the result by the pkID in the recipe table to keep duplicates from being shown. If you remember, we have peppers twice in the second recipe (Onion and pepper relish), one green and one red. That could create confusion in our user's mind. Our menu uses

```
searchin = raw_input('Enter
Search Type -> ')

if searchin != '4':
```

which says: if searchin (the value the user entered) is NOT equal to 4 then do the options, if it is 4, then don't do

```
    def PrintSingleRecipe(self,which):
            sql = 'SELECT * FROM Recipes WHERE pkID = %s' %
str(which)
            print
'~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~'
            for x in cursor.execute(sql):
                recipeid =x[0]
                print "Title: " + x[1]
                print "Serves: " + x[2]
                print "Source: " + x[3]
            print
'~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~'
            sql = 'SELECT * FROM Ingredients WHERE RecipeID =
%s' % recipeid
            print 'Ingredient List:'
            for x in cursor.execute(sql):
                print x[1]
            print ''
            print 'Instructions:'
            sql = 'SELECT * FROM Instructions WHERE RecipeID
= %s' % recipeid
            for x in cursor.execute(sql):
                print x[1]
            print
'~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~'
            resp = raw_input('Press A Key -> ')
```

```
    def SearchForRecipe(self):
        # print the search menu
        print '-------------------------------'
        print ' Search in'
        print '-------------------------------'
        print ' 1 - Recipe Name'
        print ' 2 - Recipe Source'
        print ' 3 - Ingredients'
        print ' 4 - Exit'
        searchin = raw_input('Enter Search Type -> ')
        if searchin != '4':
            if searchin == '1':
                search = 'Recipe Name'
            elif searchin == '2':
                search = 'Recipe Source'
            elif searchin == '3':
                search = 'Ingredients'
            parm = searchin
            response = raw_input('Search for what in %s (blank to exit) -> ' % search)
            if parm == '1': # Recipe Name
                sql = "SELECT pkid,name,source,servings FROM Recipes WHERE name like '%%%s%%'" %response
            elif parm == '2': # Recipe Source
                sql = "SELECT pkid,name,source,servings FROM Recipes WHERE source like '%%%s%%'" %response
            elif parm == '3': # Ingredients
                sql = "SELECT r.pkid,r.name,r.servings,r.source,i.ingredients FROM Recipes r Left Join ingredients i
on (r.pkid = i.recipeid) WHERE i.ingredients like '%%%s%%' GROUP BY r.pkid" %response
            try:
                if parm == '3':
                    print '%s %s %s %s %s'
%('Item'.ljust(5),'Name'.ljust(30),'Serves'.ljust(20),'Source'.ljust(30),'Ingredient'.ljust(30))
                    print '--------------------------------------------------------------------------------------'
                else:
                    print '%s %s %s %s' %('Item'.ljust(5),'Name'.ljust(30),'Serves'.ljust(20),'Source'.ljust(30))
                    print '--------------------------------------------------------------------------------------'
                for x in cursor.execute(sql):
                    if parm == '3':
                        print '%s %s %s %s %s'
%(str(x[0]).rjust(5),x[1].ljust(30),x[2].ljust(20),x[3].ljust(30),x[4].ljust(30))
                    else:
                        print '%s %s %s %s' %(str(x[0]).rjust(5),x[1].ljust(30),x[3].ljust(20),x[2].ljust(30))
            except:
                print 'An Error Occured'
            print '--------------------------------------------------------------------------------------'
            inkey = raw_input('Press a key')
```

anything, just fall through. Notice that I used "!=" as Not Equal To instead of "<>". Either will work under Python 2.x. However, in Python 3.x, it will give a syntax error. We'll cover more Python 3.x changes in a future article. For now, start using "!=" to make your life easier to move to Python 3.x in the future. Finally, we "pretty print" again our output. Let's look at what the user will see, shown right.

You can see how nicely the program prints the output. Now, the user can go back to the menu and use option #3 to print whichever recipe they want to see. Next we will add recipes to our database. Again, we just have to add one line to our menu routine, the call to the EnterNew routine:

```
cbk.EnterNew()
```

The code that needs to replace the stub in the Cookbook class for EnterNew() is at: http://pastebin.com/f1d868e63.

We start by defining a list named "ings" – which stands

```
Enter a selection -> 2
-------------------------------
Search in
-------------------------------
1 - Recipe Name
2 - Recipe Source
3 - Ingredients
4 - Exit
Enter Search Type -> 1
Search for what in Recipe Name (blank to exit) -> rice
Item  Name                         Serves                    Source
--------------------------------------------------------------------------------------
    1 Spanish Rice                 4                         Greg
--------------------------------------------------------------------------------------
Press a key
```

Easy enough. Now for the ingredient search...

```
Enter a selection -> 2
-------------------------------
Search in
-------------------------------
1 - Recipe Name
2 - Recipe Source
3 - Ingredients
4 - Exit
Enter Search Type -> 3
Search for what in Ingredients (blank to exit) -> onion
Item  Name                  Serves             Source                         Ingredient

--------------------------------------------------------------------------------------
1 Spanish Rice              4                  Greg                           1 small
Onion chopped
2 Pickled Pepper-Onion Relish  9 half pints    Complete Guide to Home Canning 6 cups
finely chopped Onions
--------------------------------------------------------------------------------------
Press a key
```

for ingredients. We then ask the user to enter the title, source, and servings. We then enter a loop, asking for each ingredient, appending to the ing list. If the user enters 0, we exit the loop and continue on asking for the instructions. We then show the recipe contents and ask the user to verify before saving the data. We use INSERT INTO statements, like we did last time, and return to the menu. One thing we have to be careful of is the single quote in our entries. USUALLY, this won't be a problem in the ingredient list or the instructions, but in our title or source fields, it could come up. We need to add an escape character to any single quotes. We do this with the string.replace routine, which is why we imported the string library. In the menu routine, put the code shown above right under option #4.

Then, in the Cookbook class, use the code shown below right for the DeleteRecipe() routine.

Quickly, we'll go through the delete routine. We first ask the user which recipe to delete (back in the menu), and pass that pkID number into our delete routine. Next, we ask the user 'are they SURE' they want to delete the recipe. If the response is “Y” (string.upper(resp) == 'Y'), then we create the sql delete statements. Notice that this time we have to delete records from all three tables. We certainly could just delete the record from the recipes table, but then we'd have orphan records in the other two, and that wouldn't be good. When we delete the record from the recipe table, we use the pkID field. In the other two tables, we use the recipeID field.

Finally, we will deal with the routine to print the recipes. We'll be creating a VERY simple HTML file, opening the default browser and allowing them to print from there. This is why we are importing the webbrowser library. In the menu routine for option #6, insert the code shown at the top of the next page.

Again, we display a list of all the recipes, and allow them to select the one that they wish to print. We call the PrintOut routine in the Cookbook class. That code is shown at the top right of the next page.

```
cbk.PrintAllRecipes()
      print '0 - Return To Menu'
      try:
           res = int(raw_input('Select a Recipe to DELETE
or 0 to exit -> '))
           if res != 0:
                cbk.DeleteRecipe(res)
           elif res == '0':
                print 'Back To Menu...'
           else:
                print 'Unrecognized command.  Returning to
menu.'
      except ValueError:
            print 'Not a number...back to menu.'
```

```
     def DeleteRecipe(self,which):
         resp = raw_input('Are You SURE you want to Delete
this record? (Y/n) -> ')
         if string.upper(resp) == 'Y':
             sql = "DELETE FROM Recipes WHERE pkID = %s" %
str(which)
             cursor.execute(sql)
             sql = "DELETE FROM Instructions WHERE recipeID
= %s" % str(which)
             cursor.execute(sql)
             sql = "DELETE FROM Ingredients WHERE recipeID
= %s" % str(which)
             cursor.execute(sql)
             print "Recipe information DELETED"
             resp = raw_input('Press A Key -> ')
         else:
             print "Delete Aborted - Returning to menu"
```

page.

We start with the fi = open([filename],'w') command which creates the file. We then pull the information from the recipe table, and write it to the file with the fi.write command. We use the <H1></H1> header 1 tag for the title, the

<H2> tag for servings and source. We then use the list tags for our ingredient list, and then write the instructions. Other than that it's simple queries we've already learned. Finally, we close the file with the fi.close() command, and use webbrowser.open([filename]) with the file we just created. The user can then print from their web browser – if required.

WHEW! This was our biggest application to date. I've posted the full source code (and the sample database if you missed last month) on my website. If you don't want to type it all in or have any problems, then hop over to my web site, www.thedesignatedgeek.com to get the code.

```
cbk.PrintAllRecipes()
        print '0 - Return To Menu'
        try:
            res = int(raw_input('Select a Recipe to DELETE or 0 to exit -> '))
            if res != 0:
                cbk.PrintOut(res)
            elif res == '0':
                print 'Back To Menu...'
            else:
                print 'Unrecognized command.  Returning to menu.'
        except ValueError:
            print 'Not a number...back to menu.'
```

```
    def PrintOut(self,which):
        fi = open('recipeprint.html','w')
        sql = "SELECT * FROM Recipes WHERE pkID = %s" % which
        for x in cursor.execute(sql):
            RecipeName = x[1]
            RecipeSource = x[3]
            RecipeServings = x[2]
        fi.write("<H1>%s</H1>" % RecipeName)
        fi.write("<H2>Source: %s</H2>" % RecipeSource)
        fi.write("<H2>Servings: %s</H2>" % RecipeServings)
        fi.write("<H3> Ingredient List: </H3>")
        sql = 'SELECT * FROM Ingredients WHERE RecipeID = %s' % which
        for x in cursor.execute(sql):
            fi.write("<li>%s</li>" % x[1])
        fi.write("<H3>Instructions:</H3>")
        sql = 'SELECT * FROM Instructions WHERE RecipeID = %s' % which
        for x in cursor.execute(sql):
            fi.write(x[1])
        fi.close()
        webbrowser.open('recipeprint.html')
        print "Done"
```

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HOW-TO

Written by Greg Walters

Program In Python - Part 9

SEE ALSO:
FCM#27-34 - Python Parts 1 - 8

APPLICABLE TO:
ubuntu kubuntu xubuntu

CATEGORIES:
Dev Graphic Internet M/media System

DEVICES:
CD/DVD HDD USB Drive Laptop Wireless

If you are anything like me, you have some of your favorite music on your computer in the form of MP3 files. When you have less than 1000 music files, it's rather easy to remember what you have and where it is. I, on the other hand, have many more than that. In a past life, I was a DJ and converted most of my music a number of years ago. The biggest problem that I had was disk space. Now the biggest problem is remembering what I have and where it is.

In this and the next installment we will look at making a catalog for our MP3 files. We will also take a look at some new python concepts as well as re-visiting our database skills.

First, an MP3 file can hold information about the file itself. The title of the song, the album, artist and more information. This information is held in ID3 tags and is referred to as metadata. Back in the early days, there was only a limited amount of information that could be held inside of the MP3 file. Originally, it was stored at the very end of the file in a block of 128 bytes. Because of the small size of this block, you could only hold 30 characters for the title of the song, name of the artist, and so on. For many music files, this was fine, but (and this is one of my favorite songs ever) when you had a song with the name “Clowns (The Demise of the European Circus with No Thanks to Fellini)”, you only got the first 30 characters. That was a BIG frustration for many people. So, the “standard” ID3 tag became known as ID3v1 and a new format was created called, amazingly enough, ID3v2. This new format allowed for variable length information and was placed at the beginning of the file, while the old ID3v1 metadata was still stuck at the end of the file for the benefit of the older players. Now the metadata container could hold up to 256 MB of data. This was ideal for radio stations and crazies like me. Under ID3v2, each group of information is held in what's called a frame and each frame has a frame identifier. In an earlier version of ID3v2, the identifier was three characters long. The current version (ID3v2.4) uses a four character identifier.

In the early days, we would open the file in binary mode, and dig around getting the information as we needed it, but that was a lot of work, because there were no standard libraries available to handle it. Now we have a number of libraries that handle this for us. We will use one for our project called Mutagen. You will want to go into Synaptic and install python-mutagen. If you want, you could do a search for “ID3” in Synaptic. You'll find there are over 90 packages (in Karmic), and if you type “Python” in the quick search box, you'll find 8 packages. There are pros and cons with any of them, but for our project, we'll stick with Mutagen. Feel free to dig into some of the other ones for your extended learning.

Now that you have Mutagen installed, we'll start our coding.

Start a new project and name it “mCat”. We'll start by doing our imports.

```
from mutagen.mp3 import MP3

import os

from os.path import
join,getsize,exists

import sys

import apsw
```

For the most part, you've seen these before. Next, we want to create our stubbed function headers.

```
def MakeDataBase():
     pass
def S2HMS(t):
    pass
def WalkThePath(musicpath):
     pass
def error(message):
    pass
def main():
    pass
def usage():
    pass
```

Ahhh...something new. We now have a main function and a usage function. What are these for? Let's put one more thing in before we discuss them.

```
if __name__ == '__main__':
    main()
```

What the heck is that? This is a trick that allows our file to be used as either a stand alone application or a re-usable module that gets imported into another app. Basically it says "IF this file is the main app, we should go into the main routine to run, otherwise we are going to use this as a utility module and the functions will be called directly from another program.

Next, we'll flesh out the usage function. Below is the full code for the usage routine.

Here we are going to create a message to display to the user if they don't start our application with a parameter that we need to be able to run as a standalone app. Notice we use '\n' to force a new line and '\t' to force a tab. We also use a '%s' to include the application name which is held in the sys.argv[0]. We then use the error routine to output the message, then exit the application (sys.exit(1)).

Next, let's flesh out the error routine. Here is the full error routine.

```
def error(message):
    print >> sys.stderr,
str(message)
```

We are using something called redirection here (the ">>"). When we use the function "print", we are telling python we want to output, or stream, to the standard output device, usually the terminal that we are running in. To do this we use (invisibly) stdout. When we want to send an error message, we use the stderr stream. This is also the terminal. So we redirect the print output to the stderr stream.

Now, let's work on the main routine. Here we will setup our connection and cursor for our database, then look at our system argument parameters, and if everything is good, we'll call our functions to do the actual work we want done. Here's the code:

As we did last time, we

```
def usage():
    message = (
        '==============================================\n'
        'mCat - Finds all *.mp3 files in a given folder (and sub-folders),\n'
        '\tread the id3 tags, and write that information to a SQLite database.\n\n'
        'Usage:\n'
        '\t{0} <foldername>\n'
        '\t WHERE <foldername> is the path to your MP3 files.\n\n'
        'Author: Greg Walters\n'
        'For Full Circle Magazine\n'
        '==============================================\n'
        ).format(sys.argv[0])
    error(message)
    sys.exit(1)
```

```
def main():
    global connection
    global cursor
    #----------------------------------------------
    if len(sys.argv) != 2:
        usage()
    else:
        StartFolder = sys.argv[1]
        if not exists(StartFolder): # From os.path
            print('Path {0} does not seem to
exist...Exiting.').format(StartFolder)
            sys.exit(1)
        else:
            print('About to work {0}
folder(s):').format(StartFolder)
        # Create the connection and cursor.
        connection=apsw.Connection("mCat.db3")
        cursor=connection.cursor()
        # Make the database if it doesn't exist...
        MakeDataBase()
        # Do the actual work...
        WalkThePath(StartFolder)
        # Close the cursor and connection...
        cursor.close()
        connection.close()
        # Let us know we are finished...
        print("FINISHED!")
```

create two global variables called connection and cursor for our database. Next we look at the parameters (if any) passed from the command line in the terminal. We do this with the sys.argv command. Here we are looking for two parameters, first the application name which is automatic and secondly the path to our MP3 files. If we don't see two parameters, we jump to the usage routine, which prints our message to the screen and exits. If we do, we fall into the else clause of our IF statement. Next, we put the parameter for the starting path into the StartFolder variable. Understand that if you have a path with a space in it, for example, (/mnt/musicmain/Adult Contemporary), the characters after the space will be seen as another parameter. So, whenever you use a path with a space, make sure you quote it. We then setup our connection and cursor, create the database, then do the actual hard work in the WalkThePath routine and finally close our cursor and connection to the database and then tell the user we are done. The full WalkThePath routine can be found at: http://pastebin.com/CegsAXjW.

First we clear the three counters we will be using to keep track of the work that has been done. Next we open a file to hold our error log just in case we have any problems. Next we do a recursive walk down the path provided by the user. Basically, we start at the provided file path and "walk" in and out of any sub-folders that happen to be there, looking for any files that have a ".mp3" extension. Next we increment the folder counter then the file counter to keep track of how many files we've dealt with. Next we we step through each of the files. We clear the local variables that hold the information about each song. We use the join function from os.path to create a proper path and filename so we can tell mutagen where to find the file. Now we pass the filename to the MP3 class getting back an instance of "audio". Next we get all the ID3 tags this file contains and then step through that list checking for the tags we want to deal with and assigning them to our temporary variables. This way, we can keep errors to a minimum. Take a look at the portion of code dealing with the track number. When mutagen returns a track number it can be a single value, a value like "4/18" or as _trk[0] and _trk[1] or it can be absolutely nothing. We use the try/except wrappers to catch any errors that will occur due to this. Next, look at the writing of the data records. We are doing things a bit different from last time. Here we create the SQL statement like before, but this time we are replacing the value variables with "?". We then put in the values in the cursor.execute statement. According to the ASPW web site, this is the better way to deal with it, so I won't argue with them. Finally we deal with any other types of errors we come up with. For the most part, these will be TypeErrors or ValueErrors and will probably occur because of Unicode characters that can't be handled. Take a quick look at the strange way we are formatting and outputting the string. We aren't using the '%' substitution character. We are using a “{0}” type substitution, which is part of the Python 3.x specification. The basic form is:

```
Print('String that will be
printed with {0} number of
statements”).format(replaceme
nt values)
```

We are using the basic syntax for the efile.writelines as well.

Finally we should take a look at the S2HMS routine. This routine will take the length of the song which is a floating point value returned by mutagen and convert it to a string using either “Hour:Minutes:Seconds” format or “Minutes:Seconds” format. Look at the return statements. Once again, we are using the Python 3.x formatting syntax. However, there's something new in the mix. We are using three substitution sets (0, 1 and 2), but what's the “:02n” after numbers 1 and 2? That says that we want leading zeros to two places. So if a song is 2 minutes and 4 seconds, the returned string would be “2:04”, not “2:4”.

The full code of our program is at: http://pastebin.com/rFf4Gm7E.

Dig around on the web and see what you can find about Mutagen. It does more than just MP3s.

Greg Walters is owner of *RainyDay Solutions, LLC*, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family.

MY STORY QUICKIE

My studio is fully digital with four Windows XP machines in a peer to peer network. My fifth machine runs Linux Ubuntu 9.04 exclusively as my test machine for Linux. I started with Ubuntu 7.04 and have upgraded each time there was a release. I have found it to be very stable, easy to use and configure as each version improves the OS.

At this time it is only my test bed but is linked to my network and shares data with my Windows machines. I have been very happy with the stability of Ubuntu in its upgrades, programs, hardware support, and driver updates. Although it is unfortunate that more major vendors such as Adobe don't port over, but Wine seems to work well. There are graphics programs and professional printers related to my camera equipment that do not work so I will have to wait until Wine gets better or the software gets ported over.

Audio, video, CD/DVD, USB, and Zip drives all seem to work 'out of the box' which is nice. Still some flaws in the software but they appear to be minor annoyances.

All in all Ubuntu has been visually refreshing and fun to play with. I am not a geek so I really do not use the command line unless curious about a tutorial and want to try it, the OS GUI is quite complete for us non-geeks who want to stick to a GUI.

I download Full Circle Magazine every month and have shared it with one of my colleagues to show him what is available. A lot of people still do not know about the OS and how easy it is to use, but as the Microsoft disgruntled get the word out I expect to see more growth. The one thing I absolutely love about this OS is the ability to shut down a misbehaving program. The break button works slickly in Linux and eliminates the frustration of waiting for Windows to unfreeze in XP. Why can't Windows do something as easy as that? I seldom need to use the button in Linux anyway which shows how stable Linux is.

Brian G Hartnell - *Photographer*

Program In Python - Part 10

SEE ALSO:
FCM#27-35 - Python Parts 1 - 9

APPLICABLE TO:
ubuntu kubuntu xubuntu

CATEGORIES:
Dev Graphic Internet M/media System

DEVICES:
CD/DVD HDD USB Drive Laptop Wireless

You probably have heard of the term XML. You may not, however, know what it is. XML will be the focus of our lesson this month. The goal is:

- To familiarize you with what XML is.
- To show you how to read and write XML files in your own applications.
- Get you ready for a fairly large XML project next time.

So... let's talk about XML. XML stands for EXtensible Markup Language, very much like HTML. It was designed to provide a way to store and transport data efficiently over the Internet or other communication path. XML is basically a text file that is formatted using your own tags and should be fairly self-documenting. Being a text file, it can be compressed to allow for faster and easier transfer of the data. Unlike HTML, XML doesn't do anything by itself. It doesn't care how you want your data to look. As I said a moment before, XML doesn't require you to stick to a series of standard tags. You can create your own.

Let's take a look at a generic example of an XML file:

```
<root>
     <node1>Data
Here</node1>
     <node2
attribute="something">Node 2
data</node2>
     <node3>
        <node3sub1>more
data</node3sub1>
     </node3>
</root>
```

The first thing to notice is the indentation. In reality, indentation is simply for human consumption. The XML file would work just as well if it looked like this...

```
<root><node1>Data
Here</node1><node2
attribute="something">Node 2
data</node2><node3><node3sub
1>more
data</node3sub1></node3></ro
ot>
```

Next, the tags contained in the “<>” brackets have some rules. First, they must be a single word. Next, when you have a start tag (for example <root>) you must have a matching closing tag. The closing tag starts with a “/”. Tags are also case sensitive: <node>, <Node>, <NODE> and <NodE> are all different tags, and the closing tag must match. Tag names may contain letters, numbers and other characters, but may not start with a number or punctuation. You should avoid “-”, “.” and “:” in your tag names since some software applications might consider them some sort of command or property of an object. Also, colons are reserved for something else. Tags are referred to as elements.

Every XML file is basically a tree - starting from a root and branching out from there. Every XML file MUST have a root element, which is the parent of everything else in the file. Look again at our example. After the root, there are three child elements: node1, node2 and node3. While they are children of the root element, node3 is also a parent of node3sub1.

Now take a look at node2. Notice that in addition to having its normal data inside the brackets, it also has something called an attribute. These days, many developers avoid attributes, since elements are just as effective and less hassle, but you will find that attributes are still used. We'll look at them some more in a little bit.

Let's take a look at the useful example below.

Here we have the root element named "people", containing two child elements named "person". Each 'person' child has 6 child elements: firstname, lastname, gender, address, city and state. At first glance, you might think of this XML file as a database (remembering the last few lessons), and you would be correct. In fact, some applications use XML files as simple database structures. Now, writing an application to read this XML file could be done without too much trouble. Simply open the file, read each line and, based on the element, deal with the data as it's read and then close the file when you are done. However, there are better ways to do it.

In the following examples, we are going to use a library module called ElementTree. You can get it directly from Synaptic by installing python-elementtree. However, I chose to go to the ElementTree website (http://effbot.org/downloads/#elementtree) and download the source file directly (elementtree-1.2.6-20050316.tar.gz). Once downloaded, I used the package manager to extract it to a temporary folder. I changed to that folder and did a "sudo python setup.py install". This placed the files into the python common folder so I could use it in either python 2.5 or 2.6. Now we can start to work. Create a folder to hold this month's code, copy the above XML data into your favorite text editor, and save it into that folder as "xmlsample1.xml".

```
<people>
    <person>
        <firstname>Samantha</firstname>
        <lastname>Pharoh</lastname>
        <gender>Female</gender>
        <address>123 Main St.</address>
        <city>Denver</city>
        <state>Colorado</state>
    </person>
    <person>
        <firstname>Steve</firstname>
        <lastname>Levon</lastname>
        <gender>Male</gender>
        <address>332120 Arapahoe Blvd.</address>
        <city>Denver</city>
        <state>Colorado</state>
    </person>
</people>
```

Now for our code. The first thing we want to do is test our install of ElementTree. Here's the code:

```
import elementtree.ElementTree as ET

tree = ET.parse('xmlsample1.xml')

ET.dump(tree)
```

When we run the test program, we should get back something like what is shown below right.

All that we did was allow ElementTree to open the file, parse the file into its base

```
/usr/bin/python -u "/home/greg/Documents/articles/xml/reader1.py"

<people>
    <person>
        <firstname>Samantha</firstname>
        <lastname>Pharoh</lastname>
        <gender>Female</gender>
        <address>123 Main St.</address>
        <city>Denver</city>
        <state>Colorado</state>
    </person>
    <person>
        <firstname>Steve</firstname>
        <lastname>Levon</lastname>
        <gender>Male</gender>
        <address>332120 Arapahoe
Blvd.</address>
        <city>Denver</city>
        <state>Colorado</state>
    </person>
</people>
```

parts, and dump it out as it is in memory. Nothing fancy here.

Now, replace your code with the following:

```
import
elementtree.ElementTree as ET

tree =
ET.parse('xmlsample1.xml')

person =
tree.findall('.//person')

for p in person:
    for dat in p:
        print "Element: %s -
Data: %s" %(dat.tag,dat.text)
```

and run it again. Now your output should be:

```
/usr/bin/python -u
"/home/greg/Documents/article
s/xml/reader1.py"

Element: firstname - Data:
Samantha
Element: lastname - Data:
Pharoh
Element: gender - Data:
Female
Element: address - Data: 123
Main St.
Element: city - Data: Denver
Element: state - Data:
Colorado
Element: firstname - Data:
Steve
Element: lastname - Data:
Levon
Element: gender - Data: Male
Element: address - Data:
332120 Arapahoe Blvd.
Element: city - Data: Denver
Element: state - Data:
Colorado
```

Now we have each piece of data along with the tag name. We can simply do some pretty printing to deal with what we have. Let's look at what we did here. We had ElementTree parse the file into an object named tree. We then asked ElementTree to find all instances of person. In the sample we are using, there are two, but it could be 1 or 1000. Person is a child of people and we know that people is simply the root. All of our data is broken down within person. Next we created a simple for loop to walk through each person object. We then created another for loop to pull out the data for each person, and display it by showing the element name (.tag) and the data (.text).

Now for a more real-world example. My family and I enjoy an activity called Geocaching. If you don't know what that is, it's a "geeky" treasure hunt that uses a hand-held GPS device to find something someone else has hidden. They post the gross GPS coordinates on a web site, sometimes with clues, and we enter the coordinates into our GPS and then try to go find it. According to Wikipedia, there are over 1,000,000 active cache sites world wide, so there are probably a few in your area. I use two websites to get the locations we search for. One is http://www.geocaching.com/ and the other is http://navicache.com/. There are others, but these two are about the biggest.

Files that contain the information for each geocaching site are usually basic XML files. There are applications that will take those data and transfer them to the GPS device. Some of

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<loc version="1.0" src="NaviCache">
   <waypoint>
      <name id="N02CAC"><![CDATA[Take Goofy Pictures at Grapevine Lake  by g_phillips
Open Cache: Unrestricted
Cache Type: Normal
Cache Size: Normal
Difficulty: 1.5
Terrain    : 2.0]]></name>
      <coord  lat="32.9890166666667"  lon="-97.0728833333333" />
      <type>Geocache</type>
      <link text="Cache Details">http://www.navicache.com/cgi-
bin/db/displaycache2.pl?CacheID=11436</link>
   </waypoint>
</loc>
```

Navicache file

them act as database programs - that allow you to keep track of your activity, sometimes with maps. For now, we'll concentrate on just parsing the download files.

I went to Navicache and found a recent hide in Texas. The information from the file is shown on the previous page.

Copy the data from that box, and save it as “Cache.loc”. Before we start coding, let's examine the cache file.

The first line basically tells us that this is a validated XML file, so we can safely ignore it. The next line (that starts with “loc”) is our root, and has the attributes "version" and "src". Remember I said earlier that attributes are used in some files. We'll deal with more attributes in this file as we go on. Again, the root in this case can be ignored. The next line gives us our waypoint child. (A waypoint is a location where, in this case, the cache is to be found.) Now we get the important data that we want. There is the name of the cache, the coordinates in latitude and longitude, the type of cache it is, and a link to the web page for more information about this cache. The name element is a long string that has a bunch of information that we can use, but we'll need to parse it ourselves. Now let's create a new application to read and display this file. Name it "readacache.py". Start with the import and parse statements from our previous example.

```
import
elementtree.ElementTree as ET

tree = ET.parse('Cache.loc')
```

Now we want to get back just the data within the waypoint tag. To do this, we use the .find function within ElementTree. This will be returned in the object “w”.

```
w = tree.find('.//waypoint')
```

Next, we want to go through all the data. We'll use a for loop to do this. Within the loop, we will check the tag to find the elements 'name', 'coord', 'type' and 'link'. Based on which tag we get, we'll pull out the information to print it later on.

```
for w1 in w:
    if w1.tag == "name":
```

Since we will be looking at the 'name' tag first, let's review the data we will be getting back.

```
<name
id="N02CAC"><![CDATA[Take
Goofy Pictures at Grapevine
Lake  by g_phillips

Open Cache: Unrestricted

Cache Type: Normal

Cache Size: Normal

Difficulty: 1.5

Terrain    : 2.0]]></name>
```

This is one really long string. The 'id' of the cache is set as an attribute. The name is the part after “CDATA” and before the “Open Cache:” part. We will be chopping up the string into smaller portions that we want. We can get part of a string by using:

```
newstring =
oldstring[startposition:endpo
sition]
```

So, we can use the code below to grab the information we need.

Next we need to grab the id that's located in the attribute of the name tag. We check to see if there are any attributes (which we know there are), like this:

```
# Get text of cache name up to the phrase "Open Cache: "
CacheName = w1.text[:w1.text.find("Open Cache: ")-1]
# Get the text between "Open Cache: " and "Cache Type: "
OpenCache = w1.text[w1.text.find("Open Cache:
")+12:w1.text.find("Cache Type: ")-1]
# More of the same
CacheType = w1.text[w1.text.find("Cache Type:
")+12:w1.text.find("Cache Size: ")-1]
CacheSize = w1.text[w1.text.find("Cache Size:
")+12:w1.text.find("Difficulty: ")-1]
Difficulty= w1.text[w1.text.find("Difficulty:
")+12:w1.text.find("Terrain    : ")-1]
Terrain =   w1.text[w1.text.find("Terrain    : ")+12:]
```

```
if w1.keys():
    for name,value in w1.items():
        if name == 'id':
            CacheID = value
```

Now, we can deal with the other tags for Coordinates, type, and link the code shown below right. Finally, we print them out to see them using the code at the bottom right. Far right is the full code.

You've learned enough now to read most XML files. As always, you can get the full code for this lesson on my website which is at: http://www.thedesignatedgeek.com.

Next time, we will utilize our XML knowledge to get information from a wonderful weather site and display it in a terminal. Have fun!

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```
elif w1.tag == "coord":
    if w1.keys():
        for name,value in w1.items():
            if name == "lat":
                Lat = value
            elif name == "lon":
                Lon = value
elif w1.tag == "type":
    GType = w1.text
elif w1.tag == "link":
    if w1.keys():
        for name, value in w1.items():
            Info = value
    Link = w1.text
```

```
print "Cache Name: ",CacheName
print "Cache ID: ",CacheID
print "Open Cache: ",OpenCache
print "Cache Type: ",CacheType
print "Cache Size: ",CacheSize
print "Difficulty: ", Difficulty
print "Terrain: ",Terrain
print "Lat: ",Lat
print "Lon: ",Lon
print "GType: ",GType
print "Link: ",Link
```

```
import elementtree.ElementTree as ET
tree = ET.parse('Cache.loc')
w = tree.find('.//waypoint')
for w1 in w:
    if w1.tag == "name":
        # Get text of cache name up to the phrase "Open Cache: "
        CacheName = w1.text[:w1.text.find("Open Cache: ")-1]
        # Get the text between "Open Cache: " and "Cache Type: "
        OpenCache = w1.text[w1.text.find("Open Cache: ")+12:w1.text.find("Cache Type: ")-1]
        # More of the same
        CacheType = w1.text[w1.text.find("Cache Type: ")+12:w1.text.find("Cache Size: ")-1]
        CacheSize = w1.text[w1.text.find("Cache Size: ")+12:w1.text.find("Difficulty: ")-1]
        Difficulty= w1.text[w1.text.find("Difficulty: ")+12:w1.text.find("Terrain  : ")-1]
        Terrain =  w1.text[w1.text.find("Terrain  : ")+12:]
        if w1.keys():
            for name,value in w1.items():
                if name == 'id':
                    CacheID = value
    elif w1.tag == "coord":
        if w1.keys():
            for name,value in w1.items():
                if name == "lat":
                    Lat = value
                elif name == "lon":
                    Lon = value
    elif w1.tag == "type":
        GType = w1.text
    elif w1.tag == "link":
        if w1.keys():
            for name, value in w1.items():
                Info = value
        Link = w1.text
print "Cache Name: ",CacheName
print "Cache ID: ",CacheID
print "Open Cache: ",OpenCache
print "Cache Type: ",CacheType
print "Cache Size: ",CacheSize
print "Difficulty: ", Difficulty
print "Terrain: ",Terrain
print "Lat: ",Lat
print "Lon: ",Lon
print "GType: ",GType
print "Link: ",Link
print "="*25

print "finished"
```

Program In Python - Part 11

SEE ALSO:
FCM#27-36 - Python Parts 1 - 10

APPLICABLE TO:
ubuntu kubuntu xubuntu

CATEGORIES:
Dev Graphic Internet M/media System

DEVICES:
CD/DVD HDD USB Drive Laptop Wireless

Last time, I promised you that we would use our XML expertise to grab weather information from a website and display it in a terminal. Well, that time has come.

We will use an API from www.wunderground.com. I hear the question "What's an API" rising in your throat. API stands for Application Programming Interface. It's really a fancy phrase for a way to interface with another program. Think of the libraries we import. Some of those can be run as stand-alone applications, but if we import the application as a library, we can use many of its functions in our own program, and we get to use someone else's code. In this case, we will use specially formatted URL addresses to query the wunderground website for information about the weather - without using a web browser. Some people might say that an API is like a secret back door into another program - that the programmer(s) intentionally put there for our use. Either way, this is a supported extension of one application for its use in other applications.

Sounds intriguing? Well, read on, my dear padawan.

Fire up your favorite browser, and head to www.wunderground.com. Now enter your postal code or city and state (or country) into the search box. There is a wealth of information here. Now, let's jump to the API web page: http://wiki.wunderground.com/index.php/API_-_XML

One of the first things you will notice is the API Terms of Service. Please read and follow them. They aren't onerous, and are really simple to abide by. The things that are going to be of interest to us are the *GeoLookupXML, WXCurrentObXML, AlertsXML* and *ForecastXML* calls. Take some time to scan over them.

I'm going to skip the GeoLookupXML routine, and let you look at that on your own. We will concentrate on two other commands: WXCurrentObXML (Current Conditions) this time, and ForecastXML (Forecast) next time.

Here's the link for WXCurrentObXML:
http://api.wunderground.com/auto/wui/geo/WXCurrentObXML/index.xml?query=80013

Replace the 80013 U.S. ZIP code with your postal code or if you are outside the U.S. you can try city, country - like Paris, France, or London, England.

And the link for the ForecastXML:
http://api.wunderground.com/auto/wui/geo/ForecastXML/index.xml?query=80013

Again, replace the 80013 U.S. ZIP code with your postal code or city, country.

Let's start with the current information. Paste the address into your favorite browser. You'll see a great deal of information returned. I'll let you decide what's really important to you, but we'll look at a few of the elements.

For our example, we'll pay attention to the following tags:

display_location

observation_time
weather
temperature_string
relative_humidity
wind_string
pressure_string

Of course, you can add other tags that are of interest to you. However, these tags will provide enough of an example to take you as far as you would like to go.

Now that we know what we will be looking for, let's start coding our app. Let's look at the gross flow of the program.

First, we check what the user has asked us to do. If she passed a location, we will use that, otherwise we will use the default location we code into the main routine. We then pass that getCurrents routine. We use the location to build the request string to send out to the web. We use urllib.urlopen to get the response from the web, and put that in an object, and pass that object to ElementTree library function parse. We then close the connection to the web and start looking for our tags. When we find a tag we are interested in, we save that text into a variable that we can use to output the data later on. Once we have all our data, we display it. Fairly simple in concept.

Start by naming your file w_currents.py. Here's the import portion of our code:

```
from xml.etree import
ElementTree as ET

import urllib

import sys

import getopt
```

Next, we'll put a series of help lines (above right) above the imports.

Be sure to use the triple double-quotes. This allows us to have a multi-line comment. We'll discuss this part more in a bit.

Now we'll create our class stubs, below right, and the main routines, which are shown on the following page.

You will remember from

```
""" w_currents.py
Returns current conditions, forecast and alerts for a
given zipcode from WeatherUnderground.com.
Usage: python wonderground.py [options]
Options:
-h, --help Show this help
-l, --location City,State to use
-z, --zip Zipcode to use as location

Examples:
w_currents.py -h (shows this help information)
w_currents.py -z 80013 (uses the zip code 80013 as
location)
"""
```

```
class CurrentInfo:
"""
This routine retrieves the current condition xml data from
WeatherUnderground.com
based off of the zip code or Airport Code...
currently tested only with Zip Code and Airport code
For location,
if zip code use something like 80013 (no quotes)
if airport use something like "KDEN" (use double-quotes)
if city/state (US) use something like "Aurora,%20CO" or
“Aurora,CO” (use double-quotes)
if city/country, use something like "London,%20England"
(use double-quotes)
"""
def getCurrents(self,debuglevel,Location):
pass

def output(self):
pass
def DoIt(self,Location):
pass

#=========================================
# END OF CLASS CurrentInfo()
#=========================================
```

previous articles the "if __name__" line. If we are calling this as a stand alone app, we will run the main routine - otherwise we can use this as part of a library. Once in the main routine, we then check what was passed into the routine, if anything.

If the user uses the "-h" or "--help" parameter, we print out the triple-commented help lines at the top of the program code. This is called by the usage routine telling the app to print __doc__.

If the user uses the "-l" (location) or "-z" (zipcode), that will override the internally set location value. When passing a location, be sure that you use double quotes to enclose the string and that you do not use spaces. For example, to get the current conditions for Dallas, Texas, use -l "Dallas,Texas".

Astute readers will realize that the -z and -l checks are pretty much the same. You can modify the -l to check for spaces and reformat the string before passing it to the routines. That's something you can do by now.

Finally, we create an instance of our CurrentInfo class that we call currents, and then pass the location to the "DoIt" routine. Let's fill that in now:

```
def DoIt(self,Location):

self.getCurrents(1,Location)

self.output()
```

Very simple. We pass the location and debug level to the getCurrents routine, and then call the output routine. While we could have simply done the output directly from the getCurrents routine, we are developing the flexibility to output in various ways if we need to.

The code for the getCurrents routine is displayed on the next page.

Here we have a parameter called debuglevel. By doing this, we can print out helpful information if things don't seem to be going quite the way we want them to. It's also useful when we are doing our early code. If, when you are all happy with the way your code is working, you can remove anything related to debuglevel. If you are going to release this into the wild, like if you are doing this for someone else, be sure to remove the code and test it again before release.

Now, we use a try/except wrapper to make sure that if something goes wrong, the app doesn't just blow up. Under the try side, we set up the URL, then set a timeout of eight seconds (urllib.socket.setdefaulttimeout(8)) . We do this because, sometimes, wunderground is busy and doesn't respond. This

```
def usage():
print __doc__
def main(argv):
location = 80013
try:
opts, args = getopt.getopt(argv, "hz:l:", ["help=",
"zip=", "location="])
except getopt.GetoptError:
usage()
sys.exit(2)
for opt, arg in opts:
if opt in ("-h", "--help"):
usage()
sys.exit()
elif opt in ("-l", "--location"):
location = arg
elif opt in ("-z", "--zip"):
location = arg
print "Location = %s" % location
currents = CurrentInfo()
currents.DoIt(location)

#============================================
# Main loop
#============================================
if __name__ == "__main__":

main(sys.argv[1:])
```

way we don't just sit there waiting for the web. If you want to get more information on urllib, a good place to start is http://docs.python.org/library/urllib.html.

If anything unexpected happens, we fall through to the except section, and print an error message, and then exit the application (sys.exit(2)).

Assuming everything works, we start looking for our tags. The first thing we do is find our location with the tree.findall("//full"). Remember, tree is the parsed object returned by elementtree. What is returned by the website API in part is shown below.

This is our first instance of the tag <full>, which in this case is "Aurora, CO". That's what we want to use as our location. Next, we are looking for "observation_time". This is the time when the current conditions were recorded. We continue looking for all the data we are interested in - using the same methodology.

Finally we deal with our output routine which is shown top left on the following page.

Here we simply print out the variables.

That's all there is to it. A sample output from my zip code with debuglevel set to 1 is shown bottom left on the next page.

Please note that I chose to use the tags that included both

```
<display_location>
<full>Aurora, CO</full>
<city>Aurora</city>
<state>CO</state>
<state_name>Colorado</state_name>
<country>US</country>
<country_iso3166>US</country_iso3166>
<zip>80013</zip>
<latitude>39.65906525</latitude>
<longitude>-104.78105927</longitude>
<elevation>1706.00000000 ft</elevation>
</display_location>
```

```
def getCurrents(self,debuglevel,Location):
if debuglevel > 0:
print "Location = %s" % Location
try:
CurrentConditions =
'http://api.wunderground.com/auto/wui/geo/WXCurrentObXML
/index.xml?query=%s' % Location
urllib.socket.setdefaulttimeout(8)
usock = urllib.urlopen(CurrentConditions)
tree = ET.parse(usock)
usock.close()
except:
print 'ERROR - Current Conditions - Could not get
information from server...'
if debuglevel > 0:
print Location
sys.exit(2)
# Get Display Location
for loc in tree.findall("//full"):
self.location = loc.text
# Get Observation time
for tim in tree.findall("//observation_time"):
self.obtime = tim.text
# Get Current conditions
for weather in tree.findall("//weather"):
self.we = weather.text
# Get Temp
for TempF in tree.findall("//temperature_string"):
self.tmpB = TempF.text
#Get Humidity
for hum in tree.findall("//relative_humidity"):
self.relhum = hum.text
# Get Wind info
for windstring in tree.findall("//wind_string"):
self.winds = windstring.text
# Get Barometric Pressure
for pressure in tree.findall("//pressure_string"):
self.baroB = pressure.text
```

getCurrents routine

```
def output(self):
print 'Weather Information From Wunderground.com'
print 'Weather info for %s ' % self.location
print self.obtime
print 'Current Weather - %s' % self.we
print 'Current Temp - %s' % self.tmpB
print 'Barometric Pressure - %s' % self.baroB
print 'Relative Humidity - %s' % self.relhum
print 'Winds %s' % self.winds
```

Fahrenheit and Celsius values. If you wish, for example, to display only Celsius values, you can use the <temp_c> tag rather than the <temperature_string> tag.

The full code can be downloaded from: http://pastebin.com/4ibJGm74

Next time, we'll concentrate on the forecast portion of the API. In the meantime, have fun!

```
Location = 80013
Weather Information From Wunderground.com
Weather info for Aurora, Colorado
Last Updated on May 3, 11:55 AM MDT
Current Weather - Partly Cloudy
Current Temp - 57 F (14 C)
Barometric Pressure - 29.92 in (1013 mb)
Relative Humidity - 25%
Winds From the WNW at 10 MPH
Script terminated.
```

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HOW-TO

Written by Greg Walters

Program In Python - Part 12

SEE ALSO:
FCM#27-37 - Python Parts 1 - 11

APPLICABLE TO:

ubuntu kubuntu xubuntu

CATEGORIES:

Dev Graphic Internet M/media System

DEVICES:

CD/DVD HDD USB Drive Laptop Wireless

In our last session, we looked at the API from wunderground, and wrote some code to grab the current conditions. This time, we will be dealing with the forecast portion of the API. If you haven't had a chance to look at the last two installments about XML, and the last one specifically, you might want to review them before moving forward.

Just as there was a web address for the current conditions, there is one for the forecast. Here is the link to the forecast XML page: http://api.wunderground.com/auto/wui/geo/ForecastXML/index.xml?query=80013

As before, you can change the '80013' to your City/Country, City/State, or postal code. You'll probably get back about 600 lines of XML code. You have a root element of 'forecast', and then four sub elements: 'termsofservice', 'txt_forecast', 'simpleforecast' and 'moon_phase'. We will concentrate on the 'txt_forecast' and 'simpleforecast' elements.

Since we went over the usage, main, and "if __name__" sections last time, I'll leave those to you to deal with and just concentrate on the goodies that we need for this time. Since I showed you a snippet f txt_forecast, let's start with that.

Shown below is a very small portion of the txt_forecast set for my area.

After the txt_forecast parent element, we get the date, a "number" element, then an element that has children of its own called forecastday which includes period, icon, icons, title and something called fcttext...then it repeats itself. The first thing you'll notice is that under txt_forecast, the date isn't a date, but a time value. It turns out that this is when the forecast was released. The <number> tag shows how many forecasts there are for the next 24 hour period. I can't think of a time that I've seen this value less than 2. For each forecast for the 24 hour period (<forecastday>), you have a period number, multiple icon options, a title option ("Today", "Tonight", "Tomorrow"), and the text of a simple forecast. This is a quick overview of the forecast, usually for the next 12 hours.

```
<txt_forecast>
              <date>3:31 PM MDT</date>
              <number>2</number>
              -<forecastday>
                            <period>1</period>
                            <icon>nt_cloudy</icon>
                            +<icons></icons>
                            <title>Tonight</title>
                            -<fcttext>
                            Mostly cloudy with a 20
percent chance of thunderstorms in the evening...then
partly cloudy after midnight. Lows in the mid 40s.
Southeast winds 10 to 15 mph shifting to the south after
midnight.
                    </fcttext>
              </forecastday>
              +<forecastday></forecastday>
</txt_forecast>
```

Before we start working with our code, we should take a look at the <simpleforecast> portion of the xml file which is shown right.

There is a <forecastday> tag for each day of the forecast period, usually 6 days including the current day. You have the date information in various formats (I personally like the <pretty> tag), projected high and low temps in both Fahrenheit and Celsius, gross condition projection, various icons, a sky icon (sky conditions at the reporting station), and "pop" which stands for "Probability Of Precipitation". The <moon_phase> tag provides some interesting information including sunset, sunrise, and moon information.

Now we'll get into the code. Here is the import set:

```
from xml.etree import
ElementTree as ET

import urllib

import sys

import getopt
```

Now we need to start our class. We will create an __init__ routine to setup and clear the variables that we need, this is shown top right on the following page.

If you don't care about carrying the ability of both Fahrenheit and Celsius, then leave out whichever variable set you don't want. I decided to carry both.

Next, we'll start our main retrieval routine to get the forecast data. This is shown bottom right on the next page.

This is pretty much the same as the current conditions routine we worked on last time. The only major difference (so far) is the URL we are using. Now things change. Since we have multiple children that have the same tag within the parent, we have to make our parse calls a bit different. The code is top left on the following page.

Notice we are using tree.find this time, and we are using for loops to walk through the data. It's a shame that Python

```
<simpleforecast>
    -<forecastday>
        <period>1</period>
        -<date>
            <epoch>1275706825</epoch>
            <pretty_short>9:00 PM MDT</pretty_short>
            <pretty>9:00 PM MDT on June 04, 2010</pretty>
            <day>4</day>
            <month>6</month>
            <year>2010</year>
            <yday>154</yday>
            <hour>21</hour>
            <min>00</min>
            <sec>25</sec>
            <isdst>1</isdst>
            <monthname>June</monthname>
            <weekday_short/>
            <weekday>Friday</weekday>
            <ampm>PM</ampm>
            <tz_short>MDT</tz_short>
            <tz_long>America/Denver</tz_long>
        </date>
        -<high>
            <fahrenheit>92</fahrenheit>
            <celsius>33</celsius>
        </high>
        -<low>
            <fahrenheit>58</fahrenheit>
            <celsius>14</celsius>
        </low>
        <conditions>Partly Cloudy</conditions>
        <icon>partlycloudy</icon>
        +<icons>
        <skyicon>partlycloudy</skyicon>
        <pop>10</pop>
    </forecastday>
                    ...
</simpleforecast>
```

```
#==================================
# Get the forecast for today and (if available)
tonight
#==================================
 fcst = tree.find('.//txt_forecast')
 for f in fcst:
     if f.tag == 'number':
         self.periods = f.text
     elif f.tag == 'date':
         self.date = f.text
     for subelement in f:
         if subelement.tag == 'period':
             self.period=int(subelement.text)
         if subelement.tag == 'fcttext':
             self.forecastText.append(subelement.text)
         elif subelement.tag == 'icon':
             self.icon.append( subelement.text)
         elif subelement.tag == 'title':
             self.Title.append(subelement.text)
```

```
class ForecastInfo:
    def __init__(self):
        self.forecastText = []  # Today/tonight forecast
information
        self.Title = []         # Today/tonight
        self.date = ''
        self.icon = []          # Icon to use for conditions
today/tonight
        self.periods = 0
        self.period = 0
       #============================================
       # Extended forecast information
       #============================================
        self.extIcon = []       # Icon to use for extended
forecast
        self.extDay = []        # Day text for this forecast
("Monday", "Tuesday" etc)
        self.extHigh = []       # High Temp. (F)
        self.extHighC = []      # High Temp. (C)
        self.extLow = []        # Low Temp. (F)
        self.extLowC = []       # Low Temp. (C)
        self.extConditions = [] # Conditions text
        self.extPeriod = []     # Numerical Period information
(counter)
        self.extpop = []        # Percent chance Of
Precipitation
```

```
def GetForecastData(self,location):
        try:
            forecastdata = 'http://api.wunderground.com/auto/wui/geo/ForecastXML/index.xml?query=%s' % location
            urllib.socket.setdefaulttimeout(8)
            usock = urllib.urlopen(forecastdata)
            tree = ET.parse(usock)
            usock.close()
        except:
            print 'ERROR - Forecast - Could not get information from server...'
            sys.exit(2)
```

doesn't offer a SELECT/CASE command set like other languages. The IF/ELIF routine, however, works well, just a bit clunkier. Now we'll break down the code. We assign the variable fcst to everything within the <txt_forecast> tag. This gets all the data for that group. We then look for the tags <date> and <number> - since those are simple "first level" tags - and load that data into our variables. Now things get a bit more difficult. Look back at our xml response example. There are two instances of <forecastday>. Under <forecastday> are sub-elements that consist of <period>, <icon>, <icons>, <title> and <fcttext>. We'll loop through these, and again use the IF statement to load them into our variables.

Next we need to look at the extended forecast data for the next X number of days. We are basically using the same methodology to fill our variables; this is shown top right.

Now we need to create our output routine. As we did last time, it will be fairly generic. The code for this is shown on the right of the following page.

Again, if you don't want to carry both Centigrade and Fahrenheit information, then modify the code to show what you want. Finally, we have a "DoIt" routine:

```
def DoIt(self,Location,US,IncludeToday,Output):

    self.GetForecastData(Location)

    self.output(US,IncludeToday,Output)
```

Now we can call the routine as follows:

```
forecast = ForecastInfo()

forecast.DoIt('80013',1,0,0) # Insert your own postal code
```

That's about it for this time. I'll leave the alert data to you, if you want to go through that.

Here is the complete running code: http://pastebin.com/wsSXMXQx

Have fun until next time.

```
#=================================
        # Now get the extended forecast
#=================================
    fcst = tree.find('.//simpleforecast')
    for f in fcst:
        for subelement in f:
            if subelement.tag == 'period':
                self.extPeriod.append(subelement.text)
            elif subelement.tag == 'conditions':
                self.extConditions.append(subelement.text)
            elif subelement.tag == 'icon':
                self.extIcon.append(subelement.text)
            elif subelement.tag == 'pop':
                self.extpop.append(subelement.text)
            elif subelement.tag == 'date':
                for child in subelement.getchildren():
                    if child.tag == 'weekday':
                        self.extDay.append(child.text)
            elif subelement.tag == 'high':
                for child in subelement.getchildren():
                    if child.tag == 'fahrenheit':
                        self.extHigh.append(child.text)
                    if child.tag == 'celsius':
                        self.extHighC.append(child.text)
            elif subelement.tag == 'low':
                for child in subelement.getchildren():
                    if child.tag == 'fahrenheit':
                        self.extLow.append(child.text)
                    if child.tag == 'celsius':
                        self.extLowC.append(child.text)
```

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Program In Python - Part 13

This month, we talk about using Curses in Python. No, we're not talking about using Python to say dirty words, although you can if you really feel the need. We are talking about using the Curses library to do some fancy screen output.

If you are old enough to remember the early days of computers, you will remember that, in business, computers were all mainframes - with dumb terminals (screens and keyboards) for input and output. You could have many terminals connected to one computer. The problem was that the terminals were very dumb devices. They had neither windows, colors, or much of anything - just 24 lines of 80 characters (at best). When personal computers became popular, in the old days of DOS and CPM, that is what you had as well. When programmers worked on fancy screens (those days), especially for data input and display, they used graph paper to design the screen. Each block on the graph paper was one character position. When we deal with our Python programs that run in a terminal, we still deal with a 24x80 screen. However, that limitation can be easily dealt with by proper forethought and preparation. So, go out to your local office supply store and get yourself a few pads of graph paper.

Anyway, let's jump right in and create our first Curses program, shown above right. I'll explain after you've had a look at the code.

```
#!/usr/bin/env python
# CursesExample1
#-------------------------------
# Curses Programming Sample 1
#-------------------------------
import curses
myscreen = curses.initscr()
myscreen.border(0)
myscreen.addstr(12, 25, "See Curses, See Curses Run!")
myscreen.refresh()
myscreen.getch()
curses.endwin()
```

Short but simple. Let's examine it line by line. First, we do our imports, which you are very familiar with by now. Next, we create a new Curses screen object, initialize it, and call the object myscreen. (myscreen = curses.initscr()). This is our canvas that we will paint to. Next, we use the myscreen.border(0) command to draw a border around our canvas. This isn't needed, but it makes the screen look nicer. We then use the addstr method to "write" some text on our canvas starting on line 12 position 25. Think of the .addstr method of a Curses print statement. Finally, the .refresh() method makes our work visible. If we don't refresh the screen, our changes won't be seen. Then we wait for the user to press any key (.getch) and then we release the screen object (.endwin) to allow our terminal to act normally. The curses.endwin() command is VERY important, and, if it doesn't get called, your terminal will be left in a major mess. So, make sure that you get this method called before your application ends.

Save this program as CursesExample1.py and run it in a terminal. Some things to note. Whenever you use a border, it takes up one of our "usable" character positions for each character in the border. In addition, both the line and character position count is ZERO based. This means that the first line in our screen is line 0 and the last line is line 23. So, the very top left position is referred to 0,0 and the bottom right position is 23,79. Let's make a quick example (above right) to show this.

Very simple stuff except the try/finally blocks. Remember, I said that curses.endwin is VERY important and needs to be called before your application finishes. Well, this way, even if things go very badly, the endwin routine will get called. There's many ways of doing this, but this way seems pretty simple to me.

Now let's create a nice menu system. If you remember back a while, we did a cookbook application that had a menu (Programming Python - Part 8). Everything in the terminal simply scrolled up when we printed something. This time we'll take that idea and make a dummy menu that you can use to pretty up the cookbook. Shown below is what we used back then.

This time, we'll use Curses. Start with the following template. You might want to save this snippet (below right) so you can use it for your own future programs.

Now, save your template again as “cursesmenu1.py” so that we can work on the file and keep the template.

```
===================================================
                 RECIPE DATABASE
===================================================
 1 - Show All Recipes
 2 - Search for a recipe
 3 - Show a Recipe
 4 - Delete a recipe
 5 - Add a recipe
 6 - Print a recipe
 0 - Exit
===================================================
Enter a selection ->
```

```
#!/usr/bin/env python
# CursesExample2
import curses
#==========================================================
#                        MAIN LOOP
#==========================================================
try:
    myscreen = curses.initscr()
    myscreen.clear()
    myscreen.addstr(0,0,"0         1         2         3
4         5         6         7")

myscreen.addstr(1,0,"123456789012345678901234567890123456789O
1234567890123456789012345678901234567890")
    myscreen.addstr(10,0,"10")
    myscreen.addstr(20,0,"20")
    myscreen.addstr(23,0, "23 - Press Any Key to Continue")
    myscreen.refresh()
    myscreen.getch()
finally:
```

```
#!/usr/bin/env python
#--------------------------------
# Curses Programming Template
#--------------------------------
import curses

def InitScreen(Border):
    if Border == 1:
        myscreen.border(0)

#==========================================================
#                        MAIN LOOP
#==========================================================
myscreen = curses.initscr()
InitScreen(1)
try:
    myscreen.refresh()
    # Your Code Stuff Here...
    myscreen.addstr(1,1, "Press Any Key to Continue")
    myscreen.getch()
finally:
    curses.endwin()
```

Before we go any further with our code, we are going to do this in a modular way. Here (above right) is a pseudo-code example of what we are going to do.

Of course this pseudo code is just that...pseudo. But it gives you an idea of where we are going with this whole thing. Since this is just an example, we'll only go just so far here, but you can take it all the way if you want. Let's start with the main loop (middle far right).

Not much in the way of programming here. We have our try|finally blocks just as we had in our template. We initialize the Curses screen and then call a routine named LogicLoop. That code is shown bottom far right.

Again, not much, but this is only a sample. Here we are going to call two routines. One called DoMainMenu and the other MainInKey. DoMainMenu will show our main menu, and the MainInKey routine handles everything for that main menu. Tthe DoMainMenu routine is shown right.

```
curses.initscreen
LogicLoop
    ShowMainMenu                        # Show the main menu
    MainInKey                           # This is our main input handling routine
        While Key != 0:
            If Key == 1:
                ShowAllRecipesMenu    # Show the All Recipes Menu
                Inkey1                # Do the input routines for this
                ShowMainMenu          # Show the main menu
            If Key == 2:
                SearchForARecipeMenu # Show the Search for a Recipe Menu
                InKey2                # Do the input routines for this option
                ShowMainMenu          # Show the main menu again
            If Key == 3:
                ShowARecipeMenu       # Show the Show a recipe menu routine
                InKey3                # Do the input routine for this routine
                ShowMainMenu          # Show the main menu again
            …                      # And so on and so on
curses.endwin()                         # Restore the terminal
```

```
def DoMainMenu():
    myscreen.erase()
    myscreen.addstr(1,1,
"========================================")
    myscreen.addstr(2,1,  "           Recipe
Database")
    myscreen.addstr(3,1,
"========================================")
    myscreen.addstr(4,1,  "  1 - Show All
Recipes")
    myscreen.addstr(5,1,  "  2 - Search for a
recipe")
    myscreen.addstr(6,1,  "  3 - Show a recipe")
    myscreen.addstr(7,1,  "  4 - Delete a recipe")
    myscreen.addstr(8,1,  "  5 - Add a recipe")
    myscreen.addstr(9,1,  "  6 - Print a recipe")
    myscreen.addstr(10,1, "  0 - Exit")
    myscreen.addstr(11,1,
"========================================")
    myscreen.addstr(12,1, "  Enter a selection: ")
    myscreen.refresh()
```

```
#    MAIN LOOP
try:
    myscreen = curses.initscr()
    LogicLoop()
finally:
    curses.endwin()
```

```
def LogicLoop():
    DoMainMenu()
    MainInKey()
```

Notice that this routine does nothing but clear the screen (myscreen.erase), and then print what we want on the screen. There is nothing here dealing with keyboard handling. That's the job of the MainInKey routine, which is shown below.

This is really a simple routine. We jump into a while loop until the key that is entered by the user equals 0. Within the loop, we check to see if it's equal to various values, and, if so, we do a series of routines, and finally call the main menu when we are done. You can fill in most of these routines for yourself by now, but we will look at option 2, Search for a Recipe. The menu is short and sweet. The InKey2 routine (right) is a bit more complicated.

```
def MainInKey():
    key = 'X'
    while key != ord('0'):
        key = myscreen.getch(12,22)
        myscreen.addch(12,22,key)
        if key == ord('1'):
            ShowAllRecipesMenu()
            DoMainMenu()
        elif key == ord('2'):
            SearchForARecipeMenu()
            InKey2()
            DoMainMenu()
        elif key == ord('3'):
            ShowARecipeMenu()
            DoMainMenu()
        elif key == ord('4'):
            NotReady("'Delete A Recipe'")
            DoMainMenu()
        elif key == ord('5'):
            NotReady("'Add A Recipe'")
            DoMainMenu()
        elif key == ord('6'):
            NotReady("'Print A Recipe'")
            DoMainMenu()
        myscreen.refresh()
```

```
def SearchForARecipeMenu():
    myscreen.addstr(4,1, "-------------------------------")
    myscreen.addstr(5,1, " Search in")
    myscreen.addstr(6,1, "-------------------------------")
    myscreen.addstr(7,1, " 1 - Recipe Name")
    myscreen.addstr(8,1, " 2 - Recipe Source")
    myscreen.addstr(9,1, " 3 - Ingredients")
    myscreen.addstr(10,1," 0 - Exit")
    myscreen.addstr(11,1,"Enter Search Type -> ")
    myscreen.refresh()

def InKey2():
    key = 'X'
    doloop = 1
    while doloop == 1:
        key = myscreen.getch(11,22)
        myscreen.addch(11,22,key)
        tmpstr = "Enter text to search in "
        if key == ord('1'):
            sstr = "'Recipe Name' for -> "
            tmpstr = tmpstr + sstr
            retstring = GetSearchLine(13,1,tmpstr)
            break
        elif key == ord('2'):
            sstr = "'Recipe Source' for -> "
            tmpstr = tmpstr + sstr
            retstring = GetSearchLine(13,1,tmpstr)
            break
        elif key == ord('3'):
            sstr = "'Ingredients' for -> "
            tmpstr = tmpstr + sstr
            retstring = GetSearchLine(13,1,tmpstr)
            break
        else:
            retstring = ""
            break
    if retstring != "":
        myscreen.addstr(15,1,"You entered - " + retstring)
    else:
        myscreen.addstr(15,1,"You entered a blank string")
    myscreen.refresh()
    myscreen.addstr(20,1,"Press a key")
    myscreen.getch()

def GetSearchLine(row,col,strng):
    myscreen.addstr(row,col,strng)
    myscreen.refresh()
    instring = myscreen.getstr(row,len(strng)+1)
    myscreen.addstr(row,len(strng)+1,instring)
    myscreen.refresh()
    return instring
```

Again, we are using a standard while loop here. We set the variable doloop = 1, so that our loop is endless until we get what we want. We use the break command to drop out of the while loop. The three options are very similar. The major difference is that we start with a variable named tmpstr, and then append whatever option text has been selected...making it a bit more friendly. We then call a routine called GetSearchLine to get the string to search for. We use the getstr routine to get a string from the user rather than a character. We then return that string back to our input routine for further processing.

The full code is at: http://pastebin.com/ELuZ3T4P

One final thing. If you are interested in looking into Curses programming further, there are many other methods available than what we used this month. Besides doing a Google search, your best starting point is the official docs page at http://docs.python.org/library/curses.html.

See you next time.

OOPS!

It seems that the code for **Python Pt.11** isn't properly indented on Pastebin. The correct URL for Python Pt.11 code is: http://pastebin.com/Pk74fLF3

Please check: http://fullcirclemagazine.pastebin.com for all Python (and future) code.

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Program In Python - Part 14

Last time we talked about the Curses library. This time we are going to delve further into the curses library, and concentrate on the color commands. Just in case you missed the last article, let's have a quick review. First, you have to import the curses library. Next you have to call curses.initscr to get things started. To put text on the screen you call the addstr function, and then call refresh to show your changes to the screen. Finally, you have to call curses.endwin() to restore the terminal window to its normal state.

Now, we are going to create a quick and easy program that uses color. It's pretty much the same as what we did before, but we have a few new commands this time. First we use curses.start_color() to tell the system that we want to use color in our program. Next, we assign a color pair of foreground and background. We can assign many pairs, and use them whenever we want. We do that by using the curses.init_pair function. The syntax is:

```
curses.init_pair([pairnumber]
,[foreground
color],[background color])
```

The colors are set up by using "curses.COLOR_" and the color you want. For example, curses.COLOR_BLUE or curses.COLOR_GREEN. The options here are black, red, green, yellow, blue, magenta, cyan and white. Just add "curses.COLOR_", and the color you want, in upper case. Once we have set up our color pair, we can use it as a final parameter in our screen.addstr function like this:

```
myscreen.addstr([row],[column
],[text],curses.color_pair(X)
)
```

Here X is the color set we wish to use.

Save the following code (above right) as colortest1.py, then run it. Don't try to run a curses program in an IDE like SPE or Dr. Python. Run it from a terminal.

```
import curses
try:
    myscreen = curses.initscr()
    curses.start_color()
    curses.init_pair(1, curses.COLOR_BLACK,
curses.COLOR_GREEN)
    curses.init_pair(2, curses.COLOR_BLUE,
curses.COLOR_WHITE)
    curses.init_pair(3,
curses.COLOR_MAGENTA,curses.COLOR_BLACK)
    myscreen.clear()
    myscreen.addstr(3,1," This is a test
",curses.color_pair(1))
    myscreen.addstr(4,1," This is a test
",curses.color_pair(2))
    myscreen.addstr(5,1," This is a test
",curses.color_pair(3))
    myscreen.refresh()
    myscreen.getch()
finally:
    curses.endwin()
```

What you should see is a grey background, with three lines of text saying " This is a test " in different colors. The first should be black-on-green, the second blue-on-white, and the third magenta on the grey background.

Remember the Try/Finally set. This makes sure that if anything happens, our program will automatically restore our terminal to its normal state. There is another way. There is a curses command called wrapper. Wrapper does all the work for you. It does the curses.initscr(), the curses.start_color(), and the curses.endwin(), so that you don't have to. The one thing you have to remember is that you call curses.wrapper with your main routine. It passes back your screen pointer. On the following page (top right) is the same program as before, but this time using the curses.wrapper function.

That's a whole lot easier, and we don't have to worry about calling curses.endwin() if something bad happens. All the work is done for us.

Now that we have a bunch of basics, let's put some of the things we've learned over the past year to work, and start making a game. Before we start however, let's lay out what we are going to do. Our game will pick a random uppercase letter, and move it from the right side of the screen to the left side. At a random position, it will drop down to the bottom of the screen. We'll have a “gun” that can be moved using the right and left arrow keys to be positioned below the falling letter. Then, by pressing the space bar, we will shoot it. If we shoot the letter before it gets to our gun, we get a point. If not, our gun explodes. If we loose three guns, the game is over. While on the surface this seems like a simple game, there's a lot of code to it.

Let's get started. We need to do our setup, and create a few routines before we go very far. Create a new project and call it game1.py. Start with the code shown below right:

This code won't do much right now, but it's our starting point. Notice that we have four init_pair statements setting the colors that we will use for our random color sets, and one for the explosions (number 5). Now we need to set up some variables and constants that will be used during our game. We will put them in the __init__ routine of class Game1. Replace the pass statement in __init__ with the code on the following page.

You should be able to figure out what is happening in these definitions. If you are unsure at this precise moment, it should become clearer as we fill in the code.

We are getting closer to having something that will run. We still need to make a few more routines before it will do much. Let's work on the routine that will move a letter from right to left on the screen:
http://fullcirclemagazine.pastebin.com/z5CgMAgm

This is our longest routine in the program, and there are some

```
import curses
def main(stdscreen):
    curses.init_pair(1, curses.COLOR_BLACK,
curses.COLOR_GREEN)
    curses.init_pair(2, curses.COLOR_BLUE,
curses.COLOR_WHITE)
    curses.init_pair(3,
curses.COLOR_MAGENTA,curses.COLOR_BLACK)
    stdscreen.clear()
    stdscreen.addstr(3,1,"  This is a test
",curses.color_pair(1))
    stdscreen.addstr(4,1,"  This is a test
",curses.color_pair(2))
    stdscreen.addstr(5,1,"  This is a test
",curses.color_pair(3))
    stdscreen.refresh()
    stdscreen.getch()
curses.wrapper(main)
```

```
import curses
import random

class Game1():
    def __init__(self):
        pass
    def main(self,stdscr):
        curses.init_pair(1, curses.COLOR_BLACK,
curses.COLOR_GREEN)
        curses.init_pair(2, curses.COLOR_BLUE,
curses.COLOR_BLACK)
        curses.init_pair(3, curses.COLOR_YELLOW,
curses.COLOR_BLUE)
        curses.init_pair(4, curses.COLOR_GREEN,
curses.COLOR_BLUE)
        curses.init_pair(5, curses.COLOR_BLACK,
curses.COLOR_RED)

    def StartUp(self):
        curses.wrapper(self.main)
g = Game1()
g.StartUp()
```

new functions in this routine. The scrn.delch function deletes the character at the given row | column. The curses.napms() tells python to sleep (nap) for X number of milliseconds (ms).

So the logic in this routine is as follows (in pseudocode) on the next page (top right).

You should be able to follow the code by now. We need two new routines to keep everything correct. The first is Explode, which we will stub with the pass directive. The second is ResetForNew. This is where we will reset the current row for the letter to the default letterline, reset the current column, set the DroppingLetter flag to 0, pick a random letter, and pick a random drop point. Following page, middle right, are those two routines.

Now we need four more routines to keep up with things (next page, bottom right). One picks a random letter, the other picks a random drop point. Remember we quickly discussed the random module early on in the series.

In PickALetter, we generate a r andom integer between 65 and 90 (“A” to “Z”). Remember when we use the random integer function we must give a range of minimum-number to maximum-number. The same thing goes for PickDropPoint. We also make a call to random.seed() in both routines, which sets up the random generator with a different number every time it's called. The fourth routine is called CheckKeys. This routine will look at any keystrokes entered by the user, and deal with them to move our gun. However, we'll stub it out for the moment but we will need it later. We'll also need a routine called CheckForHit, which we will also stub for the time being.

```
def
CheckKeys(self,scrn,keyin):
    pass
def CheckForHit(self,scrn):
    pass
```

We are going to create a small

```
        # Line Specific Stuff
        self.GunLine = 22                #Row where our gun lives
        self.GunPosition = 39            #Where the gun starts on GunLine
        self.LetterLine = 2              #Where our letter runs right to left
        self.ScoreLine = 1               #Where we are going to display the score
        self.ScorePosition = 50          #Where the score column is
        self.LivesPosition = 65          #Where the lives column is

        # Letter Specific Stuff
        self.CurrentLetter = "A"         #A dummy Holder Variable
        self.CurrentLetterPosition = 78 #Where the letter will start on the LetterLine
        self.DropPosition = 10           #A dummy Holder Variable
        self.DroppingLetter = 0          #Flag - Is the letter dropping?
        self.CurrentLetterLine = 3       #A dummy Holder Variable
        self.LetterWaitCount = 15        #How many times should we loop before actually
                                          working?

        # Bullet Specific Stuff
        self.Shooting = 0                #Flag - Is the gun shooting?
        self.BulletRow = self.GunLine - 1
        self.BulletColumn = self.GunPosition

        # Other Stuff
        self.LoopCount = 0               #How many loops have we done in MoveLetter
        self.GameScore = 0               #Current Game Score
        self.Lives = 3                   #Default number of lives
        self.CurrentColor = 1            #A dummy Holder Variable
        self.DecScoreOnMiss = 0          #Set to 1 if you want to decrement the
                                         #score every time the letter hits the
                                         #bottom row
```

routine which will be the "brains" of our game. We'll call it GameLoop (next page, top right).

The logic behind this is to first set our keyboard to nodelay(1). This means that we won't wait for a keystroke to happen, and when it does, we just cache it for latter processing. Then we enter a while loop which we force to always be true (1) so that the game continues until we are ready for it to end. We nap for 40 milliseconds, move our letter and then check to see if the user has pressed a key. If it's a "Q" (notice it's upper case), or the ESC key, then we break out of our loop and end the program. Otherwise, we check to see if it's a left or right arrow key, or the space bar. Later on, you can make the game a bit more difficult by checking the keystroke against the current character and only fire the gun if the user has pressed the same key, ala a simple typing tutor. Just remember to remove the "Q" as a quit key.

We'll also need to create a routine that sets up for each new play of our game. Let's call it NewGame (next page, middle right).

```
IF we have waited the correct number of loops THEN
   Reset the loop counter
   IF we are moving to the left of the screen THEN
     Delete the character at the the current row,column.
     Sleep for 50 milliseconds
     IF the current column is greater than 2 THEN
          Decrement the current column
     Set the character at the current row,column
     IF the current column is at the random column to drop to the bottom THEN
          Set the DroppingLetter flag to 1
   ELSE
     Delete the character at the current row,column
     Sleep for 50 milliseconds
     IF the current row is less than the line the gun is on THEN
          Increment the current row
          Set the character at the current row,column
     ELSE
          IF
          Explode (which includes decrementing the score if you wish) and check to
           see if we continue.
          Pick a new letter and position and start everything over again.
ELSE
   Increment the loopcounter
Refresh the screen.
```

We also need the PrintScore routine that will show the current score and the number of lives that are left (next page, bottom right).

Now we only need to add some code (next page, bottom left) to our main routine to start our game loop. The additional code is below. Add it under the last init_pair call.

Now we should have a program that does something. Give it a try. I'll wait.

```
    def Explode(self,scrn):
        pass
    def ResetForNew(self):
        self.CurrentLetterLine = self.LetterLine
        self.CurrentLetterPosition = 78
        self.DroppingLetter = 0
        self.PickALetter()
        self.PickDropPoint()
```

```
    def PickALetter(self):
        random.seed()
        char = random.randint(65,90)
        self.CurrentLetter = chr(char)

    def PickDropPoint(self):
        random.seed()
        self.DropPosition = random.randint(3,78)
```

Now we have a program that picks a random uppercase letter, moves it from the right side of the screen to the left a random number of columns, then moves that letter down to the bottom(ish) of the screen. However, the first thing you should notice is that every time you run the program the first letter is always “A”, and the drop point is always column 10. That's because we set defaults in the __init__ routine. To fix this, simply call self.ResetForNew before you enter the while loop in the Main routine.

At this point, we need to work on our “gun” and supporting routines. Add the code (next page, top right) to the Game1 class.

Movegun will take the current gun position and move it in whichever direction we want it to go. The only thing that is new in this routine is at the end of the addch routine. We are calling the colorpair (2) to set the color, and, at the same time, we are forcing the gun to have the bold attribute. We are using a bitwise OR (“|”) to force the attribute on. Next we need to flesh out our CheckKeys routine. Replace the pass

```
        stdscr.addstr(11,28,"Welcome to Letter Attack")
        stdscr.addstr(13,28,"Press a key to begin....")
        stdscr.getch()
        stdscr.clear()
        PlayLoop = 1
        while PlayLoop == 1:
            self.NewGame(stdscr)
            self.GameLoop(stdscr)
            stdscr.nodelay(0)
            curses.flushinp()
            stdscr.addstr(12,35,"Game Over")
            stdscr.addstr(14,23,"Do you want to play
again? (Y/N)")
            keyin = stdscr.getch(14,56)
            if keyin == ord("N") or keyin == ord("n"):
                break
            else:
                stdscr.clear()
```

```
    def GameLoop(self,scrn):
        test = 1            #Set the loop
        while test == 1:
            curses.napms(20)
            self.MoveLetter(scrn)
            keyin =
scrn.getch(self.ScoreLine,self.ScorePosition)
            if keyin == ord('Q') or keyin == 27:   # 'Q'
or <Esc>
                break
            else:
                self.CheckKeys(scrn,keyin)
            self.PrintScore(scrn)
            if self.Lives == 0:
                break
        curses.flushinp()
        scrn.clear()
```

```
    def NewGame(self,scrn):
        self.GunChar = curses.ACS_SSBS

scrn.addch(self.GunLine,self.GunPosition,self.GunChar,cur
ses.color_pair(2) | curses.A_BOLD)
        scrn.nodelay(1)    #Don't wait for a
keystroke...just cache it.
        self.ResetForNew()
        self.GameScore = 0
        self.Lives = 3
        self.PrintScore(scrn)
```

```
    def PrintScore(self,scrn):

scrn.addstr(self.ScoreLine,self.ScorePosition,"SCORE:
%d" % self.GameScore)

scrn.addstr(self.ScoreLine,self.LivesPosition,"LIVES:
```

statement with the new code (next page, bottom right).

Now we need to make a routine that will move our bullet "up" the screen (below left).

We need a few more routines (next page, top right) before we are finished. Here's the code to fill out the CheckForHit routine and the code to ExplodeBullet.

Finally we need to flesh out our Explode routine. Replace pass with the following code (next page, bottom).

Now we have a working program. You can tweak the value in LetterWaitCount to speed up or slow down the movement of the letter going across the screen to make it easier or harder. You can also use the variable CurrentColor to create a random color choice and set the letter color to one of the 4 color sets we have made and change the color assignment to the random color. I wanted to give you a challenge.

I hope you had fun this time, and will add some additional code to make the game more playable. As always, the full code is available at www.thedesignatedgeek.com, or at: http://fullcirclemagazine.pastebin.com/DeReeh8m.

```
    def MoveGun(self,scrn,direction):
        scrn.addch(self.GunLine,self.GunPosition," ")
        if direction == 0:      # left
            if self.GunPosition > 0:
                self.GunPosition -= 1
        elif direction == 1:   # right
            if self.GunPosition < 79:
                self.GunPosition += 1

scrn.addch(self.GunLine,self.GunPosition,self.GunChar,cur
```

```
        if keyin == 260: # left arrow -  NOT on keypad
            self.MoveGun(scrn,0)
            curses.flushinp()  #Flush out the input buffer for safety.
        elif keyin == 261: # right arrow - NOT on keypad
            self.MoveGun(scrn,1)
            curses.flushinp()  #Flush out the input buffer for safety.
        elif keyin == 52:  # left arrow  ON keypad
            self.MoveGun(scrn,0)
            curses.flushinp()  #Flush out the input buffer for safety.
        elif keyin == 54:  # right arrow ON keypad
            self.MoveGun(scrn,1)
            curses.flushinp()  #Flush out the input buffer for safety.
        elif keyin == 32:  #space
            if self.Shooting == 0:
                self.Shooting = 1
                self.BulletColumn = self.GunPosition
                scrn.addch(self.BulletRow,self.BulletColumn,"|")
                curses.flushinp()  #Flush out the input buffer for safety.
```

```
    def MoveBullet(self,scrn):
        scrn.addch(self.BulletRow,self.BulletColumn," ")
        if self.BulletRow > self.LetterLine:
            self.CheckForHit(scrn)
            self.BulletRow -= 1

scrn.addch(self.BulletRow,self.BulletColumn,"|")
        else:
            self.CheckForHit(scrn)

scrn.addch(self.BulletRow,self.BulletColumn," ")
            self.BulletRow = self.GunLine - 1
            self.Shooting = 0
```

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Program In Python - Part 15

This month we are going to explore Pygame, a set of modules designed for writing games. The website is http://www.pygame.org/. To quote from the Pygame read-me: “Pygame is a cross-platform library designed to make it easy to write multimedia software, such as games, in Python. Pygame requires the Python language and SDL multimedia library. It can also make use of several other popular libraries.”

You can install Pygame through Synaptic as 'python-pygame'. Do this now so we can move forward.

First, we import Pygame (see above right). Next, we set the os.environ to make our window centered in our screen. Next, we initialize Pygame, then set the Pygame window to 800x600 pixels, and set the caption. Finally, we display the screen, and go into a loop waiting for a keystroke or mouse-button-down event. The screen is an object that will contain anything we decide to put on it. It's called a surface. Think of it as a piece of paper that we will draw things onto.

```
#This is the Import
import pygame
from pygame.locals import *
import os
# This will make our game window centered in the screen
os.environ['SDL_VIDEO_CENTERED'] = '1'
# Initialize pygame
pygame.init()
#setup the screen
screen = pygame.display.set_mode((800, 600))
# Set the caption (title bar of the window)
pygame.display.set_caption('Pygame Test #1')
# display the screen and wait for an event
doloop = 1
while doloop:
    if pygame.event.wait().type in (KEYDOWN,
MOUSEBUTTONDOWN):
        break
```

Not very exciting, but it's a start. Let's make it a bit less boring. We can change the background color to something less dark. I found a program called “colorname” that you can install via the Ubuntu Software Center. This allows you to use the “color wheel” to pick a color you like, and it will give you the RGB or Red, Green, Blue values of that color. We must use RGB colors if we don't want to use the predefined colors that Pygame gives us. It's a neat utility that you should consider installing.

Right after the import statements, add...

```
Background = 208, 202, 104
```

This will set the variable Background to a tanish color. Next, after the pygame.display.set_caption line, add the following lines...

```
screen.fill(Background)
pygame.display.update()
```

The screen.fill() method will set the color to whatever we pass it. The next line, pygame.display.update(), actually updates the changes to our screen.

Save this off as pygame1.py, and we'll move on.

Now we will display some text in our bland looking window. Again, let's start with our import statements and the background variable assignment from our last program.

```
import pygame
from pygame.locals import *
import os
Background = 208, 202, 104
```

Now, add an additional variable assignment for the foreground color of our font.

```
FontForeground = 255,255,255
# White
```

Then, we will add in the majority of the code from our last program (shown right).

If you run this now, nothing has changed visually since all we did is add the foreground definition. Now, after the screen.fill() line, and before the loop portion of our code, enter the following lines:

```
font =
pygame.font.Font(None,27)
text = font.render('Here is
some text', True,
FontForeground, Background)
textrect = text.get_rect()
screen.blit(text,textrect)
pygame.display.update()
```

Go ahead, save the program as pygame2.py, and run the program. On the top left of our window, you should see the text “Here is some text”.

Let's break down the new commands. First, we call the Font method and pass it two arguments. The first is the name of the font we wish to use, and the second is the font size. Right now, we'll just use 'None', and let the system pick a generic font for us, and set the font size to 27 points.

Next we have the font.render() method. This has four arguments. In order, they are the text we wish to display, whether we want to use anti-aliasing (True in this case), the foreground color of the font, and, finally, the background color of the font.

The next line (text.get_rect()) assigns a rectangle object that we will use to put the text on the screen. This is an important thing, since almost everything else we will deal with is rectangles. (You'll understand more in a bit.) Then we blit the rectangle onto the screen. And, finally, we update the screen to show our text. What is blit, and why the heck should I want to do something that sounds so weird? Well, the term goes WAY back to the 1970s, and came from Xerox PARC (which is where we owe so much of today's technology). The term was originally called BitBLT which stands for Bit (or Bitmap) Block Transfer. That changed to Blit (possibly because it's shorter). Basically we are plopping our image or text on to the screen.

What if we want the text to be centered in the screen instead of on the top line where it takes a bit of time to see? In between the text.get_rect() line and the screen.blit line, put the following two lines:

```
# This will make our game window centered in the screen
os.environ['SDL_VIDEO_CENTERED'] = '1'
# Initialize pygame
pygame.init()
# Setup the screen
screen = pygame.display.set_mode((800, 600))
# Set the caption (title bar of the window)
pygame.display.set_caption('Pygame Test #1')
screen.fill(Background)
pygame.display.update()

#  Our Loop
doloop = 1
while doloop:
    if pygame.event.wait().type in (KEYDOWN,
MOUSEBUTTONDOWN):
        break
```

```
textRect.centerx =
screen.get_rect().centerx
textRect.centery =
screen.get_rect().centery
```

Here we are getting the center of the screen object (remember surface) in x and y pixel positions, and setting our textRect object x and y center points to those values.

Run the program. Now our text is centered within our surface. You can also modify the text by using (in our sample code) font.set_bold(True) and/or font.set_italic(True) right after the pygame.font.Font line.

Remember we discussed very briefly the 'None' option when we set the font to a generic font. Let's say you want to use a fancier font. As I stated before, the pygame.font.Font() method takes two arguments. The first is the path and file name of the font we want to use, and the second is the font size. The problem is multi-fold at this point. How do we know what the actual path and filename of the font we want to use is on any given system? Thankfully, Pygame has a function that takes care of that for us. It's called match_font. Here's a quick program that will print the path and filename of (in this case) the Courier New font.

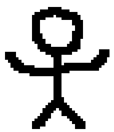
```
import pygame
from pygame.locals import *
import os
print
pygame.font.match_font('Couri
er New')
```

On my system, the returned value is "/usr/share/fonts/truetype/msttcorefonts/cour.ttf". If, however, the font is not found, the return value is "None". Assuming that the font IS found, then we can assign the returned value to a variable, and we can then use the following assignment.

```
courier =
pygame.font.match_font('Couri
er New')
font =
pygame.font.Font(courier,27)
```

Change your last version of the program to include these two lines and try it again. The bottom line is, either use a font that you KNOW will be available on the end user's machine, or include it when you distribute your program and hard code the font path and name. There are other ways around this, but I'll leave that to you to figure out so we can move on.

While text is nice, graphics are better. I found a really nice tutorial for Pygame written by Peyton McCollugh, and thought I'd take and modify it. For this part, we need to start with a picture that will move around our surface. This picture is known as a sprite. Use GIMP or some other tool and create a stick figure. Nothing fancy, just a generic stick figure. I'll assume that you are using GIMP. Start a new image, set the size to 50 pixels in both height and width, and, under advance options, set the 'Fill With' option to Transparency. Use the pencil tool with a brush of Circle (03). Draw your little figure, and save it as stick.png into the same folder you have been using for the code this time. Here is what mine looks like. I'm sure you can do better.



I know...I'm not an artist. However, for our purposes, that will do. We saved it as a .png file, and set the background to be transparent, so that just the little black lines of our stick figure show up - and not a white or other color background will show.

Let's talk about what we want the program to do. We want to show a Pygame window that has our stick figure drawing in it. We want the figure to move when we press any of the arrow keys up, down, right and left, assuming we aren't at the edge of the screen and cannot move any further. We want the game to quit when we press the "q" key. Now, moving the sprite around might seem easy, and it is, but it is a bit harder than it initially sounds. We start by creating two rectangles. One for the sprite itself and one that is the same size but is blank. We blit the sprite onto the surface to start, then, when the user presses a key, we blit the blank rectangle over the original sprite, figure out the new position, and blit the sprite back onto the surface at its new position. Pretty much what we did with the alphabet game last time. That's about it for this program. It will give us an idea how to actually place a graphic on the screen and move it around.

```
import pygame
from pygame.locals import *
import os

Background = 0,255,127
os.environ['SDL_VIDEO_CENTERED'] = '1'
pygame.init()
screen = pygame.display.set_mode((800, 600))
pygame.display.set_caption('Pygame Example #4 - Sprite')
screen.fill(Background)
```

So, start a new program, and call it pygame4.py. Put in the includes we've been using during this tutorial. This time we'll use a minty green background so those values should be 0, 255, 127 (see above).

Next, we create a class that will handle our graphic or sprite (next page, shown bottom left). Put this right after the imports.

What is all this doing? Let's start with the __init__ routine. We initialize the sprite module of Pygame with the pygame.sprte.Sprite.__init__ line. We then set the surface, and call it screen. This will allow us to check to see if the sprite is going off the screen. We then create and set the position of the blank oldsprite variable, which will keep the old position of our sprite. Now we load our stick figure sprite with the pygame.image.load routine, passing it the filename (and path, if it's not in the program's path). Then we get a reference (self.rect) to the sprite which sets up the width and height of the rectangle automatically, and set the x,y position of that rectangle to the position we pass into the routine.

The update routine basically makes a copy of the sprite, then checks to see if the sprite goes off the screen. If so, it's left where it was, otherwise its position is moved the amount we send into it.

Now, after the screen.fill statement, put the code shown on the following page (right-hand side).

Here we create an instance of our class, calling it character. Then we blit the sprite. We create the blank sprite rectangle, and fill it with the background color. We update the surface and start our loop.

As long as DoLoop is equal to 1, we loop through the code. We use pygame.event.get() to get a keyboard character. We then test it against the event type. If it's QUIT, we exit. If it's a pygame KEYDOWN event, we process it. We look at the key value returned, and compare it to constants defined by Pygame. We then call the update routine in our class. Notice here that we simply are passing a list containing the number of pixels on the X and Y axis to move the character. We bump it by 10 pixels (positive for right or down, negative for left or up. If the key value is equal to “q”, we set DoLoop to 0, and so will break out of the loop. After all of that, we blit the blank character to the old position, blit the sprite to the new position, and finally update - but in this case, we update only the two rectangles containing the blank sprite and the active sprite. This saves a tremendous amount of time and processing.

As always, the full code is available at www.thedesignatedgeek.com or at http://fullcirclemagazine.pastebin.com/DvSpZbaj.

There's a ton more that Pygame can do. I suggest that you hop over to their website, and look at the reference page

```
class Sprite(pygame.sprite.Sprite):
   def __init__(self, position):
        pygame.sprite.Sprite.__init__(self)
        # Save a copy of the screen's rectangle
        self.screen = pygame.display.get_surface().get_rect()
        # Create a variable to store the previous position of the sprite
        self.oldsprite = (0, 0, 0, 0)
        self.image = pygame.image.load('stick3.png')
        self.rect = self.image.get_rect()
        self.rect.x = position[0]
        self.rect.y = position[1]

   def update(self, amount):
        # Make a copy of the current rectangle for use in erasing
        self.oldsprite = self.rect
        # Move the rectangle by the specified amount
        self.rect = self.rect.move(amount)
        # Check to see if we are off the screen
        if self.rect.x < 0:
            self.rect.x = 0
        elif self.rect.x > (self.screen.width - self.rect.width):
            self.rect.x = self.screen.width - self.rect.width
        if self.rect.y < 0:
            self.rect.y = 0
        elif self.rect.y > (self.screen.height - self.rect.height):
            self.rect.y = self.screen.height - self.rect.height
```

(http://www.pygame.org/docs/ref/index.html). In addition, you can take a look at some of the games that others have put up.

Next time, we will be digging deeper into Pygame by creating a game that comes from my past...my very DISTANT past.

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```
character = Sprite((screen.get_rect().x, screen.get_rect().y))
screen.blit(character.image, character.rect)

# Create a Surface the size of our character
blank = pygame.Surface((character.rect.width, character.rect.height))
blank.fill(Background)

pygame.display.update()
DoLoop = 1
while DoLoop:
    for event in pygame.event.get():
        if event.type == pygame.QUIT:
            sys.exit()
        # Check for movement
        elif event.type == pygame.KEYDOWN:
            if event.key == pygame.K_LEFT:
                character.update([-10, 0])
            elif event.key == pygame.K_UP:
                character.update([0, -10])
            elif event.key == pygame.K_RIGHT:
                character.update([10, 0])
            elif event.key == pygame.K_DOWN:
                character.update([0, 10])
            elif event.key == pygame.K_q:
                DoLoop = 0

    # Erase the old position by putting our blank Surface on it
    screen.blit(blank, character.oldsprite)
    # Draw the new position
    screen.blit(character.image, character.rect)
    # Update ONLY the modified areas of the screen
    pygame.display.update([character.oldsprite, character.rect])
```

Program In Python - Part 16

A while ago, I promised someone that I would discuss the differences between Python 2.x and 3.x. Last time, I said that we would continue our pygame programming, but I felt that I should keep my promise, so we'll delve into pygame more next time.

Many changes have gone into Python 3.x. There is a large amount of information about these changes on the Web, and I'll include a few links at the end of the article. There are also many concerns about making the change. I'm going to concentrate on changes that affect the things you've learned so far.

Let's get started.

PRINT

As I've said before, one of the most important issues is the way we deal with the Print command. Under 2.x we simply can use:

```
print "This is a test"
```

and be done with it. However under 3.x, if we try that we will get the error message shown above right.

```
>>> print "This is a test"
  File "<stdin>", line 1
    print "This is a test"
                         ^
SyntaxError: invalid syntax
>>>
```

Not happy. In order to use the print command, we must put what we want to print in parentheses like this:

```
print("this is a test")
```

Not a very big change, but something we have to be aware of. You can get ready for your own migration by using this syntax under python 2.x.

Formatting and variable substitution

Formatting and variable substitution have also changed. Under 2.x, we have used things like the example shown below left, and, under 3.1, you can get the proper result. However, that is due to change since the '%s' and '%d' formatting functions are going away. The new way is to use '{x}' replacement statements is shown below.

```
>>> months = ['Jan','Feb','Mar','Apr','May','Jun','Jul','Aug','Sep','Oct','Nov','Dec']
>>> print "You selected month %s" % months[3]
You selected month Apr
>>>
```

OLD WAY

```
>>> months = ['Jan','Feb','Mar','Apr','May','Jun','Jul','Aug','Sep','Oct','Nov','Dec']
>>> print("You selected month {0}".format(months[3]))
You selected month Apr
>>>
```

NEW WAY

It seems to me to be actually easier to read. You can also do things like this:

```
>>> print("Hello {0}. I'm
glad you are here at
{1}".format("Fred","MySite.co
m"))

Hello Fred. I'm glad you are
here at MySite.com

>>>
```

Remember, you can still use '%s' and so on, but they will be going away.

Numbers

Under Python 2.x, if you did:

```
x = 5/2.0
```

x would contain 2.5. However if you did:

```
x = 5/2
```

x would contain 2 due to truncation. Under 3.x, if you do:

```
x = 5/2
```

you still get 2.5. To truncate the division you have to do:

```
x = 5//2
```

INPUT

A while back, we dealt with a menu system that used raw_input() to get a response from the user of our application. It went something like this:

```
response = raw_input('Enter a selection -> ')
```

That was fine under 2.x. However, under 3.x we get:

```
Traceback (most recent call last):

  File "<stdin>", line 1, in <module>

NameError: name 'raw_input' is not defined
```

This isn't a big issue. The raw_input() method has been replaced with input(). Simply change the line to:

```
response = input('Enter a selection -> ')
```

and it works just fine.

Not Equal

Under 2.x, we could test for 'not equal' with "<>". However, that's not allowed in 3.x The test operator is now "!=".

Converting older programs to Python 3.x

Python 3.x comes with a utility to help convert a 2.x application to 3.x compliant code. This doesn't always work, but it will get you close in many cases. The conversion tool is named (aptly) "2to3". Let's take a really simple program as an example. The example below is from way back in Beginning Python Part 3.

```
#pprint1.py
#Example of semi-useful functions

def TopOrBottom(character,width):
      # width is total width of returned line
      return '%s%s%s' % ('+',(character * (width-2)),'+')

def Fmt(val1,leftbit,val2,rightbit):
      # prints two values padded with spaces
      # val1 is thing to print on left, val2 is thing to print on right
      # leftbit is width of left portion, rightbit is width of right portion
      part2 = '%.2f' % val2
      return '%s%s%s%s' % ('| ',val1.ljust(leftbit-2,' '),part2.rjust(rightbit-2,' '),' |')
# Define the prices of each item
item1 = 3.00
item2 = 15.00
# Now print everything out...
print TopOrBottom('=',40)
print Fmt('Item 1',30,item1,10)
print Fmt('Item 2',30,item2,10)
print TopOrBottom('-',40)
print Fmt('Total',30,item1+item2,10)
print TopOrBottom('=',40)
```

```
+======================================+
| Item 1                          3.00 |
| Item 2                         15.00 |
+--------------------------------------+
| Total                          18.00 |
+======================================+
Script terminated.
```

When run under 2.x, the output looks like that shown above right.

Of course, when we run it under 3.x, it doesn't work.

```
  File "pprint1.py", line 18
    print TopOrBottom('=',40)
                    ^
SyntaxError: invalid syntax
```

We'll try to let the conversion app fix it for us. First, we should create a backup of our application that will be converted. I do it by creating a copy of the file, and append a “v3” to the end of the filename:

```
cp pprint1.py pprint1v3.py
```

There's multiple ways to run the app. The simplest way is just to let the app check our code and tell us where the problems are, which is shown below left.

Notice that the original source code is not changed. We have to use the “-w” flag to tell it to write the changes to the file. This is shown below right.

You'll also notice that the output is the same. This time, however, our source file (shown on the next page) is changed to a “version 3.x compatible” file.

Now the program works as it is supposed to under 3.x. And, since it was simple, it still runs under version 2.x as well.

Do I switch to 3.x now?

Most of the issues are common to any change in a programming language. Syntax changes abound with every new version. Short cuts like += or -= sometimes come out of the blue and actually make our lives easier.

What's the downside to simply migrating to 3.x right now? Well, there's a little bit. Many of the library modules that we've used are not available for version 3.x right now. Things like Mutegen that we've used a few articles back just aren't available yet. While this is a stumbling block, it doesn't require you to completely give up on Python v3.x.

My suggestion is to start coding

```
> 2to3 pprint1v3.py
RefactoringTool: Skipping implicit fixer: buffer
RefactoringTool: Skipping implicit fixer: idioms
RefactoringTool: Skipping implicit fixer: set_literal
RefactoringTool: Skipping implicit fixer: ws_comma
RefactoringTool: Refactored pprint1v3.py
--- pprint1v3.py (original)
+++ pprint1v3.py (refactored)
@@ -15,9 +15,9 @@
 item1 = 3.00
 item2 = 15.00
 # Now print everything out...
-print TopOrBottom('=',40)
-print Fmt('Item 1',30,item1,10)
-print Fmt('Item 2',30,item2,10)
-print TopOrBottom('-',40)
-print Fmt('Total',30,item1+item2,10)
-print TopOrBottom('=',40)
+print(TopOrBottom('=',40))
+print(Fmt('Item 1',30,item1,10))
+print(Fmt('Item 2',30,item2,10))
+print(TopOrBottom('-',40))
+print(Fmt('Total',30,item1+item2,10))
+print(TopOrBottom('=',40))
RefactoringTool: Files that need to be modified:
RefactoringTool: pprint1v3.py
```

```
> 2to3 -w pprint1v3.py
RefactoringTool: Skipping implicit fixer: buffer
RefactoringTool: Skipping implicit fixer: idioms
RefactoringTool: Skipping implicit fixer: set_literal
RefactoringTool: Skipping implicit fixer: ws_comma
RefactoringTool: Refactored pprint1v3.py
--- pprint1v3.py (original)
+++ pprint1v3.py (refactored)
@@ -15,9 +15,9 @@
 item1 = 3.00
 item2 = 15.00
 # Now print everything out...
-print TopOrBottom('=',40)
-print Fmt('Item 1',30,item1,10)
-print Fmt('Item 2',30,item2,10)
-print TopOrBottom('-',40)
-print Fmt('Total',30,item1+item2,10)
-print TopOrBottom('=',40)
+print(TopOrBottom('=',40))
+print(Fmt('Item 1',30,item1,10))
+print(Fmt('Item 2',30,item2,10))
+print(TopOrBottom('-',40))
+print(Fmt('Total',30,item1+item2,10))
+print(TopOrBottom('=',40))
RefactoringTool: Files that were modified:
RefactoringTool: pprint1v3.py
```

using proper 3.x syntax now. Python version 2.6 supports almost everything you would need to write in the 3.x way. This way, you will be good to go once you have to change to 3.x. If you can live with the standard module library, go ahead and make the plunge. If, on the other hand, you push the envelope, you might just want to wait until the module library catches up. It will.

Below are some links that I thought might be helpful. The first is to the usage page of 2to3. The second is a 4-page cheat sheet that I have found to be a very good reference. The third is to what I consider to be just about the best book on using Python. (That is until I get around to writing mine.)

We'll see you next time.

Links

2to3 usage
http://docs.python.org/library/2to3.html

Moving from Python 2 to Python 3
(A 4 page cheat sheet)
http://ptgmedia.pearsoncmg.com/imprint_downloads/informit/promotions/python/python2python3.pdf

Dive into Python 3
http://diveintopython3.org/

```
#pprint1.py
#Example of semi-useful functions

def TopOrBottom(character,width):
      # width is total width of returned line
      return '%s%s%s' % ('+',(character * (width-2)),'+')
def Fmt(val1,leftbit,val2,rightbit):
      # prints two values padded with spaces
      # val1 is thing to print on left, val2 is thing to print on right
      # leftbit is width of left portion, rightbit is width of right portion
      part2 = '%.2f' % val2
      return '%s%s%s%s' % ('| ',val1.ljust(leftbit-2,' '),part2.rjust(rightbit-2,' '),' |')
# Define the prices of each item
item1 = 3.00
item2 = 15.00
# Now print everything out...
print(TopOrBottom('=',40))
print(Fmt('Item 1',30,item1,10))
print(Fmt('Item 2',30,item2,10))
print(TopOrBottom('-',40))
print(Fmt('Total',30,item1+item2,10))
print(TopOrBottom('=',40))
```

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Program In Python - Part 17

As I was finishing up the last installment of our series, I got an email about a programming competition. While we don't have time to deal with this one, various sites have programming competitions throughout the year. The competition information can be found at http://www.freiesmagazin.de/third_programming_contest - if you are interested. That made me realize that we haven't talked about true Client/Server programming. So with that in mind, we'll dig into this topic, and see where we can go with it.

So, what is a Client/Server Application? In very simple terms, anytime you use a program (or even a web interface) that accesses data from another application or computer, you are using a client/server system. Let's look at an example that we actually used before. Remember when we made our cookbook program? That was a VERY simple example (and not a very good one) of a client/server application. The SQLite database is the server, the application we wrote is the client. A better example would be the following. There is a database on a computer in another part of your office, floors away. It holds information on the inventory of the store you work at. You use a point of sale register (one of 10) within the store. Each of those registers are a client and the database located somewhere is the server.

While we won't try to create that kind of system here, we can learn some of the basics.

The first thing we need to think about is the location of our server. Many people have only one computer in their house. Some people might have 7 or 8.

To use a client/server system, we have to connect from the client machine to the server machine. We do this with what is called a pipe or socket. If you ever made a “tin can” telephone when you were a kid, you have an idea of what I'm going to be talking about. If not, let me paint you a picture of times gone by. First, you had to get your mother to save you two tin cans from beans or something. Then you cleaned them carefully, and took them out to the garage. You used a small nail and a hammer to poke a small hole in the bottom of each. Then you got about 15 feet of string (again from your loving mother), ran the end of the string through each can, and tied a large knot in each end of the string to hold it inside the can. You then got your best buddy, and stretched the string tightly and yelled into the can while your friend held his can up to his ear. The vibrations from the bottom of the can went through the taut string, and caused the other can bottom to vibrate. Of course, you could hear without the can, but that was beside the point. It was cool. The socket is about the same thing. The client has a direct connection (think of the string) to the server. If many clients are connecting to the server, each client would have a tin can of their own, and the poor server has to have the same number of tin cans all held tightly to each client's string phone. The bottom line here is each client has its own direct line to the server.

Let's make a simple server and client. We'll start with the server first. In pseudo code, here's what happens.

Create a socket
Get name of server machine
Select a port
Bind socket to address and port
Listen for a connection
If connected...
    Accept the connection
    Print we got a connection
    Close the connection

The actual code to our server is shown on the next page, bottom left.

So, we create the socket, get the hostname of the machine we are running the server on, bind the socket to the port, and start to listen. When we get a connection request, we accept it, we print the fact we are connected, send “Hello and Goodbye”, and close the socket.

Now we need to have a client to make the whole thing work (shown bottom right).

The code is almost like the server, but, in this case, we connect, print what we receive, and close the socket.

The output from the programs are very predictable. On the server side of things we get...

```
My hostname is  earth

I'm now connected to
('127.0.1.1', 45879)
```

and on the client side we get...

```
Hello and Goodbye
```

So, it's pretty simple. Now let's do something a bit more realistic.

We'll create a server that actually will do something. The code for server version 2 can be found at: http://fullcirclemagazine.pastebin.com/Az8vNUv7

Let's break it down. After our imports, we set up some variables. BUFSIZ holds the size of the buffer that we will use to hold the information that we receive from the client. We also set up the port we will listen on, and a list holding the host and port number.

We next create a class called ServCmd. In the __init__ routine, we create a socket, and bind the interface to that socket. In the run routine, we start listening, and wait for a command from the client.

When we do get a command from the client, we use the os.popen() routine. This basically creates a command shell and runs the command.

Next the client (above right), which is a good deal easier.

```
#!/usr/bin/env python
#server1.py
import socket
soc = socket.socket()
hostname = socket.gethostname()
print "My hostname is ", hostname
port = 21000
soc.bind((hostname,port))
soc.listen(5)
while True:
     con,address = soc.accept()
     print "I'm now connected to ",address
     con.send("Hello and Goodbye")
     con.close()
```

```
#!/usr/bin/env python
# client2.py

from socket import *
from time import time
from time import sleep
import sys
BUFSIZE = 4096

class CmdLine:
    def __init__(self,host):
        self.HOST = host
        self.PORT = 29876
        self.ADDR = (self.HOST,self.PORT)
        self.sock = None

    def makeConnection(self):
        self.sock = socket( AF_INET,SOCK_STREAM)
        self.sock.connect(self.ADDR)

    def sendCmd(self, cmd):
        self.sock.send(cmd)

    def getResults(self):
        data = self.sock.recv(BUFSIZE)
        print data

if __name__ == '__main__':
    conn = CmdLine('localhost')
    conn.makeConnection()
    conn.sendCmd('ls -al')
    conn.getResults()
    conn.sendCmd('BYE')
```

```
#!/usr/bin/python
# client1.py
#====================
import socket

soc = socket.socket()
hostname = socket.gethostname()
port = 21000

soc.connect((hostname, port))
print soc.recv(1024)
soc.close
```

We'll skip everything here except the send command, since you now have enough information to figure it out on your own. The **conn.sendCmd()** line (line 31) sends a simple **ls -al** request. Here's what my responses look like. Yours will be somewhat different.

Server:

```
python server2.py
...listening
...connected:  ('127.0.0.1',
42198)
Command received -  ls -al
Command received -  BYE
...listening
```

Client:

```
python client2a.py
total 72
drwxr-xr-x 2 greg greg 4096
2010-11-08 05:49 .
drwxr-xr-x 5 greg greg 4096
2010-11-04 06:29 ..
-rw-r--r-- 1 greg greg  751
2010-11-08 05:31 client2a.py
-rw-r--r-- 1 greg greg  760
2010-11-08 05:28 client2a.py~
-rw-r--r-- 1 greg greg  737
2010-11-08 05:25 client2.py
-rw-r--r-- 1 greg greg  733
2010-11-08 04:37 client2.py~
-rw-r--r-- 1 greg greg 1595
2010-11-08 05:30 client2.pyc
-rw-r--r-- 1 greg greg  449
2010-11-07 07:38 ping2.py
-rw-r--r-- 1 greg greg  466
2010-11-07 10:01
python_client1.py
-rw-r--r-- 1 greg greg  466
2010-11-07 10:01
python_client1.py~
-rw-r--r-- 1 greg greg  691
2010-11-07 09:51
python_server1.py
-rw-r--r-- 1 greg greg  666
2010-11-06 06:57
python_server1.py~
-rw-r--r-- 1 greg greg  445
2010-11-04 06:29 re-test1.py
-rw-r--r-- 1 greg greg 1318
2010-11-08 05:49 server2a.py
-rw-r--r-- 1 greg greg 1302
2010-11-08 05:30 server2a.py~
-rw-r--r-- 1 greg greg 1268
2010-11-06 08:02 server2.py
-rw-r--r-- 1 greg greg 1445
2010-11-06 07:50 server2.py~
-rw-r--r-- 1 greg greg 2279
2010-11-08 05:30 server2.pyc
```

We can also connect from another machine without changes anywhere - with the single exception of the conn = CmdLine('localhost') (line 29) in the client program. In this case, change the 'localhost' portion to the IP address of the machine that the server is running on. For my home setup, I use the following line:

```
conn =
CmdLine('192.168.2.12')
```

So, now we are able to send information back and forth from one machine (or terminal) to another.

Next time, we'll make our client/server applications much more robust.

Greg Walters is owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family.

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Project page, **for ideas**:
https://launchpad.net/fullcircle
Team page **for writers**:
https://launchpad.net/~fullcircle

Program In Python - Part 18

Last time, we created a very simple client/server system. This time, we are going to extend it a bit. The server is a tic-tac-toe (or naughts and crosses) board and checker. The client portion acts as the input/output.

We'll start by using the same server code as last time, and modifying it as we go. If you didn't save the code from then, go to http://fullcirclemagazine.pastebin.com/UhquVK4N, get the source code for this time, and follow along. The first change comes in the __init__ routine where we initialize two new variables, self.player and self.gameboard. The gameboard is a simple list of lists or a basic array. We can access it as follows (more visual than just the flat list). This list will hold our data. There are three possible entries per cell. "-" means the cell is empty. "X" means the cell is occupied by player 1 and "O" means the cell is occupied by player 2. The grid looks like this when put in two dimensions:

```
[0][0]  |  [0][1]  |  [0][2]
[1][0]  |  [1][1]  |  [1][2]
[2][0]  |  [2][1]  |  [2][2]
```

So starting with the server code from last month, in the routine __init__ routine, add the following lines:

```
# The next three lines are
new...

    self.player = 1

    self.gameboard = [['-','-
','-'],['-','-','-'],['-','-
','-']]

    self.run()
```

The run, listen, and servCmd routines have no changes, so we'll concentrate on the changes to the procCmd routine next.

In last time's article, the server waited for a command from the client, then sent it to the os.popen routine. This time, we will parse the command sent in. In this case, we have three separate commands we will listen for. They are 'Start', 'Move', and 'GOODBYE'. When we receive the 'Start' command, the server should initialize the game board to all "-" and then send a "print out" of the board to the client.

The 'Move' command is a compound command, in that it contains the command, and the position that the player wants to move to. For example, 'Move A3'. We parse the command to get three parts, the 'move' command itself, and the the row and column. Finally the 'GOODBYE' command simply resets the game board for another game.

So, we receive the command from the client in the procCmd routine. We then check the command to see what we are supposed to do. Within the procCmd routine, find the 5th line down, and, after the line that says "if self.processingloop:", remove the rest of that set of code. Now we'll set up the commands as we laid the out. Here's the code for the Start command:

```
if self.processingloop:
    if cmd == 'Start':
        self.InitGameBoard()
        self.PrintGameBoard(1)
```

Next, let's look at the Move portion of the routine (shown below). We first check the first four characters of the passed-in command to see if they match 'Move'. If they match, we then pull the rest of the string starting at position 5 (since things are 0 based), and assign that to a variable named position. We then check to see if the first character is either an 'A', 'B', or 'C'. These represent the row that the client has sent. We then take the integer value of the next character and that's our column:

```
if cmd[:4] == 'Move':
print "MOVE COMMAND"
position = cmd[5:]
if position[0] == 'A':
    row = 0
elif position[0] == 'B':
    row = 1

elif position[0] == 'C':
    row = 2
else:
    self.cli.send('Invalid
position')
    return
col = int(position[1])-1
```

Next, we make a quick check to verify that the row position is within the allowable positions:

```
if row < 0 or row > 2:

   self.cli.send('Invalid
position')

   return
```

Finally, we verify that the position is empty ('-'), and, if the current player is number 1, we put an "X" otherwise we put a "O". We then call the PrintGameBoard routine with a "0" parameter:

```
if self.gameboard[row][col]
== '-':

    if self.player == 1:


self.gameboard[row][col] =
"X"

else:


self.gameboard[row][col] =
"O"

self.PrintGameBoard(0)
```

That finishes the changes to the procCmd routine. Next we have the "initialize the game board" routine. All it does is to set each position to a "-", which the move logic uses to verify that a space is empty:

```
def InitGameBoard(self):

   self.gameboard = [['-','-
','-'],['-','-','-'],['-','-
','-']]
```

The PrintGameBoard routine (below) prints the game board, calls the checkwin routine, and sets the player number. We build a large string to send to the client so it only has to enter the listen routine once per move. The firsttime parameter is included to send the pretty print of the gameboard when the client first connects or resets the game:

Next, we check to see if the firsttime parameter is set to 0 or 1 (below). Only if firsttime is set to 0, we check to see if the current player has won, and, if so, add the 'Player X WINS!' text to the output string. If the current player did not win, we then add the "Enter move..." text to the output string. Finally we send the string out to the client with the cli.send routine:

Finally, on the next page, we have the server check for a win routine. We have already set the player to either an "X" or "O", so we start by using a simple for loop. If we find a win, we return True from the routine. Our for variable 'C' represents each row in our list of lists. First, we will check each Row for a horizontal win:

```
if firsttime == 0:
            if self.player == 1:
                ret = self.checkwin("X")
            else:
                ret = self.checkwin("O")
            if ret == True:
                if self.player == 1:
                    outp += "Player 1 WINS!"
                else:
                    outp += "Player 2 WINS!"
            else:
                if self.player == 1:
                    self.player = 2
                else:
                    self.player = 1
                outp += ('Enter move for player %s' %
self.player)
        self.cli.send(outp)
```

```
def PrintGameBoard(self,firsttime):
    #Print the header row
    outp = ('    1   2   3') + chr(13) + chr(10)
    outp += (" A {0} | {1} | {2}".format(self.gameboard[0][0],self.gameboard[0][1],self.gameboard[0][2])) + chr(13)+chr(10)
    outp += ('   ------------')+ chr(13)+chr(10)
    outp += (" B {0} | {1} | {2}".format(self.gameboard[1][0],self.gameboard[1][1],self.gameboard[1][2]))+ chr(13)+chr(10)
    outp += ('   ------------')+ chr(13)+chr(10)
    outp += (" C {0} | {1} | {2}".format(self.gameboard[2][0],self.gameboard[2][1],self.gameboard[2][2]))+ chr(13)+chr(10)
    outp += ('   ------------')+ chr(13)+chr(10)
```

```
First, we will check each Row for a horizontal win:
   def checkwin(self,player):
        #loop through rows and columns
        for c in range(0,3):
        #check for horizontal line
            if self.gameboard[c][0] == player and
self.gameboard[c][1] == player and self.gameboard[c][2] ==
player:
                print "*********\n\n%s wins\n\n*********" %
player
                playerwin = True
                return playerwin

Next, we check each Column for a win:
            #check for vertical line
            elif self.gameboard[0][c] == player and
self.gameboard[1][c] == player and self.gameboard[2][c] ==
player:
                print "** %s wins **" % player
                playerwin = True
                return playerwin

Now we check for the diagonal win from left to right...
            #check for diagonal win (left to right)
            elif self.gameboard[0][0] == player and
self.gameboard[1][1] == player and self.gameboard[2][2] ==
player:
                print "** %s wins **" % player
                playerwin = True
                return playerwin

Then from right to left...
            #check for diagonal win (right to left)
            elif self.gameboard[0][2] == player and
self.gameboard[1][1] == player and self.gameboard[2][0] ==
player:
                print "** %s wins **" % player
                playerwin = True
                return playerwin

Finally, if there is no win, we return false:
        else:
            playerwin = False
            return playerwin
```

The Client

Once again, we start with the simple routine that we had last time. The changes start right after the call to conn.makeConnection. We send a Start, various Moves, and finally a Goodbye command. The biggest thing to remember here is that you must send a command, then get a response before sending another command. Think of it as a polite conversation. Make your statement, listen for a response, then make another statement, listen for a response, and so on. In this sample we use raw_input simply so you can see what is going on:

```
if __name__ == '__main__':
    conn =
CmdLine('localhost')
    conn.makeConnection()
    conn.sendCmd('Start')
    conn.getResults()
    conn.sendCmd('Move A3')
    conn.getResults()
    r = raw_input("Press
Enter")
    conn.sendCmd('Move B2')
    conn.getResults()
    r = raw_input("Press
Enter")
```

Continue the sendCmd, getResults, raw_input routine set with the following commands (you already have the code for the A3 and B2 moves), C1, A1, C3, B3, C2, then end with a GOODBYE command.

Moving Forward

So, here is your "homework" assignment. In the client app, remove the hard coded move commands, and use raw_input() to prompt for and get moves from the player(s) in the form of "A3" or "B2", then prepend the command "Move" before sending it to the server.

Next time, we'll modify our server to actually play the other player.

Server and Client Full Source Code can be found at http://fullcirclemagazine.pastebin.com/UhquVK4N or at http://thedesignatedgeek.com

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Program In Python - Part 19

This time, we are going to work on finishing our Tic-Tac-Toe program. However, unlike most of my other articles, I won't be providing the code. You will! I will however, be giving you the rules. After 18 months, you have the tools and knowledge to finish this project. I'm sure of it.

First, let's look at the logic of playing Tic-Tac-Toe. We'll look at it in pseudo-code. Let's look first at the game board. It's laid out like this...

```
Corner |   Side   | Corner
-------+---------+-------
 Side   | Center |  Side
-------+---------+-------
Corner |   Side   | Corner
```

Now, whoever is "X", goes first. Their first best move is to take a corner square. Any corner square, it doesn't matter. We'll deal with the permutations of playing "X" first, these are shown right.

The standpoint of the "O" player is shown below right.

```
IF "O" takes a CORNER square THEN
     # Scenario 1
     "X" should take one of the remaining corner squares. Doesn't matter which.
     IF "O" blocks the win THEN
          "X" takes remaining corner square.
          Finish for win.
     ELSE
          Finish for win.
ELIF "O" takes a SIDE square THEN
     # Scenario 2
     "X" takes CENTER square
     IF "O" blocks win THEN
          "X" takes corner square that is not bordered by any "O"
          Finish for win.
     ELSE
          Finish for win.
ELSE
     # "O" has played in the CENTER square – Scenario 3
     "X" takes corner square diagonally to
original move
     IF "O" plays on corner square
          "X" plays remaining open corner square
          Finish for win.
     ELSE
          # Game will be a draw – Scenario 4
          Block "O" win.
          Block any other possible wins
```

Some possible play outs are shown on the next page.

As you can see, the logic is somewhat complex, but can easily be broken down in a series of IF statements (notice I used "Then", but in Python, we don't, we use the ":"). You should be able to modify the code from last month to deal with this, or at least write one from scratch to simply be a desktop tic-tac-toe program.

```
IF "X" plays to non-center square
THEN
     "O" takes Center Square
     IF "X" has corner square AND
side square THEN
          #Scenario 5
          "O" takes corner diagonally
from corner "X"
          Block possible wins to a
draw.
     ELSE
          # "X" has two Edge squares
– Scenario 6
          "O" moves to corner
bordered by both "X"s
          IF "X" blocks win THEN
               "O" takes any square.
               Block and force draw
          ELSE
               Finish for win.
```

```
Scenario 1
 X | - | -    X | - | -    X | - | -    X | - | -    X | - | X    X | - | X    X | X | X
 - | - | -    - | - | -    - | - | -    O | - | -    O | - | -    O | O | -    O | O | -
 - | - | -    - | - | O    X | - | O    X | - | O    X | - | O    X | - | O    X | - | O

Scenario 2
 X | - | -    X | - | -    X | - | -    X | - | -    X | - | X    X | - | X    X | X | X
 - | - | -    O | - | -    O | X | -    O | X | -    O | X | -    O | X | -    O | X | -
 - | - | -    - | - | -    - | - | -    - | - | O    - | - | O    O | - | O    X | - | O

Scenario 3
 X | - | -    X | - | -    X | - | -    X | - | X    X | O | X    X | O | X    X | O | X
 - | - | -    - | O | -    - | O | -    - | O | -    - | O | -    - | O | -    - | O | X
 - | - | -    - | - | -    - | - | X    O | - | X    O | - | X    O | - | X    O | - | X

Scenario 4
 X | - | -    X | - | -    X | - | -    X | - | -    X | - | -    X | - | X    X | O | X
 - | - | -    - | O | -    - | O | O    X | O | O    X | O | O    X | O | O    X | O | O
 - | - | -    - | - | -    - | - | X    - | - | X    O | - | X    O | - | X    O | - | X

Scenario 5
 X | - | -    X | - | -    X | - | -    X | - | -    X | - | -    X | - | -    X | - | X
 - | - | -    - | O | -    - | O | X    - | O | X    X | O | X    X | O | X    X | O | X
 - | - | -    - | - | -    - | - | -    - | - | O    - | - | O    O | - | O    O | - | O

Scenario 6
 - | - | -    - | - | -    - | - | -    - | - | -    - | - | X    O | - | X    O | - | X
 X | - | -    X | O | -    X | O | -    X | O | -    X | O | -    X | O | -    X | O | -
 - | - | -    - | - | -    - | X | -    O | X | -    O | X | -    O | X | -    O | X | O
```

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https://launchpad.net/fullcircle
Team page **for writers**:
https://launchpad.net/~fullcircle

Program In Python - Part 20

Welcome back. This time we will re-address GUI programming, but this time we will be using the pyGTK library. We won't be working with a GUI designer right now, we'll just be working with the library.

Use Synaptic to install python-gtk2, python-gtk2-tutorial, and python-gtk2-doc.

Let's jump right in and make our first program using pyGTK, it's shown above right.

For awhile, we will be building on this simple code set. On line #3 is a new command. The line “pygtk.require('2.0')” means that the application will not run unless the pygtk module is at least version 2.0. In the __init__ routine, we assign a window to the self.window variable (line 8), and then show it (line 9). Remember that the __init__ routine is run as soon as we instantiate the class (line 13). Save this code as “simple1.py”.

```
# simple.py
import pygtk
pygtk.require('2.0')
import gtk

class Simple:
     def __init__(self):
          self.window = gtk.Window(gtk.WINDOW_TOPLEVEL)
          self.window.show()
     def main(self):
          gtk.main()
if __name__ == "__main__":
     simple = Simple()
     simple.main()
```

Run it in a terminal. You'll see a simple window show up somewhere on your desktop. On mine, it shows up in the upper left corner of my desktop. In order to end the program, you have to hit Ctrl-C in the terminal. Why? We haven't added any code to destroy and actually end the app. That's what we'll do next. Add the following line before the self.window.show() line...

```
self.window.connect("delete_event", self.delete_event)
```

Then after the gtk.main() call, add the following routine...

```
def delete_event(self, widget, event, data=None):
     gtk.main_quit()
     return False
```

Now save your app as “simple2.py”, and, once again, run it from a terminal. Now, when you click the “X” on the title bar, the application will exit. What is actually happening here? The first line we added (self.window.connect...) connects the delete event to a callback routine, in this case self.delete_event. By returning “False” to the system, it also destroys the actual window from system memory.

Now, I don't know about you, but I prefer my applications to open in the center of the screen, not someplace random, or in a corner - where it might be obscured by something else. Let's modify the code to do this. All we need to do is add the following line before the self.window.connect line in the __init__ function:

```
self.window.set_position(gtk.WIN_POS_CENTER)
```

As you might guess, this sets the position of the window in the center of the screen. Save the app as “simple3.py” and run it.

That's much nicer, but there's not much there. So, let's try to add a widget. If you remember WAY back when we worked with Boa Constructor, widgets are simply predefined controls that we can add to our window to do things. One of the simplest controls to add is a button. We will add the following code right after the self.window.connect line in our previous code in the __init__ routine:

```
self.button =
gtk.Button("Close Me")
self.button.connect("clicked"
,self.btn1Clicked,None)
self.window.add(self.button)
self.button.show()
```

The first line defines the button, and the text on the button surface. The next line is the connector to the click event. The third line adds the button to the window, and the fourth line shows the button on the window surface. Looking at the self.button.connect line, you'll see that there are three arguments. The first is the event we want to connect to, the second is the routine that will be called when the event is triggered, in this case "self.btn1Clicked", and the third is the argument (if any) that will be passed to the routine we just defined.

Next, we need to create the self.btn1Clicked routine. Put this after the self.delete_event routine:

```
def
btn1Clicked(self,widget,data=
None):

    print "Button 1 clicked"
    gtk.main_quit()
```

As you can see, the routine doesn't do much. It prints in the terminal "Button 1 clicked", and then calls the gtk.main_quit() routine. This will close the window and terminate the application - just as if you had clicked the "X" on the title bar. Again, save this as "simple4.py", and run it in a terminal. You'll see our centered window with a button that says "Close me". Click on it, and the application closes, as designed. Notice, however, that the window is much smaller than it was in the simple3.py application. You can resize the application, but the button resizes with it. Why is this? Well, we simply shoved a button into the window and the window resized to fit the control.

We sort of broke the rules of GUI programming by putting the button directly on the form, without using a container. Remember back when we did our first series on GUI programming using Boa Constructor - we used sizer boxes (containers) to hold our controls. We should do this, even if we only have just one control. For our next example, we'll add a HBox (Horizontal box) to hold our button, and add another button. If we wanted a vertical container, we would use a VBox.

To start, use "simple4.py" as our base code. Delete everything between the lines self.window.connect(...) and self.window.show(). This is where we will add our new lines. The code for the HBox and our first button are...

```
self.box1 = gtk.HBox(False,0)
self.window.add(self.box1)
self.button =
gtk.Button("Button 1")
self.button.connect("clicked"
,self.btn1Clicked,None)
self.box1.pack_start(self.but
ton,True,True,0)
self.button.show()
```

Breaking down this code, we add a HBox, naming it self.box1. The parameters we pass to the HBox are homogeneous (True or False), and a spacing value:

```
HBox =
gtk.HBox(homogeneous=False,
spacing=0)
```

Ideas & Writers Wanted

We've created Full Circle project and team pages on LaunchPad. The idea being that non-writers can go to the project page, click 'Answers' at the top of the page, and leave your article ideas, but **please be specific with your idea!** Don't just put 'server article', please specify what the server should do!

Readers who fancy writing an article, but aren't sure what to write about, can register on the Full Circle team page, then assign article ideas to themselves, and get writing! We do ask that **if you can't get the article written within several weeks (a month at most) that you reopen the question** to let someone else grab the idea.

Project page, **for ideas**:
https://launchpad.net/fullcircl

The homogeneous parameter controls whether each widget in the box has the same size (width in the case of an HBox and height in the case of a VBox.) In this case, we pass it false, and a spacing value of 0. Next, we add the box to the window. Now, we create the button as before, and connect the clicked event to our routine.

Now, we come to a new command. The self.box1.pack_start command is used to add the button to the container (HBox). We use this command instead of the self.window.add command for the widgets we want to be in the container. The command (as above) is...

```
box.pack_start(widget,expand=
True, fill=True, padding=0)
```

The pack_start command has the following parameters. First is the widget, next is expand (True or False), then fill (True or False), and a padding value. Spacing for the containers is the amount of space in between the widgets, and padding is for the right/left side of the widgets. The expand argument allows you to choose whether the widgets in the box will fill all the extra space in the box (True), or if the box shrinks to fit the widgets (False). The fill argument has an effect only if the expand argument is True. Finally we show the button. Next is the code for the second button:

```
self.button2 =
gtk.Button("Button 2")
self.button2.connect("clicked
",self.btn2Clicked,None)
self.box1.pack_start(self.but
ton2,True,True,0)
self.button2.show()
self.box1.show()
```

Notice that this code is pretty much the same thing as the first button widget. The last line of this new code shows the box.

Now, we have to add the self.btn2Clicked routine. After the self.btn1Clicked routine, add the following code...

```
def
btn2Clicked(self,widget,data=
None):

    print "Button 2 clicked"
```

and in the btn1Clicked routine, comment out the line:

```
gtk.main_quit()
```

We want both buttons to print their “Button X clicked” response without closing the window.

Save this as “simple4a.py”. Run it in a terminal. What you will see is a centered window with two buttons (right up to the edges of the window) marked “Button 1” and “Button 2”. Click on them and notice that they properly respond to the click event as we have discussed. Now, before closing the window, resize it (drag at the bottom right of the window), and notice that the buttons grow and shrink equally as you resize the window. To understand the expand parameter, change the code for the self.box1.pack_start from True to False in both lines. Re-run your program and see what happens. This time, the window starts out looking the same, but when you resize the window, the buttons stay the same width, and there is empty space to the right as you expand the window. Next, change the expand parameter back to True and set the fill parameter to False. Re-run and notice that the buttons stay the same width, but there is empty space to the left and right of the buttons as you resize the window. Remember the fill parameter doesn't do anything if the expand parameter is set to False.

Another way to pack widgets is by using a table. Many times, if everything you have can fit into a grid-like structure easily, then a table is your best (and easiest) bet. You can think of a table like a spreadsheet grid with rows and columns holding widgets. Each widget can take up one or more cells - as your application requires. Maybe the following diagram will help visualize the possibility. Here is a 2x2 grid:

```
  0          1          2
0+----------+----------+
 |          |          |
1+----------+----------+
 |          |          |
2+----------+----------+
```

Into the first row, we will place two buttons. One in column 1 and one in column 2. Into the second row, we will place one button spanning both columns. Like this...

```
  0           1           2
0+-----------+-----------+
 |  Button 1  |  Button 2  |
1+-----------+-----------+
 |         Button 3        |
2+-----------+-----------+
```

To set up a table, we create a table object and add it into the window. The call to create the table is...

```
Table =
gtk.Table(rows=1,columns=1,homogeneous=True)
```

If the homogeneous flag is set to True, the size of the table boxes are resized to the largest widget in the table. If set to False, the size of the table boxes will be dictated by the tallest widget in the same row and the widest widget in its column. We then create a widget (like a button above), then attach that widget into the table in the proper row and column. The attach call is as follows...

```
table.attach(widget,left point,right point,top point,bottom point,xoptions=EXPAND|FILL,yoptions=EXPAND|FILL, xpadding=0,ypadding=0)
```

The only required parameters are the first 5. So, to attach a button to the table in row 0 column 0, we would use the following command...

```
table.attach(buttonx,0,1,0,1)
```

If it were to be placed into row 0 column 1 (remember this is zero based) as button 2 is above, the call would be...

```
table.attach(buttonx,1,2,0,1)
```

Hopefully, this is as clear as mud for you now. Let's get started with our code, and you'll understand better. First the common part...

```
# table1.py
import pygtk
pygtk.require('2.0')
import gtk
class Table:
    def __init__(self):
        self.window =
gtk.Window(gtk.WINDOW_TOPLEVEL)

self.window.set_position(gtk.WIN_POS_CENTER)

self.window.set_title("Table Test 1")

self.window.set_border_width(20)

self.window.set_size_request(250, 100)

self.window.connect("delete_event", self.delete_event)
```

There are a couple of new things here that we need to discuss before we move on. Line 9 sets the title of the window to “Table Test 1”. We use the “set_border_width” call to give a border of 20 pixels around the entire window before any widgets are placed. Finally, we are forcing the window to 250 x 100 pixels using the “set_size_request” funciton. Makes sense so far? Now, we create the table and add it to the window...

```
table = gtk.Table(2, 2, True)
# Create a 2x2 grid
self.window.add(table)
```

Next, we create our first button, set up the event connection, attach it to the table grid point, and show it...

```
button1 = gtk.Button("Button 1")
button1.connect("clicked",self.callback,"button 1")
table.attach(button1,0,1,0,1)
button1.show()
```

Now button number 2...

```
button2 = gtk.Button("Button 2")
button2.connect("clicked",self.callback,"button 2")
table.attach(button2,1,2,0,1)
button2.show()
```

Almost exactly the same as button number 1, but notice the change in the table.attach call. Also notice that the routine we will be using for the event handling is called “self.callback”, and is the same for both buttons. That's good for now. You'll understand what we're doing in a moment.

Now for the third button. This will be our “Quit” button:

```
button3 = gtk.Button("Quit")
button3.connect("clicked",self.ExitApp,"button 3")
table.attach(button3,0,2,1,2)
button3.show()
```

Finally, show the table and the window. Also here is the main routine and the delete routine we have used before:

```
    table.show()
    self.window.show()
def main(self):
    gtk.main()
def delete_event(self,
widget, event, data=None):
    gtk.main_quit()
    return False
```

Now for the fun part. For both button 1 and button 2, we set the event handler routine to “self.callback”. Here's the code for that.

```
def
callback(self,widget,data=Non
e):
     print "%s was pressed" %
data
```

What happens is that when the user clicks on the button, the click event is triggered, and the data that was provided when we set the event connection is sent in. For button 1, the data that will be sent is “button 1”, and for button 2 it is “button 2”. All we are doing here is printing “button x was pressed” into the terminal. I'm sure you can see that this could be a very useful tool when combined with a nicely structured IF | ELIF | ELSE routine.

Now to finish up, we have to define the “ExitApp” routine for when the “Quit” button is clicked...

```
def ExitApp(self, widget,
event, data=None):
     print "Quit button was
pressed"
     gtk.main_quit()
```

And now the final main code...

```
if __name__ == "__main__":
    table = Table()
    table.main()
```

Combine all this code into a single app called “table1.py”. Run it in a terminal.

So to recap, when we want to use pyGTK to create a GUI program, the steps are...

- Create the window.
- Create HBox(s), VBox(s) or Table(s) to hold your widgets.
- Pack or attach the widgets (depending on box or table).
- Show the widgets.
- Show the box or table.
- Show the window.

Now we have many of the tools and knowledge to go forward. All code is up on Pastebin at http://fullcirclemagazine.pastebin.com/wnzRsXn9. See you next time.

Greg Walters is owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music,

Full Circle Podcast

In episode #15: Brainstorms, FUD and Media Players

* **Review**: FCM#44.
* **News**: Brainstorm ideas, Software Centre ratings, Fuduntu, Unity, Android, and more!
* **Gaming**: Humble Indie Bundle 2, Mass Effect, FreeCiv, and Dropbox.

File Sizes:
OGG - 46.9Mb
mp3 - 40.4Mb

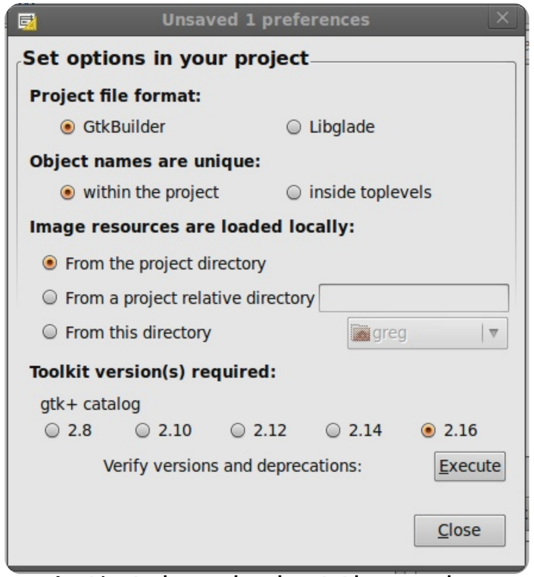
Runtime: 1hr 24min 34sec
Released: 13th Jan. 2011

Program In Python - Part 21

If you've been with me for a long while, you might remember back to parts 5 and 6. We talked about using Boa Constructor to design our GUI application. Well, this time, we are going to deal with Glade Designer. Different, but similar. You can install it from the Ubuntu Software Center: search for glade, and install GTK+ 2 User Interface Builder.

Just to let you know, this will be an application that we'll need multiple parts of these tutorials to cover. The ultimate goal is to build a playlist maker for our MP3, and other media files. This portion of the tutorial will be focusing on the design portion. Next time, we'll deal with the code that glues all the parts of the GUI together.

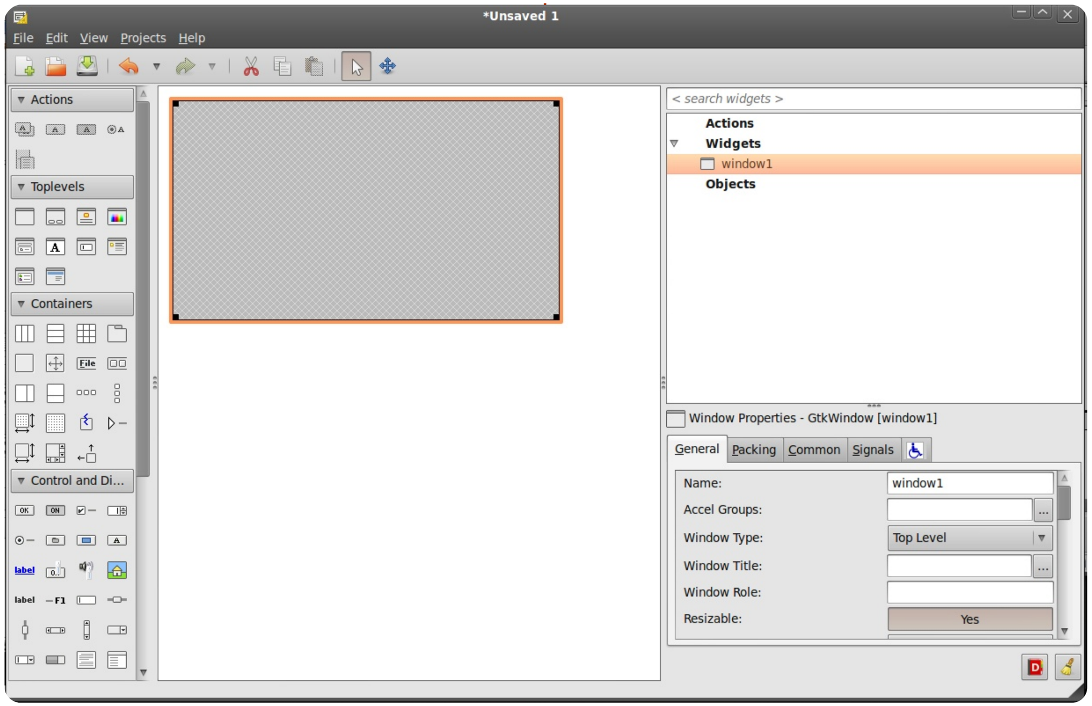
Now to start designing our application. When you first start the Glade designer, you will have a preferences window open (above). Select Libglade, and "inside toplevels", then click close. This will give us our designer main window.



Let's take a look at the main window (right). On the left is our toolkit, in the middle is the designer area, and on the right is our attribute and hierarchy areas.

In the toolkit area, find the group marked "Toplevels", and click on the first tool there (if you hover over it, it should show "Window"). This will give us our blank window "canvas" that we will be working with.

Notice that, in the hierarchy area, you see window1 under the Widgets section. Now move down to the attributes section, change the name from window1 to

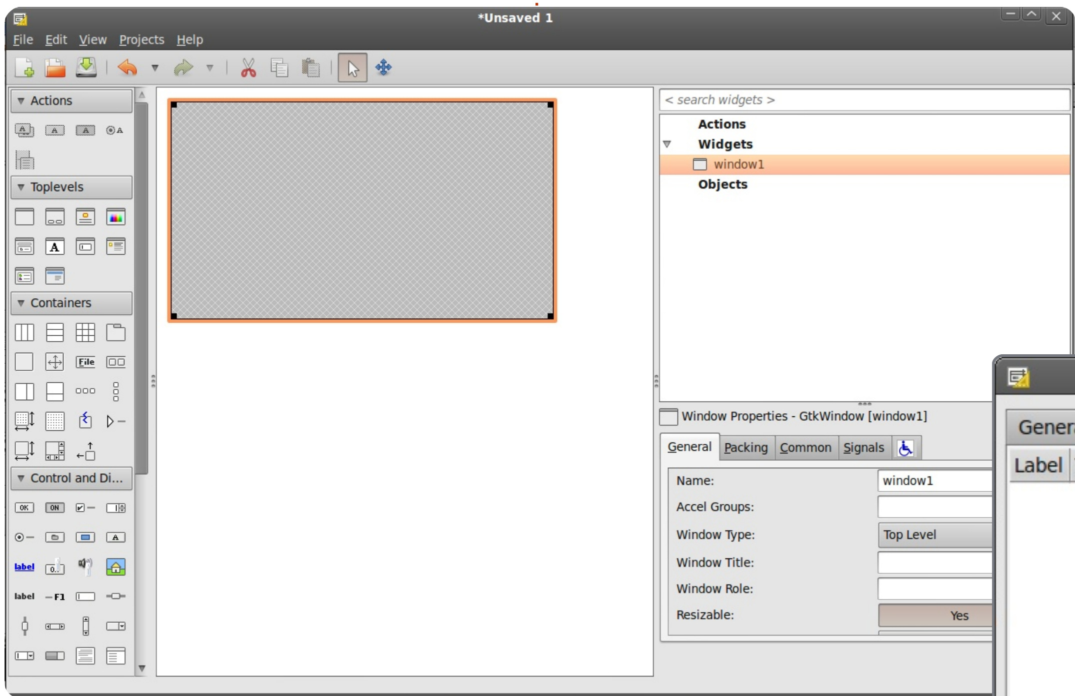


MainWindow, and set the Window Title to "Playlist Maker v1.0". Save what you have as "PlaylistMaker.glade". Before we can move on, in the attributes section of the General tab, find the Window Position pulldown and set it to Center. Click the check box for Default Width, and set this to 650. Do the same for Default Height, but set it to 350. Next, click on the Common tab, and scroll down to the entry marked "Visible". BE SURE TO SET THIS TO "YES" - otherwise your window won't show. Finally, select the Signals tab, scroll down to the GtkObject section, and click the arrow pointing to the right. Under destroy, click the pulldown in the Handler column, and select "on_MainWindow_destroy" setting. This gives us an event that gets raised when the user closes our window by clicking on the "X" in the titlebar. One word of warning... After setting the destroy event, click somewhere above or below to make the change take. This seems to be a bug in Glade Deisgner. Again, save your project.

Just as before when we were doing GUI design, we need to put our widgets in vboxes and hboxes. This is the hardest thing to remember when doing GUI programming. We will be adding a vertical box to hold our widgets in the window, so, on the toolbox under Containers, select Vertical Box (second icon from the left on the top row), and click in our blank window in the designer section. You will be presented with a pop up window that asks how many slots or items you want. The default is three, but we need five. The layout, from top to bottom, will be a toolbar, an area for a treelist control, two horizontal areas for labels, buttons and text entry boxes, and a status bar.

Now we can start adding our widgets. First, add a toolbar from the toolbox. It's the (in my setup) fourth icon on the second line under containers. Click in the topmost slot of the vbox. That slot will shrink and almost disappear. Don't worry, we'll get it back in a few minutes.

Next, we need to add a Scrolled Window to the next slot down to hold our treelist. This will allow us to scroll within the treelist. So, find the Scrolled Window icon under the Containers section of the toolbox (second icon from the left on the fifth row on my setup), and click that into the second slot of the vbox. Next, we will add two Horizontal boxes, one to each of the next slots. Each needs three slots. Finally, add a Status Bar to the bottom slot. This is under the Control and Display section of the toolbox near the bottom. Now your designer should look something like the image below.



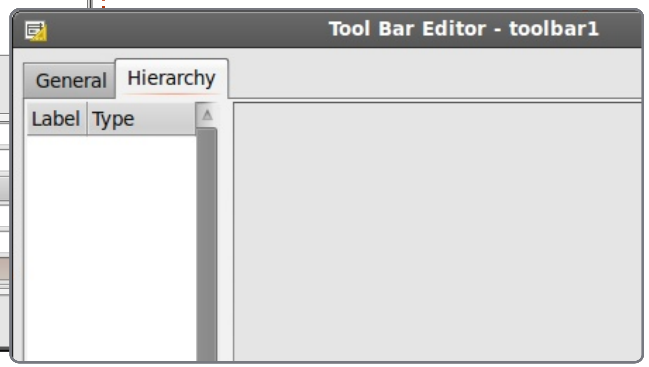
Last, but not least, add a Tree View widget from the Control and Display section of the toolbox into the scrolled window widget. You'll get a pop-up asking which TreeView model you wish to use. Just click the “OK” button for now. We'll set that up later.

Now we need to concentrate on the Scroll Window for a second. Click on it in the hierarchy area. Scroll down in the General tab to the entry marked “Horizontal Scrollbar Policy”. Change that to 'Always', and then do the same for the Vertical Scrollbar Policy. Save again.

OK, now let's concentrate on our toolbar. This area will be at the top of our application right under the title bar. It will hold various buttons for us that will do the majority of the work. We will use eleven buttons in the toolbar, and, from left to right, they are...

Add, Delete, Clear List, a Separator, Move To Top, Move Up, Move Down, Move to bottom, another Separator, About, and Exit.

Over on the hierarchy area, click on “toolbar1”. That should highlight it. At the top of the Glade Designer is something that looks like a pencil. Click that. That brings up the tool bar editor. Click on the Hierarchy tab. You'll see something like this:.



We will be adding all of our toolbar buttons from here. The steps will be:

- Click the Add Button.
- Change the name of the button.
- Modify the label of the button.
- Select the image.

This will be repeated for all eleven of our widgets. So, Click Add, then in the name box, type “tbtnAdd”. Scroll down to the Edit Label portion and type “Add” in the Label box, then a little further down under Edit Image, in the text box for Stock ID, use the pulldown to select “Add”. That takes care of our Add button. We named it “tbtnAdd” so we can reference it in our code later. The “tbtn” is shorthand for 'Toolbar Button'. This way, in our code, it's easy to find and is fairly self documenting.

Now, we need to add the rest of the widgets to our tool bar. Add another button for Delete. This one will be named (as you might guess) “tbtnDelete”. Again, set the label and the icon. Next, add another button naming it “tbtnClearAll” and use the Clear icon. Now we want a Separator. So, click Add, under name type “Sep1” and in the pulldown for type, select Separator.

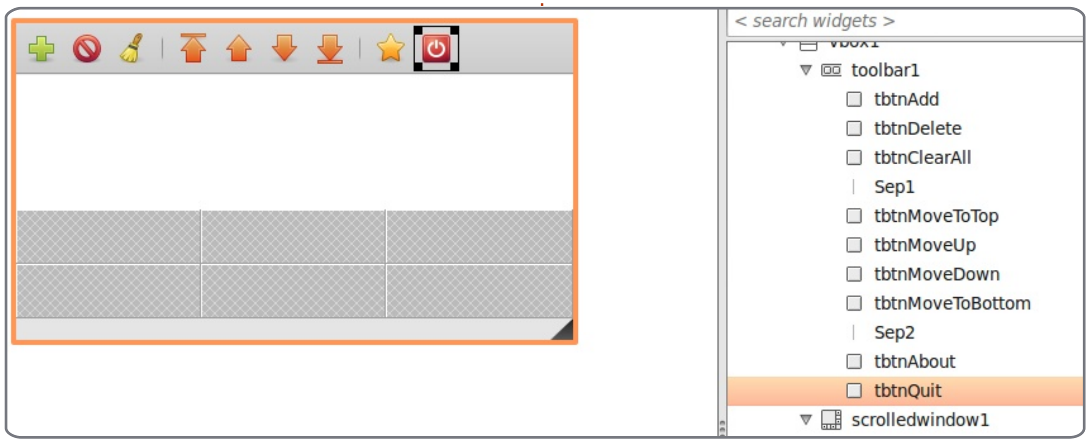
Add the rest of the widgets naming them “tbtnMoveToTop”, “tbtnMoveUp”, ”tbtnMoveDown”, ”tbtnMoveToBottom”, “Sep2”, “tbtnAbout” and “tbtnQuit”. I'm sure you can find the correct icons. Once you are finished, you can quit the hierarchy window and save your work. You should have something that looks like the image below.

Now, we need to set the event handlers for all the buttons we created. In the hierarchy area, select the tbtnAdd widget. This should highlight both the entry in the hierarchy and the button itself. Go back to the attributes section, select the Signals tab, and expand the GtkToolButton to reveal the clicked event. Under handler in the clicked event, as before, select “on_tbtnAdd_clicked”, then click above or below to force the change. Do this for all the other buttons we created - selecting the “on_tbtnDelete_clicked” event and so on. Remember to click off of it to force the change, and save your project. Our separators don't need events, so just pass over them.

Next, we need to fill in our hboxs. The top hbox will contain (from left to right) a label, a text widget, and a button. In the toolbox, select the label widget (not the blue one), and put it in the left slot. Now put a Text Entry widget in the center slot and a button in the right slot. Do the same for the second hbox.

It's now time to set our attributes for the widgets we just added. In the hierarchy area, select label1 under hbox1. In the attributes section, select the General tab, scroll down to “Edit label appearance” area, and set the label to read “Path to save file:”. Next, go to the Packing tab and set Expand to “No”. You might remember the discussion on packing from last month. Set the padding to 4, which gives a little bit of room on the left and right side of our label. Now select button1 and set the Expand under the Packing tab to “No” also. Go back to the General tab and set the name of our button to “btnGetFolder”. Notice that since this isn't a toolbar button, we didn't preface it with a 't'. Scroll down to the Label entry and enter “Folder...”. Then click on the Signals tab and set the button event of GtkButton/clicked to “on_btnGetFolder_clicked”. Before we set the attributes of the next set of widgets in the next hbox, we need to do one more thing. Select the hbox1 in the hierarchy area and under the Packing tab, set expand to “No”. This makes the hbox take up less space. Finally, set the name of the Text Entry widget to “txtPath”.

Now, do the same thing for hbox2, setting its Expand to “No”, then set the label text to “Filename:”, expand to “No”, padding to 4. Set the name of the button to “btnSavePlaylist”, its text to “Save Playlist File...”, its Expand attribute to “No”, set up its clicked event, and set the name of the Text Entry widget here to “txtFilename”. Once again, save everything.

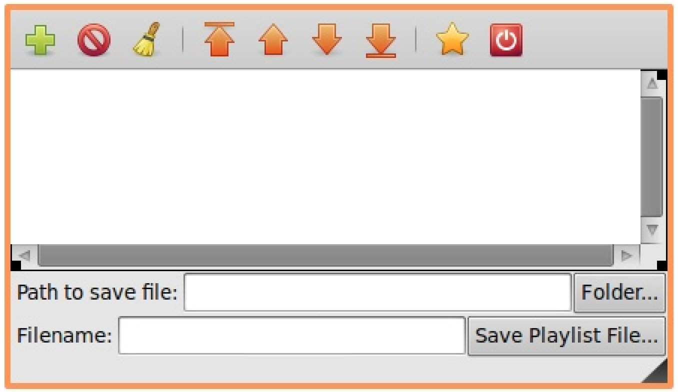


So now our window should look something like the image below left.

All that is wonderful, but what did we really do? We can't run this as a program, since we don't have any code. What we have done is create an XML file called “playlistmaker.glade”. Don't let the extension fool you. It's really an XML file. If you are very careful, you can open it with your favorite editor (gedit in my case) and look at it.

You'll see plain text describing our window and each widget with their attributes. For example, let's look at the code (above) for the main widget, the actual window itself.

You can see that the name of the widget is “MainWindow”, its title is “Playlist Maker v1.0”, the event handler, and so on.




```
<widget class="GtkWindow" id="MainWindow">
    <property name="visible">True</property>
    <property name="title" translatable="yes">Playlist Maker v1.0</property>
    <property name="window_position">center</property>
    <property name="default_width">650</property>
    <property name="default_height">350</property>
    <signal name="destroy" handler="on_MainWindow_destroy"/>
```

Let's take a look at the code (shown below) for one of our toolbar buttons.

Hopefully this is starting to make sense to you. Now, we need to write some code to allow us to see our hard work actually do something. Bring up your code editor and start with this...

So, we have created our imports pretty much like we did last month. Notice we are importing “sys” and “MP3” from mutagen.mp3. We installed mutagen back in article number 9, so if you don't have that on your system, refer back to that one. We'll need the mutagen import for next time, and the sys import is set so the system can exit properly on the last exception.

Next, we need to create our class that will define our window. This is shown above right.

Pretty much the same kind of thing we've done before. Notice the last two lines here. We are defining the glade file (self.gladfile) to be the name of the file we created in the Glade designer. Notice also that we didn't include a path, just a file name. If your glade file is going to reside somewhere away from your actual code, you must put a path as well. However, it's always smart to keep them together. Next, we define our window as self.wTree. We'll be referring to that every time we need to refer to the window. We are also saying that the file is an XML file, and the window we will be using is the one named “MainWindow”. You can

```
<child>
   <widget class="GtkToolButton" id="tbtnAdd">
      <property name="visible">True</property>
      <property name="label" translatable="yes">Add</property>
      <property name="use_underline">True</property>
      <property name="stock_id">gtk-add</property>
      <signal name="clicked" handler="on_tbtnAdd_clicked"/>
   </widget>
   <packing>
       <property name="expand">False</property>
       <property name="homogeneous">True</property>
   </packing>
</child>
```

```
#!/usr/bin/env python
import sys
from mutagen.mp3 import MP3
try:
    import pygtk
    pygtk.require("2.0")
except:
    pass
try:
    import gtk
    import gtk.glade
except:
    sys.exit(1)
```

have multiple windows defined in a single glade file. More on that another time.

Now we need to deal with our events. Last month we used button.connect or window.connect calls to refer to our event handler routines. This time we are going to do something a bit differently. We will use a dictionary. A dictionary is like an array, except rather than being referenced by its index, it's referenced by a key and then has a data element. Key and Data. Here's the code that will probably make it easier to understand. I'm only going to give you two events for now (shown below)...

```
    #===================================================
    #               Create Event Handlers
    #===================================================
    dict = {"on_MainWindow_destroy": gtk.main_quit,
            "on_tbtnQuit_clicked": gtk.main_quit}
```

So we have two events: “on_MainWindow_destroy” and “on_tbtnQuit_clicked” are the keys in our dictionary. The data for our dictionary is “gtk.main_quit” for both entries. Whenever an event is triggered by our GUI, the system uses the event to find the key of our dictionary, then knows what routine to call - from the data segment. Next we need to connect the dictionary to the signal handler of our window. We do it with the following line of code.

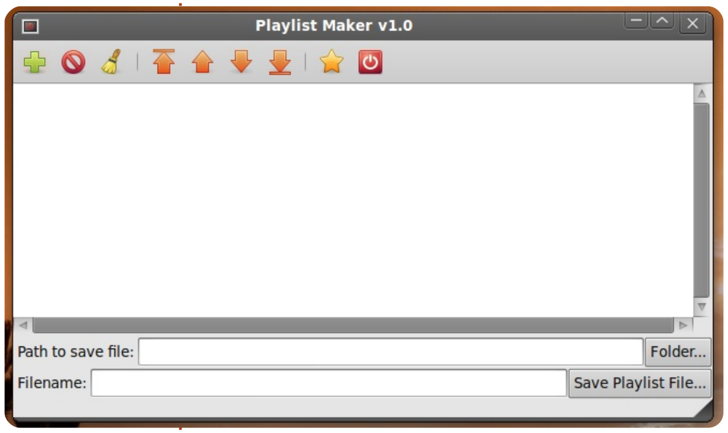
```
self.wTree.signal_autoconnect(dict)
```

We're almost ready. We still need our main routine code:

```
if __name__ == "__main__":
    plm = PlayListMaker()
    gtk.main()
```

```
class PlayListMaker:
    def __init__(self):
        #=============================================
        #                 Window Creation
        #=============================================
        self.gladefile = "playlistmaker.glade"
        self.wTree =
gtk.glade.XML(self.gladefile,"MainWindow")
```

Save this file as “playlistmaker.py”. Now you can run it (shown above right).



It doesn't do much right now, other than open and close properly. The rest is for next time. Just to whet your appetite, we'll be discussing the use of the TreeView, Dialog boxes, and adding a bunch more code. So tune in next time.

Glade file:
http://fullcirclemagazine.pastebin.com/YM6U0Ee3

Python source:
http://fullcirclemagazine.pastebin.com/wbfDmmBh

Greg Walters is owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music,

Program In Python - Part 22

Correction

Last month, in part 21, you were told to save what you have as "PlaylistMaker.glade", but, in the code, it was referred to as: "playlistmaker.glade". I'm sure you noticed that one has capitals and the other does not. The code will run only if you use both the call and file name with, or

To start off on the right foot, you need to have the playlistmaker.glade and playlistmaker.py from last month. If you don't, jump over to the last issue and get the goodies. Before we get to the code, let's take a look at what a playlist file is. There are multiple versions of play lists, and they all have different extensions. The one we will be creating will be a *.m3u type playlist. In its simplest form, it's just a text file that starts with "#EXTM3U", and then has an entry for each song file you want to play - including the full path. There's also an extension that can be added before each entry that includes the length of the song, the album name the song comes from, the track number, and the song name. We'll bypass the extension for now and just concentrate on the basic version.

Here is an example of a M3U playlist file..

.

```
#EXTM3U
Adult Contemporary/Chris
Rea/Collection/02 - On The
Beach.mp3
Adult Contemporary/Chris
Rea/Collection/07 - Fool (If
You Think It's Over).mp3
Adult Contemporary/Chris
Rea/Collection/11 - Looking
For The Summer.mp3
```

All path names are relative to the location of the playlist file.

OK...now let's get to coding. Shown right is the opening of the source code from last month.

Now, we need to create an event handler routine for each

```
#!/usr/bin/env python
import sys
from mutagen.mp3 import MP3
try:
    import pygtk
    pygtk.require("2.0")
except:
    pass
try:
    import gtk
    import gtk.glade
except:
    sys.exit(1)
```

next the class definition

```
class PlayListCreator:
    def __init__(self):
        self.gladefile = "playlistmaker.glade"
        self.wTree = gtk.glade.XML(self.gladefile,"MainWindow")
```

and the main routine

```
if __name__ == "__main__":
      plc = PlayListCreator()
      gtk.main()
```

Next, we have our dictionary which should go after the __init__ routine.

```
def SetEventDictionary(self):
  dict = {"on_MainWindow_destroy": gtk.main_quit,
    "on_tbtnQuit_clicked": gtk.main_quit,
    "on_tbtnAdd_clicked": self.on_tbtnAdd_clicked,
    "on_tbtnDelete_clicked": self.on_tbtnDelete_clicked,
    "on_tbtnClearAll_clicked": self.on_tbtnClearAll_clicked,
    "on_tbtnMoveToTop_clicked": self.on_tbtnMoveToTop_clicked,
    "on_tbtnMoveUp_clicked": self.on_tbtnMoveUp_clicked,
    "on_tbtnMoveDown_clicked": self.on_tbtnMoveDown_clicked,
    "on_tbtnMoveToBottom_clicked": self.on_tbtnMoveToBottom_clicked,
    "on_tbtnAbout_clicked": self.on_tbtnAbout_clicked,
    "on_btnGetFolder_clicked": self.on_btnGetFolder_clicked,
    "on_btnSavePlaylist_clicked": self.on_btnSavePlaylist_clicked}
```

of our events that we have set up. Notice that on_MainWindow_destroy and on_tbtnQuit_clicked are already done for us, so we need to have only 10 more (shown top right). Just make stubs for now.

We'll modify these stubbed routines in a few minutes. For now, this should get us up and running with an application, and we can test things as we go. But, we need to add one more line to the __init__ routine before we can run the app. After the self.wTree line, add...

```
self.SetEventDictionary()
```

Now, you can run the application, see the window, and click the Quit toolbar button to exit the application properly. Save the code as "playlistmaker-1a.py" and give it a try. Remember to save it in the same folder as the glade file we created last time, or copy the glade file into the folder you saved this code in.

We also need to define a few variables for future use. Add these after the SetEventDictionary call in the __init__ function.

```
self.CurrentPath = ""
self.CurrentRow = 0
self.RowCount = 0
```

Now, we will create a function that allows us to display a popup dialog box whenever we need to give some information to our user. There is a built-in set of routines that we will use, but we'll make a routine of our own to make it easier for us. It is the gtk.MessageDialog routine, and the syntax is as follows...

```
gtk.MessageDialog(parent,flags,MessageType,Buttons,message)
```

Some discussion is needed before we go too much further. The message type can be one of the following...

```
GTK_MESSAGE_INFO - Informational message
GTK_MESSAGE_WARNING - Nonfatal warning message
GTK_MESSAGE_QUESTION - Question requiring a choice
GTK_MESSAGE_ERROR - Fatal error message
```

And the button types are...

```
GTK_BUTTONS_NONE - no buttons at all
GTK_BUTTONS_OK - an OK button

GTK_BUTTONS_CLOSE - a Close button
GTK_BUTTONS_CANCEL - a Cancel button
GTK_BUTTONS_YES_NO - Yes and No buttons
GTK_BUTTONS_OK_CANCEL - OK and Cancel Buttons
```

Normally, you would use the following code , or similar, to create the dialog, display it, wait for a response, and then destroy it.

```
dlg = gtk.MessageDialog(None,0,gtk.MESSAGE_INFO,gtk.BUTTONS_OK,"This is a test message...")
response = dlg.run()
dlg.destroy()
```

However, if you want to display a message box to the user more than once or twice, that's a LOT of typing. The general rule of thumb is that if you write a series of lines-of-code more than once or twice, it's usually better to create a function and then call that. Think of it this way: If we want to display a message dialog to the user, say ten times in your

```
    def on_tbtnAdd_clicked(self,widget):
        pass
    def on_tbtnDelete_clicked(self,widget):
        pass
    def on_tbtnClearAll_clicked(self,widget):
        pass
    def on_tbtnMoveToTop_clicked(self,widget):
        pass
    def on_tbtnMoveUp_clicked(self,widget):
        pass
    def on_tbtnMoveDown_clicked(self,widget):
        pass
    def on_tbtnMoveToBottom_clicked(self,widget):
        pass
    def on_tbtnAbout_clicked(self,widget):
        pass
    def on_btnGetFolder_clicked(self,widget):
        pass
    def on_btnSavePlaylist_clicked(self,widget):
        pass
```

application, that's 10 X 3 (or 30) lines of code. By making a function to do this for us (using the example I just presented), we would have 10 + 3 (or 13) lines of code to write. The more we call a dialog, the less code we actually have to type, and the more readable our code is. Our function (top right) will allow us to call any of the four message dialog types with just one routine using different parameters.

```
def MessageBox(self,level,text):
    if level == "info":
        dlg = gtk.MessageDialog(None,0,gtk.MESSAGE_INFO,gtk.BUTTONS_OK,text)
    elif level == "warning":
        dlg = gtk.MessageDialog(None,0,gtk.MESSAGE_WARNING,gtk.BUTTONS_OK,text)
    elif level == "error":
        dlg = gtk.MessageDialog(None,0,gtk.MESSAGE_ERROR,gtk.BUTTONS_OK,text)
    elif level == "question":
        dlg = gtk.MessageDialog(None,0,gtk.MESSAGE_QUESTION,gtk.BUTTONS_YES_NO,text)
    if level == "question":
        resp = dlg.run()
        dlg.destroy()
        return resp
    else:
        resp = dlg.run()
        dlg.destroy()
```

This is a very simple function that we would then call like this...

```
self.MessageBox("info","The button QUIT was clicked")
```

Notice that if we choose to use the MESSAGE_QUESTION type of dialog, there are two possible responses that will be returned by the message dialog - a "Yes" or a "No". Whichever button the user clicks, we will receive the information back in our code. To use the question dialog, the call would be something like this...

```
response = self.MessageBox("question","Are you sure you want to do this now?")

if response == gtk.RESPONSE_YES:

   print "Yes was clicked"

elif response == gtk.RESPONSE_NO:

   print "NO was clicked"
```

You can see how you can check the value of the button returned. So now, replace the "pass" call in each of our event handler routines with something like that shown below right.

```
def on_tbtnAdd_clicked(self,widget):
    self.MessageBox("info","Button Add was clicked...")
def on_tbtnDelete_clicked(self,widget):
    self.MessageBox("info","Button Delete was clicked...")
def on_tbtnClearAll_clicked(self,widget):
    self.MessageBox("info","Button ClearAll was clicked...")
def on_tbtnMoveToTop_clicked(self,widget):
    self.MessageBox("info","Button MoveToTop was clicked...")
def on_tbtnMoveUp_clicked(self,widget):
    self.MessageBox("info","Button MoveUp was clicked...")
def on_tbtnMoveDown_clicked(self,widget):
    self.MessageBox("info","Button MoveDown was clicked...")
def on_tbtnMoveToBottom_clicked(self,widget):
    self.MessageBox("info","Button MoveToBottom was clicked...")
def on_tbtnAbout_clicked(self,widget):
    self.MessageBox("info","Button About was clicked...")
def on_btnGetFolder_clicked(self,widget):
    self.MessageBox("info","Button GetFolder was clicked...")
def on_btnSavePlaylist_clicked(self,widget):
    self.MessageBox("info","Button SavePlaylist was clicked...")
```

We won't keep it like this, but this gives you a visual indication that the buttons work the way we want. Save the code now as "playlistmaker-1b.py", and test your program. Now we are going to create a function to set our widget references. This routine is going to be called only once, but it will make our code much more manageable and readable. Basically, we want to create local variables that reference the widgets in our glade window - so we can make calls to them whenever (if ever) we need to. Put this function (above right) below the SetEventDictionary function.

```
def SetWidgetReferences(self):
    self.txtFilename = self.wTree.get_widget("txtFilename")
    self.txtPath = self.wTree.get_widget("txtPath")
    self.tbtnAdd = self.wTree.get_widget("tbtnAdd")
    self.tbtnDelete = self.wTree.get_widget("tbtnDelete")
    self.tbtnClearAll = self.wTree.get_widget("tbtnClearAll")
    self.tbtnQuit = self.wTree.get_widget("tbtnQuit")
    self.tbtnAbout = self.wTree.get_widget("tbtnAbout")
    self.tbtnMoveToTop = self.wTree.get_widget("tbtnMoveToTop")
    self.tbtnMoveUp = self.wTree.get_widget("tbtnMoveUp")
    self.tbtnMoveDown = self.wTree.get_widget("tbtnMoveDown")
    self.tbtnMoveToBottom = self.wTree.get_widget("tbtnMoveToBottom")
    self.btnGetFolder = self.wTree.get_widget("btnGetFolder")
    self.btnSavePlaylist = self.wTree.get_widget("btnSavePlaylist")
    self.sbar = self.wTree.get_widget("statusbar1")
    self.context_id = self.sbar.get_context_id("Statusbar")
```

and then add a call to it right after the self.SetEventDictionary() call in the __init__ function.

```
    self.SetWidgetReferences()
```

Please notice that there is one thing that isn't referenced in our routine. That would be the treeview widget. We'll make that reference when we set up the treeview itself. Also of note is the last line of our routine. In order to use the status bar, we need to refer to it by its context id. We'll be using this later on.

Next, let's set up the function that displays the “about” dialog when we click the About toolbar button. Again, there is a built-in routine to do this provided by the GTK library. Put this after the MessageBox function. Here's the code, below right.

Save your code and then give it a try. You should see a pop-up box, centered in our application, that displays everything we have set. There are more attributes that you can set for the about box (which can be found at http://www.pygtk.org/docs/pygtk/class-gtkaboutdialog.html), but these are what I would consider a minimum set.

```
def ShowAbout(self):
    about = gtk.AboutDialog()
    about.set_program_name("Playlist Maker")
    about.set_version("1.0")
    about.set_copyright("(c) 2011 by Greg Walters")
    about.set_comments("Written for Full Circle Magazine")
    about.set_website("http://thedesignatedgeek.com")
    about.run()
    about.destroy()
```

Now, comment out (or simply remove) the messagebox call in the on_tbtnAbout_clicked routine, and replace it with a call to the ShowAbout function. Make it look like this.

```
def on_tbtnAbout_clicked(self,widget):
    #self.MessageBox("info","Button About was clicked...")
    self.ShowAbout()
```

Before we go on, we need to discuss exactly what will happen from here. The general idea is that the user will click on the "Add" toolbar button, we'll pop up a file dialog box to allow them to add files to the playlist, and then display the file information into our treeview widget. From there, they can add more files, delete single file entries, delete all file entries, move a file entry up, down, or to the top or down to the bottom of the treeview. Eventually, they'll set the path that the file will be saved to, provide a filename with a "m3u" extension, and click the save file button. While this seems simple enough, there's a lot that happens behind the scenes. The magic all happens in the treeview widget, so let's discuss that. This will get pretty deep, so you might want to read carefully, since an understanding of this will keep you from making mistakes later on.

A treeview can be something as simple as a columnar list of data like a spreadsheet or database representation, or it could be more complex like a file-folder listing with parents and children, where the folder would be the parent and the files in that folder would be the children, or something even more complex. For this project, we'll use the first example, a columnar list. In the list, there will be three columns. One is for the name of the music file, one is for the extension of the file (mp3, ogg, wav, etc) and the final column is for the path. Combining this into a string (path, filename, extension) gives us the entry into the playlist we will be writing. You could, of course, add more columns as you wish, but for now, we'll deal with just three.

A treeview is simply a visual storage container that holds and displays a model. The model is the actual "device" that holds and manipulates our data. There are two different pre-defined models that are used with a treeview, but you can certainly create your own. That having been said, for 98% of your work, one of the two pre-defined models will do what you need. The two types are GTKListStore and GTKTreeStore. As their names suggest, the ListStore model is usually used for lists, the TreeStore is used for Trees. For our application, we will be using a GTKListStore.

```
def SetupTreeview(self):
    self.cFName = 0
    self.cFType = 1
    self.cFPath = 2
    self.sFName = "Filename"
    self.sFType = "Type"
    self.sFPath = "Folder"
    self.treeview = self.wTree.get_widget("treeview1")
    self.AddPlaylistColumn(self.sFName,self.cFName)
    self.AddPlaylistColumn(self.sFType,self.cFType)
    self.AddPlaylistColumn(self.sFPath,self.cFPath)
    self.playList = gtk.ListStore(str,str,str)
    self.treeview.set_model(self.playList)
    self.treeview.set_grid_lines(gtk.TREE_VIEW_GRID_LINES_BOTH)
```

The basic steps are:

- Create a reference to the TreeView widget.
- Add the columns.
- Set the type of renderer to use.
- Create the ListStore.
- Set the model attribute in the Treeview to our model.
- Fill in the data.

The third step is to set up the type of renderer the column will use to display the data. This is simply a routine that is used to draw the data into the tree model. There are many different cell renderers that come with GTK, but most of the ones that you would normally use include GtkCellRenderText and GtkCellRendererToggle.

So, let's create a function (shown above) that sets up our TreeView widget. We'll call it SetupupTreeview. First we'll define some variables for our columns, set the variable reference of the TreeView itself, add the columns, set up the ListStore, and set the model. Here's the code for the function. Put it after the

SetWidgetReferences function.

The variables cFName, cFType and cFPath define the column numbers. The variables sFName, sFType and sFPath will hold the column names in our displayed view. The seventh line sets the variable reference of the treeview widget as named in our glade file.

Next we call a routine (next page, top right), which we'll create in just a moment, for each column we want. Then we define our GTKListStore with three text fields, and finally set the model attribute of our TreeView widget to our GTKListStore. Let's create the AddPlaylistColumn function next. Put it after the SetupTreeview function.

Each column is created with this function. We pass in the title of the column (what's displayed on the top line of each column) and a columnID. In this case, the variables we set up earlier (sFName and cFname) will be passed here. We then create a column in our TreeView widget giving the title, what kind of cell renderer it will be using, and, finally, the id of the column. We then set the column to be resizable, set the sort id, and finally append the column into the TreeView.

```
def AddPlaylistColumn(self,title,columnId):
    column = gtk.TreeViewColumn(title,gtk.CellRendererText(),text=columnId)
    column.set_resizable(True)
    column.set_sort_column_id(columnId)
    self.treeview.append_column(column)
```

Add these two functions to your code. I choose to put them right after the SetWidgetReferences function, but you can put it anywhere within the PlayListCreator class. Add the following line after the call to SetWidgetReferences() in the __init__ function to call the function.

```
self.SetupTreeview()
```

Save and run your program, and you will see that we now have three columns with headers in our TreeView widget.

There are so many things left to do. We have to have a way to get the music filenames from the user and put them into the TreeView as rows of data. We have to create our Delete, ClearAll, movement functions, save routine, and file path routines, plus a few "pretty" things that will make our application look more professional. Let's start with the Add routine. After all, that's the first button on our toolbar. When the user clicks the Add button, we want to pop up a "standard" open-file dialog that allows for multiple selections. Once the user has made their selection, we then want to take this data and add it into the treeview, as I stated above. So the first logical thing to do is work on the File Dialog. Again, GTK provides us a way to call a "standard" file dialog in code. We could hard code this as just lines in the on_tbtnAdd_clicked event handler, but let's make a separate class to handle this. While we are at it, we can make this class handle not only a file OPEN dialog, but a folder SELECT dialog as well. As before with the MessageBox function, you can pull this into a snippet file that has all kinds of reusable routines for later use.

We'll start by defining a new class called FileDialog which will have only one function called ShowDialog. That function will take two parameters, one called 'which' (a '0' or a '1'), that designates whether we are creating an open-file or select-folder dialog, and the other is the path that should be used for the default view of the dialog called CurrentPath. Create this class just before our main code at the bottom of the source file.

```
class FileDialog:

  def
ShowDialog(self,which,CurrentPat
h):
```

The first part of our code should be an IF statement

```
if which == 0: # file chooser
    ...
```

```
dialog = gtk.FileChooserDialog("Select files to add...",None,
                   gtk.FILE_CHOOSER_ACTION_OPEN,
                   (gtk.STOCK_CANCEL, gtk.RESPONSE_CANCEL,
                   gtk.STOCK_OPEN, gtk.RESPONSE_OK))
```

```
else:     # folder chooser
   ...
```

Before going any further, let's explore how the file/folder dialog is actually called and used. The syntax of the dialog is as follows

```
gtk.FileChooserDialog(title,parent,action,buttons,backend)
```

and returns a dialog object. Our first line (under if which == 0) will be the line shown below.

As you can see, the title is "Select files to add...", the parent is set to None. We are requesting a File Open type dialog (action), and we want a Cancel and an Open button, both using "stock" type icons. We are also setting the return codes of gtk.RESPONSE_CANCEL and gtk.RESPONSE_OK for when the user makes their selections. The call for our Folder Chooser under the Else clause is similar.

Basically, the only thing that changed between the two definitions are the title (shown above right) and the action type. So our code for the class should now be the code shown middle right.

These set the default response to be the OK button, and then to turn on the multiple select feature so the user can select (you guessed it) multiple files to add. If we didn't set this, the dialog would only allow one file to be selected at a time, since set_select_multiple is set to False by default. Our next lines are setting the current path, and then displaying the dialog itself. Before we type in the code, let me explain why we want to deal with the current path. Every time you pop up a file dialog box, and you DON'T set a path, the default is to the folder where our application resides. So, let's say that the music files that the user would be looking for are in /media/music_files/, and are then broken down by genre, and further by artist, and further by album. Let's further assume that the user has installed our application in /home/user2/playlistmaker. Each

```
dialog = gtk.FileChooserDialog("Select Save Folder..",None,
                      gtk.FILE_CHOOSER_ACTION_SELECT_FOLDER,
                     (gtk.STOCK_CANCEL, gtk.RESPONSE_CANCEL,
                      gtk.STOCK_OPEN, gtk.RESPONSE_OK))
```

```
class FileDialog:
    def ShowDialog(self,which,CurrentPath):
        if which == 0: #file chooser
            #gtk.FileChooserDialog(title,parent,action,buttons,backend)
            dialog = gtk.FileChooserDialog("Select files to add...",None,

                                 gtk.FILE_CHOOSER_ACTION_OPEN,
                                 (gtk.STOCK_CANCEL, gtk.RESPONSE_CANCEL,
                                  gtk.STOCK_OPEN, gtk.RESPONSE_OK))
        else:           #folder chooser
            dialog = gtk.FileChooserDialog("Select Save Folder..",None,
                                  gtk.FILE_CHOOSER_ACTION_SELECT_FOLDER,
                                 (gtk.STOCK_CANCEL, gtk.RESPONSE_CANCEL,
                                  gtk.STOCK_OPEN, gtk.RESPONSE_OK))
```

The next two lines will be (outside of the IF/ELSE statement)...

```
        dialog.set_default_response(gtk.RESPONSE_OK)
```

```
        if CurrentPath != "":
            dialog.set_current_folder(CurrentPath)
        response = dialog.run()
```

Next, we need to handle the response from the dialog.

```
        if response == gtk.RESPONSE_OK:
            fileselection = dialog.get_filenames()
            CurrentPath = dialog.get_current_folder()
            dialog.destroy()
            return (fileselection,CurrentPath)
        elif response == gtk.RESPONSE_CANCEL:
            print 'Closed, no files selected'
            dialog.destroy()
```

time we pop up the dialog, the starting folder would be /home/user2/playlistmaker. Quickly, the user would become frustrated by this, wanting the last folder he was in to be the starting folder next time. Make sense? OK. So, bottom right are our next lines of code.

Here we check the responses sent back. If the user clicked the 'Open' button which sends back a gtk.RESPONSE_OK, we get the name or names of the files the user selected, set the current path to the folder we are in, destroy the dialog, and then return the data back to the calling routine. If, on the other hand, the user clicked on the 'Cancel' button, we simply destroy the dialog. I put the print statement in there just to show you that the button press worked. You can leave it or take it out. Notice that when we return from the Open button part of the routine, we are returning two sets of values. 'fileselection' is a list of the files selected by the user, as well as the CurrentPath.

In order to get the routine to do something, add the following line under the on_tbtnAdd_click routine...

```
fd = FileDialog()

selectedfiles,self.CurrentPath =
fd.ShowDialog(0,self.CurrentPath)
```

Here we retrieve the two return values that are sent from our return call. For now, add the following code to see what the information returned will look like.

```
for f in selectedfiles:

    print "User selected %s" % f

print "Current path is %s" % self.CurrentPath
```

When you run the program, click on the 'Add' button. You'll see the file dialog. Now move to somewhere where you have some files and select them. You can hold down the [ctrl] key and click on multiple files to select them individually, or the [shift] key to select multiple contiguous files. Click on the 'Open' button, and look at the response in your terminal window. Please note that if you click on the 'Cancel' button right now, you'll get an error message. That's because the above code assumes that there are no files selected. Don't worry about that right now - we'll handle that in a little bit. I just wanted to let you see what comes back if the 'Open' button is pressed. One thing we should do is add a filter to our file-open dialog. Since we expect the user to normally select music files, we should (1) give the option to display only music files, and (2) give the option to show all files just-in-case. We do this by using the filefilter attributes of the dialog. Here's the code for that which should go in the which == 0 section right after the dialog set line.

```
filter = gtk.FileFilter()
filter.set_name("Music Files")
filter.add_pattern("*.mp3")
filter.add_pattern("*.ogg")
filter.add_pattern("*.wav")
dialog.add_filter(filter)
filter = gtk.FileFilter()
filter.set_name("All files")
filter.add_pattern("*")
dialog.add_filter(filter)
```

We are setting up two "groups", one for music files (filter.set_name("Music Files")), and the other for all files. We use a pattern to define the types of files we want. I have defined three patterns, but you can add or delete any that you wish. I put the music filter first, since that's what we will assume the user is going to be mainly concerned with. So the steps are...

- Define a filter variable.
- Set the name.
- Add a pattern.
- Add the filter to the dialog.

You can have as many or as few filters as you wish. Also notice that once you have added the filter to the dialog, you can re-use the variable for the filter.

Back in the on_tbtnAdd_clicked routine, comment out the last lines we added and replace them with this one line.

```
self.AddFilesToTreeview(selectedfiles)
```

so our routine now looks like the code shown on the next page.

So, when we get the response back from file dialog, we will send the list containing the selected files to this routine. Once here, we set up a counter variable (how many files we are adding), then parse the list. Remember that each entry contains the fully qualified filename with path and extension. We'll want to split the filename into path, filename,

```
    def on_tbtnAdd_clicked(self,widget):
        fd = FileDialog()
        selectedfiles,self.CurrentPath =
fd.ShowDialog(0,self.CurrentPath)
        self.AddFilesToTreeview(selectedfiles)
```

We now have to create the function that we just put the call to. Put this function after the on_btnSavePlaylist_clicked routine.

```
    def AddFilesToTreeview(self,FileList):
        counter = 0
        for f in FileList:
            extStart = f.rfind(".")
            fnameStart = f.rfind("/")
            extension = f[extStart+1:]
            fname = f[fnameStart+1:extStart]
            fpath = f[:fnameStart]
            data = [fname,extension,fpath]
            self.playList.append(data)
            counter += 1
        self.RowCount += counter
        self.sbar.push(self.context_id,"%s files added
```

and extension. First we get the very last 'period' from the filename and assume that is the beginning of the extension and assign its position in the string to extStart. Next we find the very last '/' in the filename to determine the beginning of the filename. Then we break up the string into extension, filename and file path. We then stuff these values into a list named 'data' and append this into our playlist ListStore. We increment the counter since we have done all the work. Finally we increment the variable RowCount which holds the total number of rows in our ListStore, and then we print a message to the status bar.

Now you can run the application and see the data in the TreeView.

As always, the full code can be found at http://pastebin.com/JtrhuE71.

Next time, we'll finalize our application, filling in the missing routines, etc.

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Program In Python - Part 23

This time, we are going to finish our playlistmaker program. Last time, we got a good bit done, but we left some things incomplete. We can't save the playlist, we don't have the movement functions done, we can't select the file path to store the file in, and so on. However, there are a few things that we need to do before we start coding. First, we need to find an image for the logo for our application in the about box, and for when the application is minimized. You can dig around in the /usr/share/icons folder for an icon you like, or you can go on the web and get one, or create one yourself. Whatever you get, put it into your code folder with the glade file and the source code from last month. Name it logo.png. Next, we need to open the glade file from last month and make a few changes.

First, using the MainWindow, go to the General tab, and scroll down until you find Icon. Using the browse tool, find your icon and select that. Now the text box should contain “logo.png”. Next, in the hierarchy box, select treeview1, go to the signal tab, and, under GtkTreeView | cursor-changed, add a handler for on_treeview1_cursor_changed. Remember, as I told you last month, to click off that to make the change stick. Finally, again in the hierarchy box, select txtFilename, and go to the signal tab. Scroll down until you find 'GtkWidget', and scroll down further until you get to 'key-press-event'. Add a handler for 'on_txtFilename_key_press_event'. Save your glade project and close glade.

Now it's time to complete our project. We'll start from where we left off using last month's code.

```
elif response == gtk.RESPONSE_CANCEL:
    print 'Closed, no files selected'
    dialog.destroy()
```

Notice that we aren't returning anything. This is what caused the error. So to fix this, we want to add the following line of code after the dialog.destroy() line.

```
Return ([],"")
```

This will keep the error from happening. Next, let's add the text box event handler we created in glade. To our dictionary, add the following line.

```
"on_txtFilename_key_press_event": self.txtFilenameKeyPress,
```

As you remember, this creates a function to handle the keypress event. We'll next create the function.

```
def txtFilenameKeyPress(self,widget,data):
   if data.keyval == 65293: # The value of the return key
```

The first thing I want to do is modify the code in class FileDialog. If you remember from last time, if the user clicked the 'Cancel' button, there was an error raised. We will fix that first. At the end of the routine, you have the code shown above.

You might imagine, this simply looks at the value of each key that is pressed when the user is in the txtFilename text box, and compares it to the value 65293, which is the code that is assigned to the return key (enter key). If it matches, then it calls the SavePlaylist function. The user doesn't have to even click the button.

Now on to new code. Let's deal with the toolbar button ClearAll. When the user clicks this button, we want the treeview and the ListStore to be cleared. This is a simple one-liner that we can put into the on_tbtnClearAll_clicked routine.

```
def
on_tbtnClearAll_clicked(self,
widget):

    self.playList.clear()
```

We are simply telling the playList ListStore to clear itself. That was easy. Now we'll deal with the Delete toolbar button. Much harder, but once we get into it, you'll understand.

First we have to discuss how we get a selection from the treeview widget and the ListStore. This is complicated, so go slowly. In order to get data back from the ListStore, we first have to get a gtk.TreeSelection which is a helper object that manages the selection within a treeview. Then we use that helper object to retrieve the model type, and an iterator that contains the selected rows.

I know that you are thinking “What the heck is an iterator?” Well you already have used them and don't even know it. Think about the following code (above right) from the AddFilesToTreeview function from last month.

Look at the 'for' statement portion. We use an iterator to walk through the list called FileList. Basically, in this case, the iterator simply goes through each entry in the list returning each item separately. What we are going to do is create an iterator, fill that with the selected rows in the treeview, and use that like a list. So the code (middle right) for on_tbtnDelete_clicked will be.

The first line creates the TreeSelection object. We use that to get the rows selected (which is only one because we didn't set the model to support multiple selections), fill that into a list called iters, and then walk it removing (like the .clear method). We also decrement the variable RowCount, and then display the number of files in the status bar.

Now, before we get to the move functions, let's deal with the save-file-path function. We'll use our FileDialog class as before. We'll do all the code (bottom right)for this in the on_btnGetFolder_clicked routine.

The only thing really different from before is the last line of this code. We are putting the name of the path returned by the FileDialog into the textbox that we set up

```
def AddFilesToTreeview(self,FileList):
    counter = 0
    for f in FileList:
        extStart = f.rfind(".")
        fnameStart = f.rfind("/")
        extension = f[extStart+1:]
        fname = f[fnameStart+1:extStart]
        fpath = f[:fnameStart]
        data = [fname,extension,fpath]
        self.playList.append(data)
        counter += 1
```

```
def on_tbtnDelete_clicked(self,widget):
    sel = self.treeview.get_selection()
    (model,rows) = sel.get_selected_rows()
    iters=[]
    for row in rows:
        iters.append(self.playList.get_iter(row))
    for i in iters:
        if i is not None:
            self.playList.remove(i)
            self.RowCount -= 1
    self.sbar.push(self.context_id,"%d files in list." %
(self.RowCount))
```

```
def on_btnGetFolder_clicked(self,widget):
    fd = FileDialog()
    filepath,self.CurrentPath = fd.ShowDialog(1,self.CurrentPath)
    self.txtPath.set_text(filepath[0])
```

previously using the set_text method. Remember that the data returned to us is in the form of a list, even though there is only one entry. That's why we use 'filepath[0]'.

Let's do the file-save function. We can safely do that before we deal with the move functions. We'll create a function called SavePlaylist. The first thing we need to do (above right) is check to see if there is anything in the txtPath text box. Next we need to check to see if there is a filename in the txtFilename text box. For both of those instances, we use the .get_text() method of the text box.

Now that we know that we have a path (fp) and a filename (fn), we can open the file, print our M3U header, and walk the playList. The path is stored (if you will remember) in column 2, the filename in column 0, and the extension in column 1. We simply (right) create a string and then write it to the file and finally close the file.

```
def SavePlaylist(self):
    fp = self.txtPath.get_text()     # Get the filepath from the text box
    fn = self.txtFilename.get_text() # Get the filename from the filename text box
```

Now check the values...

```
    if fp == "":                     # IF the path is blank...
        self.MessageBox("error","Please provide a filepath for the playlist.")
    elif fn == "":                   # IF the filename is blank...
        self.MessageBox("error","Please provide a filename for the playlist file.")
    else:                            # Otherwise we are good to go.
```

```
plfile = open(fp + "/" + fn,"w")  # Open the file
plfile.writelines('#EXTM3U\n')    # Print the M3U Header
for row in self.playList:
    plfile.writelines("%s/%s.%s\n" % (row[2],row[0],row[1])) #Write the line data
plfile.close   # Finally close the file
```

Lastly, we pop up a message box informing the user that the file has been saved.

```
self.MessageBox("info","Playlist file saved!")
```

We now need to put in a call to this routine in our on_btnSavePlaylist_clicked event handler routine.

```
def on_btnSavePlaylist_clicked(self,widget):
    self.SavePlaylist()
```

Save your code and test it. Your play list should save properly and look something like the

We can now start work on the move functions. Let's start with the Move To Top routine. Like we did when we wrote the delete function, we get the selection and then the selected row. Next we have to step through the rows to get two

```
def on_tbtnMoveToTop_clicked(self,widget):
    sel = self.treeview.get_selection()
    (model,rows) = sel.get_selected_rows()
    for path1 in rows:
        path2 = 0
    iter1=model.get_iter(path1)
    iter2 = model.get_iter(path2)
    model.move_before(iter1,iter2)
```

variables. We will call them path1 and path2. Path2, in this case will be set to 0, which is the “target” row. Path1 is the row the user has selected. We finally use the model.move_before() method to move the selected row up to row 0, effectively pushing everything down. We'll put the code (below right) directly in the on_tbtnMoveToTop_clicked routine.

For the MoveToBottom function, we will use almost exactly the same code as the MoveToTop routine, but, in place of the model.move_before() method, we will use the model.move_after() method, and, instead of setting path2 to 0, we set it to self.RowCount-1. Now you understand why we have a RowCount variable. Remember the counts are zero based, so we have to use RowCount-1 (above right).

Now let's take a look at what it will take to do the MoveUp routine. Once again, it is fairly similar to the last two functions we created. This time, we get path1 which is the selected row and then assign that row number–1 to path2. Then IF path2 (the target row) is greater than or equal to 0, we use the model.swap() method (second down, right).

The same thing applies for the MoveDown function. This time however, we check to see if path2 is LESS than or equal to the value of self.RowCount-1 (third down, right).

Now let's make some changes to the abilities of our play list. In last month's article, I showed you the basic format of the play list file (bottom).

However, I did say that there was an extended format as well. In the extended format, there is an extra line that can be added to the file before each song file entry that contains extra information about the song. The format of this line is as follows...

```
#EXTINF:[Length of song in
seconds],[Artist Name] –
[Song Title]
```

You might have wondered why we included the mutagen library from the beginning since we never used it. Well, we will now. To refresh your memory, the mutagen library is for accessing ID3 tag information from inside of MP3 files. To get

```
def on_tbtnMoveToBottom_clicked(self,widget):
        sel = self.treeview.get_selection()
        (model,rows) = sel.get_selected_rows()
        for path1 in rows:
            path2 = self.RowCount-1
        iter1=model.get_iter(path1)
        iter2 = model.get_iter(path2)
        model.move_after(iter1,iter2)
```

```
def on_tbtnMoveUp_clicked(self,widget):
        sel = self.treeview.get_selection()
        (model,rows) = sel.get_selected_rows()
        for path1 in rows:
            path2 = (path1[0]-1,)
        if path2[0] >= 0:
            iter1=model.get_iter(path1)
            iter2 = model.get_iter(path2)
            model.swap(iter1,iter2)
```

```
def on_tbtnMoveDown_clicked(self,widget):
        sel = self.treeview.get_selection()
        (model,rows) = sel.get_selected_rows()
        for path1 in rows:
            path2 = (path1[0]+1,)
        iter1=model.get_iter(path1)
        if path2[0] <= self.RowCount-1:
            iter2 = model.get_iter(path2)
            model.swap(iter1,iter2)
```

```
#EXTM3U
Adult Contemporary/Chris Rea/Collection/02 - On The Beach.mp3
Adult Contemporary/Chris Rea/Collection/07 - Fool (If You Think It's Over).mp3
Adult Contemporary/Chris Rea/Collection/11 - Looking For The Summer.mp3
```

the full discussion about this, please refer to issue 35 of Full Circle which has my part 9 of this series. We'll create a function to deal with the reading of the MP3 file and return the Artist name, the Song Title, and the length of the song in seconds, which are the three things we need for the extended information line. Put the function after the ShowAbout function within the PlaylistCreator class (next page, top right).

Again, to refresh your memory, I'll walk through the code. First we clear the three return variables so that if anything happens they are blank upon return. We then pass in the filename of the MP3 file we are going to look at. Next we pull the keys into (yes, you guessed it) an iterator, and walk through that iterator looking for two specific tags. They are 'TPE1' which is the artist name, and 'TIT2' which is the song title. Now, if the key doesn't exist, we would get an error, so we wrap each get call with a 'try|except' statement. We then pull the song length from the audio.info.length attribute, and return the whole shebang.

Now, we will want to modify the SavePlaylist function to support the extended information line. While we are there, let's check to see if the filename exists, and if so, flag the user and exit the routine. Also, to make things a bit easier for the user, since we don't support any other filetype, let's

```
def GetMP3Info(self,filename):
        artist = ''
        title = ''
        songlength = 0
        audio = MP3(filename)
        keys = audio.keys()
        for key in keys:
            try:
                if key == "TPE1":           # Artist
                    artist = audio.get(key)
            except:
                artist = ''
            try:
                if key == "TIT2":           # Song Title
                    title = audio.get(key)
            except:
                title = ''
            songlength = audio.info.length    # Audio Length
        return (artist,title,songlength)
```

```
import os.path
```

Then, go ahead and comment out your existing SavePlaylist function and we'll replace it.

```
def SavePlaylist(self):
     fp = self.txtPath.get_text()     # Get the file path from the text box
     fn = self.txtFilename.get_text() # Get the filename from the text box
     if fp == "":  # IF filepath is blank...
         self.MessageBox("error","Please provide a filepath for the playlist.")
     elif fn == "": # IF filename is blank...
         self.MessageBox("error","Please provide a filename for the playlist file.")
     else:  # Otherwise
```

Up to this point, the routine is the same. Here's where the changes start.

```
         extStart = fn.rfind(".") # Find the extension start position
         if extStart == -1:
             fn += '.m3u' #append the extension if there isn't one.
             self.txtFilename.set_text(fn) #replace the filename in the text box
```

automatically append the extension '.m3u' to the path and filename if it doesn't exist. First add an import line at the top of the code importing os.path between the sys import and the mutagen import (bottom right).

Just like in the AddFilesToTreeview function, we will use the 'rfind' method to find the position of the last period ('.') in the filename fn. If there isn't one, the return value is set to -1. So we check to see if the return value is -1, and, if so, we append the extension and then put the filename back in the text box just to be nice.

```
if os.path.exists(fp + "/" + fn):
```

```
self.MessageBox("error","The file already exists. Please select another.")
```

Next, we want to wrap the rest of the function with an IF|ELSE clause (top right) so if the file already exists, we simply fall out of the routine. We use os.path.exists(filename) to do this check.

```
else:
        plfile = open(fp + "/" + fn,"w")  # Open the file
        plfile.writelines('#EXTM3U\n')    #Print the M3U header
        for row in self.playList:
            fname = "%s/%s.%s" % (row[2],row[0],row[1])
            artist,title,songlength = self.GetMP3Info(fname)
            if songlength > 0 and (artist != '' and title != ''):
                plfile.writelines("#EXTINF:%d,%s - %s\n" % (songlength,artist,title))
            plfile.writelines("%s\n" % fname)
        plfile.close  # Finally Close the file
        self.MessageBox("info","Playlist file saved!")
```

The rest of the code is mostly the save as before, but let's look at it anyway.

Line 2 opens the file we are going to write. Line 3 puts the M3U header in. Line 4 sets up for a walk through the playList ListStore. Line 5 creates the filename from the three columns of the ListStore. Line 6 calls GetMP3Info and stores the return values into variables.

Line 7 then checks to see if we have values in all three variables. If so, we write the extended information line in line 8, otherwise we don't try. Line 9 writes the filename line as before. Line 10 closes the file gracefully, and line 11 pops up the message box letting the user know the process is all done.

```
def SetupToolTips(self):
        self.tbtnAdd.set_tooltip_text("Add a file or files to the playlist.")
        self.tbtnAbout.set_tooltip_text("Display the About Information.")
        self.tbtnDelete.set_tooltip_text("Delete selected entry from the list.")
        self.tbtnClearAll.set_tooltip_text("Remove all entries from the list.")
        self.tbtnQuit.set_tooltip_text("Quit this program.")
        self.tbtnMoveToTop.set_tooltip_text("Move the selected entry to the top of the list.")
        self.tbtnMoveUp.set_tooltip_text("Move the selected entry up in the list.")
        self.tbtnMoveDown.set_tooltip_text("Move the selected entry down in the list.")
        self.tbtnMoveToBottom.set_tooltip_text("Move the selected entry to the bottom of the list.")
        self.btnGetFolder.set_tooltip_text("Select the folder that the playlist will be saved to.")
        self.btnSavePlaylist.set_tooltip_text("Save the playlist.")
        self.txtFilename.set_tooltip_text("Enter the filename to be saved here.  The extension '.m3u' will be added for
you if you don't include it.")
```

Go ahead and save your code and give it a test drive.

At this point about the only thing that should be added would be some tool tips for our controls when the user hovers the mouse pointer over them. It adds that professional flair (below). Let's create a function to do that now.

We are using the widget references we set up earlier, and then setting the text for the tooltip via the (you guessed it) set_tooltip_text attribute. Next we need to add the call to the routine. Back in the __init__ routine, after the self.SetWidgetReferences line, add:

```
self.SetupToolTops()
```

Last, but certainly not least, we want to put our logo into our About box. Just like everything else there, there's an attribute for that. Add the following line to the ShowAbout routine.

```
about.set_logo(gtk.gdk.pixbuf_new_from_file("logo.png"))
```

That's about it. You now have a fully functioning program that looks good, and does a wonderful job of creating a playlist for your music files.

The full source code, including the glade file we created last month, can be found at pastebin: http://pastebin.com/tQJizcwT

Until next time, enjoy your new found skills.

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Program In Python - Part 24

WOW! It's hard to believe that this is the 24th issue already. Two years we've been learning Python! You've come a very long way.

This time we are going to cover two topics. The first is printing to a printer, the second is creation of RTF (Rich Text Format) files for output.

Generic Printing under Linux

So let's start with printing to a printer. The idea to cover this came from an email sent by Gord Campbell. It's actually easy to do most printing from Linux, and easier than that other operating system that starts with "WIN" - and I won't deal with that OS.

As long as all you want to print is straight text, no bold, italics, font changes, etc, it's fairly easy. Here's a simple app that will print directly to your printer...

```
import os

pr = os.popen('lpr','w')

pr.write('print test from
linux via python\n')

pr.write('Print finished\n')

pr.close()
```

This is fairly easy to understand as long as you expand your mind just a bit. In the above code, 'lpr' is the print spooler. The only requirement is that we have already configured 'lpd' and that it's running. More than likely, when you use a printer under Ubuntu, it's already done for you. 'Lpd' is usually referred to as a "magic-filter" that can automatically convert different types of documents to something the printer can understand. We are going to print to the 'lpr' device/object. Think of it simply as a file. We open the file. We have to import 'os'. Then in line 2, we open the 'lpr' with write access - assigning it to the object variable 'pr'. We then do a 'pr.write' with anything we want to print. Finally (line 5) we close the file, which will send the data out to the printer.

We can also create a text file, then send it out to the printer like this...

```
import os

filename = 'dummy.file'

os.system('lpr %s' %
filename)
```

In this case, we are still using the lpr object, but we are using the 'os.system' command to basically create a command that looks to linux like we sent it from a terminal.

I'll leave you to play with this for now.

PyRTF

Now let's deal with RTF files. RTF format (that's kind of like saying PIN number since PIN stands for Personal Identification Number, so that translates to Personal-Identification-Number Number. Something from the department of redundancy department, huh?) was originally created by the Microsoft Corporation in 1987, and its syntax was influenced by the TeX typesetting language. PyRTF is a wonderful library that makes it easy to write RTF files. You have to do some planning up front on how you want your files to look, but the results will be well worth it.

Wow! It's hard to believe that this is the 24th issue already. Two years we've been learning Python!

First, you need to download and install the PyRTF package. Go to http://pyrtf.sourceforge.net and get the PyRTF-0.45.tar.gz package. Save it someplace and use archive manager to unpack it. Then using terminal, go to where you unpacked it. First we need to install the package, so type “sudo python setup.py install” and it will be installed for you. Notice there is an examples folder there. There's some good information there on how to do some advanced things.

Here we go. Let's start as we usually do, creating the stub of our program which is shown on the next page, top right.

Before going any further, we'll discuss what's going on. Line 2 imports the PyRTF library. Note that we are using a different import format than normal. This one imports everything from the library.

Our main working routine is MakeExample. We've stubbed for now. The OpenFile routine creates the file for us with the name we pass into it, appends the extension “rtf”, puts it into the “write” mode, and returns a file handle.

We've already discussed the if __name__ routine before, but to refresh your memory, if we are running the program in a standalone mode, the internal variable __name__ is set to “__main__”. If we call it as an import from another program, then it will just ignore that portion of the code.

Here, we create an instance of the Renderer object, call the MakeExample routine, getting the returned object doc. We then write the file (in doc) using the OpenFile routine.

Now for the meat of our worker routine MakeExample. Replace the pass statement with the code shown below.

Let's look at what we have done. In the first line we create an instance of Document. Then we create an instance of the style sheet. Then we create an instance of the section object and append it to the document. Think of a section as a chapter in a book. Next we create a paragraph using the Normal style. The author of PyRTF has preset this to be 11-point Arial font. We then put whatever text we want into the paragraph, append that to the section, and return our doc document.

That is very easy. Again, you need to plan your output fairly carefully, but nothing too onerous.

Save the program as “rtftesta.py” and run it. When it's completed, use openoffice (or LibreOffice) to open the file

```
#!/usr/bin/env python
from PyRTF import *

def MakeExample():
    pass

def OpenFile(name) :
    return file('%s.rtf' % name, 'w')

if __name__ == '__main__' :
    DR = Renderer()
    doc = MakeExample()
    DR.Write(doc, OpenFile('rtftesta'))
    print "Finished"
```

```
doc = Document()
ss  = doc.StyleSheet
section = Section()
doc.Sections.append(section)

p = Paragraph(ss.ParagraphStyles.Normal)
p.append('This is our first test writing to a RTF file. '
         'This first paragraph is in the preset style called normal '
         'and any following paragraphs will use this style until we change it.')
section.append(p)

return doc
```

and look at it.

Now let's do some neat things. First, we'll add a header. Once again, the author of PyRTF has given us a predefined style called Header1. We'll use that for our header. In between the doc.Sections.append line and the p = Paragraph line, add the following.

```
p =
Paragraph(ss.ParagraphStyles.
Heading1)

p.append('Example Heading 1')

section.append(p)
```

Change the name of the rtf file to “rtftestb”. It should look like this:

```
DR.Write(doc,
OpenFile('rtftestb'))
```

Let's look at how to change fonts, font sizes and attributes (bold, italic, etc) on the fly.

```
    p = Paragraph(ss.ParagraphStyles.Normal)
    p.append( 'It is also possible to provide overrides for elements of a style. ',
            'For example you can change just the font ',
            TEXT(' size to 24 point', size=48),
            ' or',
            TEXT(' typeface to Impact', font=ss.Fonts.Impact),
            ' or even more Attributes like',
            TEXT(' BOLD',bold=True),
            TEXT(' or Italic',italic=True),
            TEXT(' or BOTH',bold=True,italic=True),
            '.' )
    section.append(p)
```

Save this as rtftestb.py and run it. So now we have a header. I'm sure your mind is going down many roads thinking about what more can we do. Here's a list of what the author has given us as the predefined styles.

Normal, Normal Short, Heading 1, Heading 2, Normal Numbered, Normal Numbered 2. There's also a List style, which I will let you play with on your own. If you want to see more, on this and other things, the styles are defined in the file Elements.py in the distribution you installed.

While these styles are good for many things, we might want to use something other than the provided styles. Let's look at how to change fonts, font sizes and attributes (bold, italic, etc) on the fly. After our paragraph and before we return the document object, insert the code shown top right, and change the output filename to rtftestc. Save the file as rtftestc.py. And run it. The new portion of our document should look like this...

It is also possible to provide overrides for elements of a style. For example you can change just the font size to 24 point or typeface to Impact or even more Attributes like BOLD or Italic or BOTH.

Now what have we done? Line 1 creates a new paragraph. We then start, as we did before, putting in our text. Look at the fourth line (TEXT(' size to 24 point', size = 48),). By using the TEXT qualifier, we are telling PyRTF to do something different in the middle of the sentence, which in this case is to change the size of the font (Arial at this point) to 24-point, followed by the 'size = ' command. But, wait a moment. The 'size =' says 48, and what we are printing says 24 point, and the output is actually in 24-point text. What's going on here? Well the size command is in half points. So if we want an 8-point font we have to use size = 16. Make sense?

Next, we continue the text and then change the font with the 'font =' command. Again, everything within the inline

TEXT command between the single quotes is going to be affected and nothing else.

Ok. If that all makes sense, what else can we do?

We can also set the color of the text within the TEXT inline command. Like this.

```
p = Paragraph()

p.append('This is a new
paragraph with the word ',


TEXT('RED',colour=ss.Colours.
Red),

     ' in Red text.')

section.append(p)
```

Notice that we didn't have to restate the paragraph style as Normal, since it sticks until we change it. Also notice that if you live in the U.S., you have to use the “proper” spelling of colour.

Here are the colors that are (again) predefined: Black, Blue, Turquoise, Green, Pink, Red, Yellow, White, BlueDark, Teal, GreenDark, Violet, RedDark, YellowDark, GreyDark and Grey.

```
    p = Paragraph(ss.ParagraphStyles.Courier)
    p.append('Now we are using the Courier style at 8 points. '
             'All subsequent paragraphs will use this style automatically. '
             'This saves typing and is the default behaviour for RTF documents.',LINE)
    section.append(p)
    p = Paragraph()
    p.append('Also notice that there is a blank line between the previous paragraph ',
             'and this one.  That is because of the "LINE" inline command.')

    section.append(p)
```

And here is a list of all the predefined fonts (in the notation you must use to set them):

Arial, ArialBlack, ArialNarrow, BitstreamVeraSans, BitstreamVeraSerif, BookAntiqua, BookmanOldStyle, BookmanOldStyle, Castellar, CenturyGothic, ComicSansMS, CourierNew, FranklinGothicMedium, Garamond, Georgia, Haettenschweiler, Impact, LucidaConsole, LucidaSansUnicode, MicrosoftSansSerif, PalatinoLinotype, MonotypeCorsiva, Papyrus, Sylfaen, Symbol, Tahoma, TimesNewRoman, TrebuchetMS and Verdana.

So now you must be thinking that this is all well and good, but how do we make our own styles? That's pretty easy. Move to the top of our file, and before our header line, add the following code.

```
result = doc.StyleSheet

NormalText =
TextStyle(TextPropertySet(res
ult.Fonts.CourierNew,16))

ps2 =
ParagraphStyle('Courier',Norm
alText.Copy())

result.ParagraphStyles.append
(ps2)
```

Before we write the code to actually use it, let's see what we have done. We are creating a new stylesheet instance called result. In the second line, we are setting the font to 8-point Courier New, and then “registering” the style as Courier. Remember, we have to use 16 as the size since the font size is in half-point values.

Column Header 1	Column Header 2	Column Header 3
Row 1 data 1	Row 1 data 2	Row 1 data 3
Row 2 data 1	Row 2 data 2	Row 2 data 3

Now, before the return line at the bottom of the routine, let's include a new paragraph using the Courier style.

So now you have a new style you can use anytime you want. You can use any font in the list above and create your own styles. Simply copy the style code and replace the font and size information as you wish. We can also do this...

```
NormalText =
TextStyle(TextPropertySet(res
ult.Fonts.Arial,22,bold=True,
colour=ss.Colours.Red))

ps2 =
```

```
ParagraphStyle('ArialBoldRed'
,NormalText.Copy())

result.ParagraphStyles.append
(ps2)
```

And add the code below...

```
p =
Paragraph(ss.ParagraphStyles.
ArialBoldRed)

p.append(LINE,'And now we are
using the ArialBoldRed
style.',LINE)

section.append(p)
```

```
to print the ArialBoldRed
style.
```

Tables

Many times, tables are the only way to properly represent data in a document. Doing tables in text is hard to do, and, in SOME cases, it's pretty easy in PyRTF. I'll explain this statement later in this article.

Let's look at a standard table (shown below) in OpenOffice/LibreOffice. It looks like a spreadsheet, where everything ends up in columns.

Rows go left to right, columns go down. Easy concept.

Let's start a new application and call it rtfTable-a.py. Start with our standard code (shown on the next page) and build from there.

```
#!/usr/bin/env python

from PyRTF import *

def TableExample():
    pass

def OpenFile(name):
    return file('%s.rtf' % name, 'w')

if __name__ == '__main__':
    DR = Renderer()
    doc = TableExample()
    DR.Write(doc, OpenFile('rtftable-a'))
    print "Finished"
```

We don't need to discuss this since it's basically the same code that we used before. Now, we'll flesh out the TableExample routine. I'm basically using part of the example file provided by the author of PyRTF. Replace the pass statement in the routine with the following code...

```
doc = Document()

ss = doc.StyleSheet

section = Section()

doc.Sections.append(section)
```

This part is the same as before, so we'll just gloss over it.

```
table =
Table(TabPS.DEFAULT_WIDTH *
7,
          TabPS.DEFAULT_WIDTH * 3,
          TabPS.DEFAULT_WIDTH * 3)
```

This line (yes, it's really one line, but is broken up for easy viewing) creates our basic table. We are creating a table with 3 columns, the first is 7 tabs wide, the second and third are three tabs wide. We don't have to deal with tabs alone, you can enter the widths in twips. More on that in a moment.

```
c1 = Cell(Paragraph('Row One,
Cell One'))

c2 = Cell(Paragraph('Row One,
Cell Two'))

c3 = Cell(Paragraph('Row One,
Cell Three'))

table.AddRow(c1,c2,c3)
```

Here we are setting the data that goes into each cell in the first row.

```
c1 =
Cell(Paragraph(ss.ParagraphSt
yles.Heading2,'Heading2
Style'))

c2 =
Cell(Paragraph(ss.ParagraphSt
yles.Normal,'Back to Normal
Style'))

c3 = Cell(Paragraph('More
Normal Style'))

table.AddRow(c1,c2,c3)
```

This group of code sets the data for row number two. Notice we can set a different style for a single or multiple cells.

```
c1 =
Cell(Paragraph(ss.ParagraphSt
yles.Heading2,'Heading2
Style'))

c2 =
Cell(Paragraph(ss.ParagraphSt
yles.Normal,'Back to Normal
Style'))

c3 = Cell(Paragraph('More
Normal Style'))

table.AddRow(c1,c2,c3)
```

This sets the final row.

```
section.append(table)

return doc
```

This appends the table into the section and returns the document for printing.

Save and run the app. You'll notice that everything is about what you would expect, but there is no border for the table. That can make things difficult. Let's fix that. Again, I'll mainly use code from the example file provided by the PyRTF author.

Save your file as rtftable-b.py. Now, delete everything between 'doc.Sections.append(section)' and 'return doc' in the TableExample routine, and replace it with the following…

```
thin_edge  = BorderPS(
width=20,
style=BorderPS.SINGLE )

thick_edge = BorderPS(
width=80,
style=BorderPS.SINGLE )

thin_frame  = FramePS(
thin_edge,  thin_edge,
thin_edge,  thin_edge )

thick_frame = FramePS(
thick_edge, thick_edge,
thick_edge, thick_edge )

mixed_frame = FramePS(
thin_edge,  thick_edge,
thin_edge,  thick_edge )
```

Here we are setting up the edge and frame definitions for borders and frames.

```
table = Table(
TabPS.DEFAULT_WIDTH * 3,
TabPS.DEFAULT_WIDTH * 3,
TabPS.DEFAULT_WIDTH * 3 )

c1 = Cell( Paragraph( 'R1C1'
), thin_frame )

c2 = Cell( Paragraph( 'R1C2'
) )

c3 = Cell( Paragraph( 'R1C3'
), thick_frame )

table.AddRow( c1, c2, c3 )
```

In row one, the cells in column one (thin frame) and column 3 (thick frame) will have a border around them.

```
c1 = Cell( Paragraph( 'R2C1'
) )

c2 = Cell( Paragraph( 'R2C2'
) )

c3 = Cell( Paragraph( 'R2C3'
) )

table.AddRow( c1, c2, c3 )
```

None of the cells will have a border in the second row.

```
c1 = Cell( Paragraph( 'R3C1'
), mixed_frame )

c2 = Cell( Paragraph( 'R3C2'
) )

c3 = Cell( Paragraph( 'R3C3'
), mixed_frame )

table.AddRow( c1, c2, c3 )
```

Once again, cells in column 1 and three have a mixed frame in row three.

```
section.append( table )
```

So. You have just about everything you need to create, through code, RTF documents.

See you next time!

Source code can be found at pastebin as usual. The first part can be found at http://pastebin.com/3Rs7T3D7 which is the sum of rtftest.py (a-e), and the second rtftable.py (a-b) is at http://pastebin.com/XbaE2uP7.

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Program In Python - Part 25

A number of you have commented about the GUI programming articles and how much you've enjoyed them. In response to that, we will start taking a look at a different GUI toolkit called Tkinter. This is the "official" way to do GUI programming in Python. Tkinter has been around for a long time, and has gotten a pretty bad rap for looking "old fashioned". This has changed recently, so I thought we'd fight that bad thought process.

PLEASE NOTE – All of the code presented here is for Python 2.x only. In an upcoming article, we'll discuss how to use tkinter in Python 3.x. If you MUST use Python 3.x, change the import statements to "from tkinter import *".

A Little History And A Bit Of Background

Tkinter stands for "**Tk** **inter**face". Tk is a programming language all on its own, and the Tkinter module allows us to use the GUI functions there. There are a number of widgets that come natively with the Tkinter module. Some of them are Toplevel (main window) container, Buttons, Labels, Frames, Text Entry, CheckButtons, RadioButtons, Canvas, Multiline Text entry, and much more. There are also many modules that add functionallity on top of Tkinter. This month, we'll focus on four widgets. Toplevel (from here I'll basically refer to it as the root window), Frame, Labels, and Buttons. In the next article, we'll look at more widgets in more depth.

Basically, we have the Toplevel container widget which contains (holds) other widgets. This is the root or master window. Within this root window, we place the widgets we want to use within our program. Each widget, other than the Toplevel root widget container, has a parent. The parent doesn't have to be the root window. It can be a different widget. We'll explore that next month. For this month, everything will have a parent of the root window.

In order to place and display the child widgets, we have to use what's called "geometry management". It's how things get put into the main root window. Most programmers use one of three types of geometry management, either Packer, Grid, or Place management. In my humble opinion, the Packer method is very clumsy. I'll let you dig into that on your own. The Place management method allows for extremely accurate placement of the widgets, but can be complicated. We'll discuss the Place method in a future article set. For this time, we'll concentrate on the Grid method.

Think of a spreadsheet.

```
        COLUMNS - >
ROWS  | 0,0 | 1,0 | 2,0 | 3,0 | 4,0 |
  |   | 0,1 | 1,1 | 2,1 | 3,1 | 4,1 |
      | 0,2 | 1,2 | 2,2 | 3,2 | 4,2 |
      | 0,3 | 1,3 | 2,3 | 3,3 | 4,3 |
```

There are rows and columns. Columns are vertical, rows are horizontal. Here's a simple text representation of the cell addresses of a simple 5-column by 4-row grid (above right).

So parent has the grid, the widgets go into the grid positions. At first glance, you might think that this is very limiting. However, widgets can span multiple grid positions in either the column direction, the row direction, or both.

Our First Example

Our first example is SUPER simple (only four lines), but shows a good bit.

```
from Tkinter import *

root = Tk()

button = Button(root, text =
```

```
"Hello FullCircle").grid()

root.mainloop()
```

Now, what's going on here? Line one imports the Tkinter library. Next, we instantiate the Tk object using root. (Tk is part of Tkinter). Here's line three.

```
button = Button(root, text =
"Hello FullCircle").grid()
```

We create a button called button, set its parent to the root window, set its text to "Hello FullCircle," and set it into the grid. Finally, we call the window's main loop. Very simple from our perspective, but there's a lot that goes on behind the scenes. Thankfully, we don't need to understand what that is at this time.

Run the program and let's see what happens. On my machine the main window shows up at the lower left of the screen. It might show up somewhere else on yours. Clicking the button doesn't do anything. Let's fix that in our next example.

Our Second Example

```
class App:
    def __init__(self, master):
        frame = Frame(master)
        self.lblText = Label(frame, text = "This is a label widget")
        self.btnQuit = Button(frame, text="Quit", fg="red", command=frame.quit)
        self.btnHello = Button(frame, text="Hello", command=self.SaySomething)
        frame.grid(column = 0, row = 0)
        self.lblText.grid(column = 0, row = 0, columnspan = 2)
        self.btnHello.grid(column = 0, row = 1)
        self.btnQuit.grid(column = 1, row = 1)
```

This time, we'll create a class called App. This will be the class that actually holds our window. Let's get started.

```
from Tkinter import *
```

This is the import statement for the Tkinter library.

We define our class, and, in the __init__ routine, we set up our widgets and place them into the grid.

The first line in the __init__ routine creates a frame that will be the parent of all of our other widgets. The parent of the frame is the root window (Toplevel widget). Next we define a label, and two buttons. Let's look at the label creation line.

```
self.lblText = Label(frame,
text = "This is a label
widget")
```

We create the label widget and call it self.lblText. That's inherited from the Label widget object. We set its parent (frame), and set the text that we want it to display (text = "this is a label widget"). It's that simple. Of course we can do much more than that, but for now that's all we need. Next we set up the two Buttons we will use:

```
self.btnQuit = Button(frame,
text="Quit", fg="red",
command=frame.quit)

self.btnHello = Button(frame,
text="Hello",
command=self.SaySomething)
```

We name the widgets, set their parent (frame), and set the text we want them to show. Now btnQuit has an attribute marked fg which we set to "red". You might have guessed this sets the foreground color or text color to the color red. The last attribute is to set the callback command we want to use when the user clicks the button. In the case of btnQuit, it's frame.quit, which ends the program. This is a built in function, so we don't need to actually create it. In the case of btnHello, it's a routine called self.SaySomething. This we have to create, but we have a bit more to go through first.

We need to put our widgets into the grid. Here's the lines again:

```
frame.grid(column = 0, row =
0)

self.lblText.grid(column = 0,
row = 0, columnspan = 2)
```

```
self.btnHello.grid(column =
0, row = 1)

self.btnQuit.grid(column = 1,
row = 1)
```

First, we assign a grid to the frame. Next, we set the grid attribute of each widget to where we want the widget to go. Notice the columnspan line for the label (self.lblText). This says that we want the label to span across two grid columns. Since we have only two columns, that's the entire width of the application. Now we can create our callback function:

```
def SaySomething(self):

   print "Hello to FullCircle
Magazine Readers!!"
```

This simply prints in the terminal window the message “Hello to FullCircle Magazine Readers!!”

Finally, we instantiate the Tk class - our App class - and run the main loop.

```
root = Tk()

app = App(root)

root.mainloop()
```

Give it a try. Now things actually do something. But again, the window position is very inconvenient. Let's fix that in our next example.

Our Third Example

Save the last example as example3.py. Everything is exactly the same except for one line. It's at the bottom in our main routine calls. I'll show you those lines with our new one:

```
root = Tk()

root.geometry
('150x75+550+150')

app = App(root)

root.mainloop()
```

What this does is force our initial window to be 150 pixels wide and 75 pixels high. We also want the upper left corner of the window to be placed at X-pixel position 550 (right and left) and the Y-pixel position at 150 (top to botton). How did I come up with these numbers? I started with some reasonable values and tweaked them from there. It's a bit of a pain in the neck to do it this way, but the results are better than not doing it at all.

Our Fourth Example - A Simple Calculator

Now, let's look at something a bit more complicated. This time, we'll create a simple “4 banger” calculator. If you don't know, the phrase “4 banger” means four functions: Add, Subtract, Multiply, and Divide. Right is what it looks like in simple text form.

```
-----------------
|              0 |
-----------------
| 1 | 2 | 3 | + |
-----------------
| 4 | 5 | 6 | - |
-----------------
| 7 | 8 | 9 | * |
-----------------
| - | 0 | . | / |
-----------------
|       =        |
-----------------
|     CLEAR      |
-----------------
```

We'll dive right into it and I'll explain the code (middle right) as we go.

```
from Tkinter import *

def StartUp():
    global val, w, root
    root = Tk()
    root.title('Easy Calc')
    root.geometry('247x330+469+199')
    w = Calculator(root)
    root.mainloop()
```

Outside of the geometry statement, this (left) should be pretty easy for you to understand by now. Remember, pick some reasonable values, tweak them, and then move on.

```
class Calculator():
    def __init__(self,root):
        master = Frame(root)
        self.CurrentValue = 0
        self.HolderValue = 0
        self.CurrentFunction = ''
        self.CurrentDisplay = StringVar()
        self.CurrentDisplay.set('0')
        self.DecimalNext = False
        self.DecimalCount = 0
        self.DefineWidgets(master)
        self.PlaceWidgets(master)
```

We begin our class definition and set up our __init__ function. We set up three variables as follows:

- CurrentValue – Holds the current value that has been input into the calculator.
- HolderValue – Holds the value that existed before the user clicks a function key.
- CurrentFunction – This is simply a “bookmark” to note what function is being dealt with.

Next, we define the CurrentDisplay variable and assign it to the StringVar object. This is a special object that is part of the Tkinter toolkit. Whatever widget you assign this to automatically updates the value within the widget. In this case, we will be using this to hold whatever we want the display label widget to... er... well... display. We have to instantiate it before we can assign it to the widget. Then we use the built in 'set' function. We then define a boolean variable called DecimalNext, and a variable DecimalCount, and then call the DefineWidgets function, which creates all the widgets, and then call the PlaceWidget function, which actually places them in the root window.

```
def DefineWidgets(self,master):

self.lblDisplay = Label(master,anchor=E,relief = SUNKEN,bg="white",height=2,textvariable=self.CurrentDisplay)
```

Now, we have already defined a label earlier. However, this time we are adding a number of other attributes. Notice that we aren't using the 'text' attribute. Here, we assign the label to the parent (master), then set the anchor (or, for our purposes, justification) for the text, when it gets written. In this case, we are telling the label to justify all text to the east or on the right side of the widget. There is a justify attribute, but that's for multiple lines of text. The anchor attribute has the following options... N, NE, E, SE, S, SW, W, NW and CENTER. The default is CENTER. You should think compass points for these. Under normal circumstances, the only really usable values are E (right), W (left), and Center.

```
self.btn1 = Button(master, text = '1',width = 4,height=3)
self.btn1.bind('<ButtonRelease-1>', lambda e: self.funcNumButton(1))
self.btn2 = Button(master, text = '2',width = 4,height=3)
self.btn2.bind('<ButtonRelease-1>', lambda e: self.funcNumButton(2))
self.btn3 = Button(master, text = '3',width = 4,height=3)
self.btn3.bind('<ButtonRelease-1>', lambda e: self.funcNumButton(3))
self.btn4 = Button(master, text = '4',width = 4,height=3)
self.btn4.bind('<ButtonRelease-1>', lambda e: self.funcNumButton(4))
```

Next, we set the relief or visual style of the label. The “legal” options here are FLAT, SUNKEN, RAISED, GROOVE, and RIDGE. The default is FLAT if you don't specify anything. Feel free to try the other combinations on your own after we're done. Next, we set the background (bg) to white in order to set it off from the rest of the window a bit. We set the height to 2 (which is two text lines high, not in pixels), and finally assign the variable we just defined a moment ago (self.CurrentDisplay) to the textvariable attribute. Whenever the value of self.CurrentDisplay changes, the label will change its text to match automatically.

Shown above, we'll create some of the buttons.

I've shown only 4 buttons here. That's because, as you can see, the code is almost exactly the same. Again, we've created buttons earlier in this tutor, but let's take a closer look at what we are doing here.

We start by defining the parent (master), the text that we want on the button, and the width and height. Notice that the width is in characters and the height is in text lines. If you were doing a graphic in the button, you would use pixels to define the height and width. This can become a bit confusing until you get your head firmly wrapped around it.

Next, we are setting the bind attribute. When we did the buttons in the previous examples, we used the 'command=' attribute to define what function should be called when the user clicks the button. This time, we are using the '.bind' attribute. It's almost the same thing, but this is an easier way to do it, and to pass information to the callback routine that is static. Notice that here we are using '<ButtonRelease-1>' as the trigger for the bind. In this case, we want to make sure that it's only after the user clicks AND releases the left mouse button that we make our callback. Lastly, we define the callback we want to call, and what we are going to pass to it. Now, those of you who are astute (which is each and every one of you) will notice something new. The 'lambda e:' call.

In Python, we use Lambda to define anonymous functions that will appear to interpreter as a valid statement. This allows us to put multiple segments into a single line of code. Think of it as a mini

```
        self.btnDash = Button(master, text = '-',width = 4,height=3)
        self.btnDash.bind('<ButtonRelease-1>', lambda e: self.funcFuncButton('ABS'))
        self.btnDot = Button(master, text = '.',width = 4,height=3)
        self.btnDot.bind('<ButtonRelease-1>', lambda e: self.funcFuncButton('Dec'))
```

The btnDash sets the value to the absolute value of the value entered. 523 remains 523 and -523 becomes 523. The btnDot button enters a decimal point. These examples, and the ones below, use the callback funcFuncButton.

```
        self.btnPlus = Button(master,text = '+', width = 4, height=3)
        self.btnPlus.bind('<ButtonRelease-1>', lambda e: self.funcFuncButton('Add'))
        self.btnMinus = Button(master,text = '-', width = 4, height=3)
        self.btnMinus.bind('<ButtonRelease-1>', lambda e:
self.funcFuncButton('Subtract'))
        self.btnStar = Button(master,text = '*', width = 4, height=3)
        self.btnStar.bind('<ButtonRelease-1>', lambda e: self.funcFuncButton('Multiply'))
        self.btnDiv = Button(master,text = '/', width = 4, height=3)
        self.btnDiv.bind('<ButtonRelease-1>', lambda e: self.funcFuncButton('Divide'))
        self.btnEqual = Button(master, text = '=')
        self.btnEqual.bind('<ButtonRelease-1>', lambda e: self.funcFuncButton('Eq'))
```

Here are the four buttons that do our math functions.

```
        self.btnClear = Button(master, text = 'CLEAR')
        self.btnClear.bind('<ButtonRelease-1>', lambda e: self.funcClear())
```

Finally, here is the clear button. It, of course, clears the holder variables and the display. Now we place the widgets in the PlaceWidget routine. First, we initialize the grid, then start putting the widgets into the grid. Here's the first part of the routine.

```
    def PlaceWidgets(self,master):
        master.grid(column=0,row=0)
        self.lblDisplay.grid(column=0,row=0,columnspan = 4,sticky=EW)
        self.btn1.grid(column = 0, row = 1)
        self.btn2.grid(column = 1, row = 1)
        self.btn3.grid(column = 2, row = 1)
        self.btn4.grid(column = 0, row = 2)
        self.btn5.grid(column = 1, row = 2)
        self.btn6.grid(column = 2, row = 2)
        self.btn7.grid(column = 0, row = 3)
        self.btn8.grid(column = 1, row = 3)
        self.btn9.grid(column = 2, row = 3)
        self.btn0.grid(column = 1, row = 4)
```

function. In this case, we are setting up the name of the callback function and the value we want to send as well as the event tag (e:). We'll talk more about Lambda in a later article. For now, just follow the example.

I've given you the first four buttons. Copy and paste the above code for buttons 5 through 9 and button 0. They are all the same with the exception of the button name and the value we send the callback. Next steps are shown right.

The only thing that hasn't been covered before are the columnspan and sticky attributes. As I mentioned before, a widget can span more than one column or row. In this case, we are “stretching” the label widget across all four columns. That's what the “columnspan” attribute does. There's a “rowspan” attribute as well. The “sticky” attribute tells the widget where to align its edges. Think of it as how the widget fills itself within the grid. Above left is the rest of our buttons.

```
        self.btnDash.grid(column = 0, row = 4)
        self.btnDot.grid(column = 2, row = 4)
        self.btnPlus.grid(column = 3,row = 1)
        self.btnMinus.grid(column = 3, row = 2)
        self.btnStar.grid(column = 3, row = 3)
        self.btnDiv.grid(column=3, row = 4)
        self.btnEqual.grid(column=0,row=5,columnspan = 4,sticky=NSEW)
        self.btnClear.grid(column=0,row=6,columnspan = 4, sticky = NSEW)
```

```
    def funcNumButton(self,val):
        if self.DecimalNext == True:
            self.DecimalCount += 1
            self.CurrentValue = self.CurrentValue + (val * (10**-self.DecimalCount))
        else:
            self.CurrentValue = (self.CurrentValue * 10) + val
        self.DisplayIt()
```

Before we go any further let's take a look at how things will work when the user presses buttons.

Let's say the user wants to enter 563 + 127 and get the answer. They will press or click (logically) 5, then 6, then 3, then the “+,” then 1, then 2, then 7, then the “=” buttons. How do we handle this in code? We have already set the callbacks for the number buttons to the funcNumButton function. There's two ways to handle this. We can keep the information entered as a string and then when we need to convert it into a number, or we can keep it as a number the entire time. We will use the latter method. To do this, we will keep the value that is already there (0 when we start) in a variable called “self.CurrentValue”, When a number comes in, we take the variable, multiply it by 10 and add the new value. So, when the user enters 5, 6 and 3, we do the following...

```
User clicks 5 – 0 * 10 + 5
(5)

User clicks 6 – 5 * 10 + 6
(56)

User clicks 3 – 56 * 10 + 3
(563)
```

Of course we then display the “self.CurrentValue” variable in the label.

Next, the user clicks the “+” key. We take the value in “self.CurrentValue” and place it into the variable “self.HolderValue,” and reset the “self.CurrentValue” to 0. We then repeat the process for the clicks on 1, 2 and 7. When the user clicks the “=” key, we then add the values in “self.CurrentValue” and “self.HolderValue”, display them, then clear both variables to continue.

Above is the code to start defining our callbacks.

The “funcNumButton routine receives the value we passed from the button press. The only thing that is different from the example above is what if the user pressed the decimal button (“.”). Below, you'll see that we use a boolean variable to hold the fact they pressed the decimal button, and, on the next click, we deal with it. That's what the “if self.DecimalNext == True:” line is all about. Let's walk through it.

The user clicks 3, then 2, then the decimal, then 4, to create “32.4”. We handle the 3 and 2 clicks through the “funcNumButton” routine. We check to see if self.DecimalNext is True (which in this case it isn't until the user clicks the “.” button). If not, we simply multiply the held value (self.CurrentValue) by 10 and add the incoming value. When the user clicks the “.”, the callback “funcFuncButton” is called with the “Dec” value. All we do is set the boolean variable “self.DecimalNext” to

```
    def funcFuncButton(self,function):
      if function =='Dec':
          self.DecimalNext = True
      else:
              self.DecimalNext = False
              self.DecimalCount = 0
              if function == 'ABS':
                  self.CurrentValue *= -1
                  self.DisplayIt()
```

The ABS function simply takes the current value and multiplies it by -1.

```
              elif function == 'Add':
                  self.HolderValue = self.CurrentValue
                  self.CurrentValue = 0
                  self.CurrentFunction = 'Add'
```

The Add function copies “self.CurrentValue” into “self.HolderValue”, clears “self.CurrentValue”, and sets the “self.CurrentFunction” to “Add”. The Subtract, Multiply and Divide functions do the same thing with the proper keyword being set in “self.CurrentFunction”.

```
              elif function == 'Subtract':
                  self.HolderValue = self.CurrentValue
                  self.CurrentValue = 0
                  self.CurrentFunction = 'Subtract'
              elif function == 'Multiply':
                  self.HolderValue = self.CurrentValue
                  self.CurrentValue = 0
                  self.CurrentFunction = 'Multiply'
              elif function == 'Divide':
                  self.HolderValue = self.CurrentValue
                  self.CurrentValue = 0
                  self.CurrentFunction = 'Divide'
```

The “Eq” function (Equals) is where the “magic” happens. It will be easy for you to understand the following code by now.

```
              elif function == 'Eq':
                  if self.CurrentFunction == 'Add':
                      self.CurrentValue += self.HolderValue
                   elif self.CurrentFunction == 'Subtract':
                      self.CurrentValue = self.HolderValue - self.CurrentValue
                   elif self.CurrentFunction == 'Multiply':
                      self.CurrentValue *= self.HolderValue
                   elif self.CurrentFunction == 'Divide':
                      self.CurrentValue = self.HolderValue / self.CurrentValue
                   self.DisplayIt()
                   self.CurrentValue = 0
                   self.HolderValue = 0
```

True. When the user clicks the 4, we will test the "self.DecimalNext" value and, since it's true, we play some magic. First, we increment the self.DecimalCount variable. This tells us how many decimal places we are working with. We then take the incoming value, multiply it by (10**-self.DecimalCount). Using this magic operator, we get a simple "raised to the power of" function. For example 10**2 returns 100. 10**-2 returns 0.01. Eventually, using this routine will result in a rounding issue, but for our simple calculator, it will work for most reasonable decimal numbers. I'll leave it to you to work out a better function. Think of this as your homework for this month.

The "funcClear" routine simply clears the two holding variables, then sets the display.

```
def funcClear(self):

self.CurrentValue = 0

self.HolderValue = 0

self.DisplayIt()
```

Now the functions. We've already discussed what happens with the function 'Dec'. We set this one up first with the "if" statement. We go to the "else," and if the function is anything else, we clear the "self.DecimalNext" and "self.DecimalCount" variables.

The next set of steps are shown on the previous page (right hand box).

The DisplayIt routine simply sets the value in the display label. Remember we told the label to "monitor" the variable "self.CurrentDisplay". Whenever it changes, the label automatically changes the display to match. We use the ".set" method to change the value.

```
def DisplayIt(self):

print('CurrentValue = {0} -
HolderValue =
{1}'.format(self.CurrentValue
,self.HolderValue))

self.CurrentDisplay.set(self.
CurrentValue)
```

Finally we have our startup lines.

```
if __name__ == '__main__':

StartUp()
```

Now you can run the program and give it a test.

As always, the code for this article can be found at PasteBin. Examples 1, 2 and 3 are at: http://pastebin.com/mBAS1Umm and the Calc.py example is at: http://pastebin.com/LbMibF0u

Next month, we will continue looking at Tkinter and its wealth of widgets. In a future article, we'll look at a GUI designer for tkinter called PAGE. In the meantime, have fun playing. I think you'll enjoy Tkinter.

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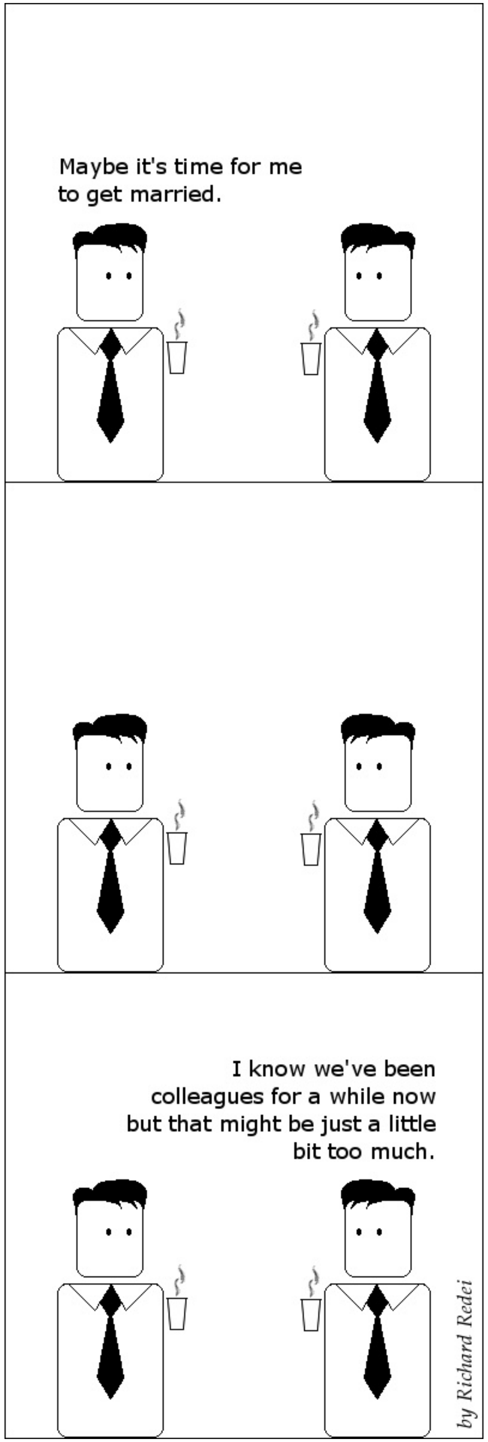


Program In Python - Part 26

Last month we discussed tkInter and four of the widgets available: TopLevel, Frames, Buttons, and Labels. I also told you last month, I'd discuss how to have a widget as a parent other than the Toplevel widget.

So, this month, we'll discuss more on Frames, Buttons, and Labels, and introduce Checkboxes, Radio buttons, Textboxes (Entry widgets), Listboxes with a vertical scrollbar, and Messageboxes. Before we get started, let's examine some of these widgets.

Checkboxes are considered a many of many type selection widget that has two options, checked or not checked, or you could consider it on or off. They are usually used to provide a series of options where any, many, or all of those options may be selected. You can set an event to inform you when the checkbox has been toggled, or just query the value of the widget at any time.

Radiobuttons are considered a one of many type selection widget. It also has two options, on and off. However, they are grouped together to provide a set of options that logically can have only one selection. You can have multiple groups of Radiobuttons that, if properly programmed, won't interact with each other.

A Listbox provides a list of items for the user to select from. Most times, you want the user to select only one of the items at a time, but there can be occasions that you will allow the user to select multiple items. A scroll bar can be placed either horizontally or vertically to allow the user to easily look through all the items available.

Our project will consist of a main window and seven main frames that visually group our widget sets:

- The first frame will be very basic. It simply consists of various labels, showing the different relief options.
- The second will contain buttons, again pretty simple, that use the different relief options.
- In this frame, we'll have two checkboxes and a button that can programmatically toggle them, and they will send their state (1 or 0) back to the terminal window when clicked or toggled.
- Next, we'll have two groups of three radio buttons, each sending a message to the terminal window when clicked. Each group is separate.
- This has some text or entry boxes, which aren't new to you, but there's also a button to enable and disable one of them. When disabled, no entry can be made to that textbox.
- This is a list box with a vertical scroll bar that sends a message to the terminal whenever an item is selected, and will have two buttons. One button will clear the list box and the other will fill it with some dummy values.
- The final frame will have a series of buttons that will call various types of message boxes.

So now, we'll start our project. Let's name it “widgetdemo1.py”. Be sure to save it because we will be writing our project in little pieces, and build on them to make our full app. Each piece revolves around one of the frames. You'll notice that I'm including a number of comments as we go, so you can refer back to what's happening. Above are first few lines.

```
# widgetdemo1.py
# Labels
from Tkinter import *

class Demo:
    def __init__(self,master):
        self.DefineVars()
        f = self.BuildWidgets(master)
        self.PlaceWidgets(f)
```

The first two lines (comments) are the name of the application and what we are concentrating on in this part. Line three is our import statement. Then we define our class. The next line starts our __init__ routine, which you all should be familiar with by now, but, if you are just joining us, it's the code that gets run when we instantiate the routine in the main portion of the program. We are passing it the Toplevel or root window, which comes in as master here. The last three lines (so far), call three different routines. The first (DefineVars) will set up various variables we'll need as we go. The next (BuildWidgets) will be where we define our widgets, and the last (PlaceWidgets) is where we actually place the widgets into the root window. As we did last time, we'll be using the grid geometry manager. Notice that BuildWidgets will return the object “f” (which is our root window), and we'll pass that along to the PlaceWidgets routine.

Above right is our BuildWidgets routine. Each of the lines that start with “self.” have been split for two reasons. First, it's good practice to keep the line length to 80 characters or less. Secondly, it makes it easier on our wonderful editor. You can do two things. One, just make each line long, or keep it as is. Python lets us split lines as long as they are within parentheses or brackets. As I said earlier, we are defining the widgets before we place them in the grid. You'll notice when we do the next routine, that we can also define a widget at the time we place it in the grid, but defining it before we put it in the grid in a routine like this makes it easier to keep track of everything, since we are doing (most of) the definitions in this routine.

```
    def BuildWidgets(self,master):
        # Define our widgets
        frame = Frame(master)
        # Labels
        self.lblframe = Frame(frame,relief = SUNKEN,padx = 3, pady = 3,
                      borderwidth = 2, width = 500)
        self.lbl1 = Label(self.lblframe,text="Flat Label",relief = FLAT,
                      width = 13,borderwidth = 2)
        self.lbl2 = Label(self.lblframe,text="Sunken Label", relief = SUNKEN,
                      width = 13, borderwidth = 2)
        self.lbl3 = Label(self.lblframe,text="Ridge Label", relief = RIDGE, width = 13,
                      borderwidth = 2)
        self.lbl4 = Label(self.lblframe,text="Raised Label", relief = RAISED,
                      width = 13, borderwidth = 2)
        self.lbl5 = Label(self.lblframe,text="Groove Label", relief = GROOVE,
                      width = 13, borderwidth = 2)
        return frame
```

So, first we define our master frame. This is where we will be putting the rest of our widgets. Next, we define a child (of the master frame) frame that will hold five labels, and call it lblframe. We set the various attributes of the frame here. We set the relief to 'SUNKEN', a padding of 3 pixels on left and right (padx), and 3 pixels on the top and bottom (pady). We also set the borderwidth to 2 pixels so that its sunken relief is noticeable. By default, the borderwidth is set to 0, and the effect of being sunken won't be noticed. Finally, we set the total width of the frame to 500 pixels.

Next, we define each label widget that we will use. We set the parent as self.lblframe, and not to frame. This way all the labels are children of lblframe, and lblframe is a child of frame. Notice that each definition is pretty much the same for all five of the labels except the name of the widget (lbl1, lbl2, etc), the text, and the relief or visual effect. Finally, we return the frame back to the calling routine (__init__).

The following page (top right) shows our PlaceWidgets routine.

We get the frame object in as a parameter called master. We assign that to 'frame' to simply be consistent with what we did in the BuildWidgets routine. Next, we set our main grid up (frame.grid(column = 0, row = 0)). If we don't do this, nothing works correctly. Then we start putting our widgets into the grid locations. First we put the frame (lblframe) that holds all our labels, and set its attributes. We put it in column 0, row 1, set the padding to 5 pixels on all sides, tell it to span 5 columns (left and right), and finally use the “sticky” attribute to force the frame to expand fully to the left and right (“WE”, or West and East). Now comes the part that sort of breaks the rule that I told you about. We are placing a label as the first widget in the frame, but we didn't define it ahead of time. We define it now. We set the parent to lblframe, just like the other labels. We set the text to “Labels |”, the width to 15, and the anchor to east ('e'). If you remember from last time, using the anchor attribute, we can set where in the widget the text will display. In this case, it's along the right border. Now the fun part. Here we define the grid location (and any other grid attributes we need to), simply by appending “.grid” at the end of the label definition.

```
def PlaceWidgets(self, master):
    frame = master
    # Place the widgets
    frame.grid(column = 0, row = 0)
    # Place the labels
    self.lblframe.grid(column = 0, row = 1, padx = 5, pady = 5,
                       columnspan = 5,sticky='WE')
    l = Label(self.lblframe,text='Labels |',width=15,
              anchor='e').grid(column=0,row=0)
    self.lbl1.grid(column = 1, row = 0, padx = 3, pady = 5)
    self.lbl2.grid(column = 2, row = 0, padx = 3, pady = 5)
    self.lbl3.grid(column = 3, row = 0, padx = 3, pady = 5)
    self.lbl4.grid(column = 4, row = 0, padx = 3, pady = 5)
    self.lbl5.grid(column = 5, row = 0, padx = 3, pady = 5)
```

Next, we lay out all of our other labels in the grid - starting at column 1, row 0.

Here is our DefineVars routine. Notice that we simply use the pass statement for now. We'll be filling it in later on, and we don't need it for this part:

```
def DefineVars(self):
  # Define our resources
  pass
```

And lastly we put in our main routine code:

```
root = Tk()
root.geometry('750x40+150+150
')
root.title("Widget Demo 1")
demo = Demo(root)
root.mainloop()
```

First, we instantiate an instance of Tk. Thern we set the size of the main window to 750 pixels wide by 40 pixels high, and locate it at 150 pixels from the left and top of the screen. Then we set the title of the window and instantiate our Demo object, and finally call the Tk mainloop.

Give it a try. You should see the five labels plus the “last minute” label in various glorious effects.

Buttons

Now save what you have as widgetdemo1a.py, and let's add some buttons. Since we built our base program to be added to, we'll simply add the parts that apply. Let's start with

```
# Place the buttons
self.btnframe.grid(column=0, row = 2, padx = 5,
                   pady = 5, columnspan = 5,sticky = 'WE')
l = Label(self.btnframe,text='Buttons |',width=15,
          anchor='e').grid(column=0,row=0)
self.btn1.grid(column = 1, row = 0, padx = 3, pady = 3)
self.btn2.grid(column = 2, row = 0, padx = 3, pady = 3)
self.btn3.grid(column = 3, row = 0, padx = 3, pady = 3)
self.btn4.grid(column = 4, row = 0, padx = 3, pady = 3)
self.btn5.grid(column = 5, row = 0, padx = 3, pady = 3)
```

the BuildWidgets routine. After the labels definitions, and before the "return frame" line, add what is shown on the next page, top right.

Nothing really new here. We've defined the buttons, with their attributes, and set their callbacks via the .bind configuration. Notice that we are using lambda to send the values 1 through 5 based on which button is clicked. In the callback, we'll use that so we know which button we are dealing with. Now we'll work in the PlaceWidgets routine. Put the code below after the last label placement.

Once again, nothing really new here, so we'll move on. Bottom right is our callback routine. Put it after the DefineVars routine.

Again, nothing really fancy here. We just use a series of IF/ELIF routines to print what button was clicked. The main thing to look at here (when we run the program) is that the sunken button doesn't "move" when you click on it. You would not usually use the sunken relief unless you were making a button that stays "down" when you click it. Finally, we need to tweak the geometry statement to support the extra widgets we put in:

```
root.geometry('750x110+150+150')
```

Ok. All done with this one. Save it and run it.

Now save this as widgetdemo1b.py, and we'll move on to checkboxes.

```
# Buttons
self.btnframe = Frame(frame,relief = SUNKEN,padx = 3, pady = 3,
                      borderwidth = 2, width = 500)
self.btn1 = Button(self.btnframe,text="Flat Button",
                   relief = FLAT, borderwidth = 2)
self.btn2 = Button(self.btnframe,text="Sunken Button",
                   relief = SUNKEN, borderwidth = 2)
self.btn3 = Button(self.btnframe,text="Ridge Button",
                   relief = RIDGE, borderwidth = 2)
self.btn4 = Button(self.btnframe,text="Raised Button",
                   relief = RAISED, borderwidth = 2)
self.btn5 = Button(self.btnframe,text="Groove Button",
                   relief = GROOVE, borderwidth = 2)
self.btn1.bind('<ButtonRelease-1>',lambda e: self.BtnCallback(1))
self.btn2.bind('<ButtonRelease-1>',lambda e: self.BtnCallback(2))
self.btn3.bind('<ButtonRelease-1>',lambda e: self.BtnCallback(3))
self.btn4.bind('<ButtonRelease-1>',lambda e: self.BtnCallback(4))
self.btn5.bind('<ButtonRelease-1>',lambda e: self.BtnCallback(5))
```

Checkboxes

As I said earlier, this part of the demo has a normal button and two checkboxes. The first checkbox is what you would normally expect a checkbox to look like. The second is more like a "sticky" button - when it's not selected (or checked), it looks like a normal button. When you select it, it looks like a button that is stuck down. We can do this by simply setting the indicatoron attribute to False. The "normal" button will toggle the checkboxes from checked to unchecked, and vice versa, each time you click the button. We get to do this programmatically by calling the .toggle method attached to the checkbox. We bind the left mouse button click event (button release) to a function so we can send a message (in this case) to the terminal. In addition to all of this, we are setting two variables (one for each of the checkboxes) that we can query at any time. In

```
    def BtnCallback(self,val):
        if val == 1:
            print("Flat Button Clicked...")
        elif val == 2:
            print("Sunken Button Clicked...")
        elif val == 3:
            print("Ridge Button Clicked...")
        elif val == 4:
            print("Raised Button Clicked...")
        elif val == 5:
            print("Groove Button Clicked...")
```

this case, each time the checkbox is clicked we query this value and print it. Pay attention to the variable portion of the code. It is used in many widgets.

Under the BuildWidget routine, after the button code we just put in and before the return statement, put the code shown on the next page, top right.

Again, you have seen all of this before. We create the frame to hold our widgets. We set up a button and two check boxes. Let's place them now using the code on the next page, middle right.

Now we define the two variables that we will use to monitor the value of each check box. Under DefineVars, comment out the pass statement, and add this...

```
self.Chk1Val = IntVar()
self.Chk2Val = IntVar()
```

After the button callback return, put the text shown bottom right.

And finally replace the geometry statement with this:

```
root.geometry('750x
170+150+150')
```

Save and run. Save it as widgetdemo1c.py, and let's do radio buttons.

Radiobuttons

If you are old enough to remember car radios with push buttons to select the station presets, you'll understand why these are called Radiobuttons. When using radiobuttons, the variable attribute is very important. This is what groups the radiobuttons

```
# Check Boxes
self.cbframe = Frame(frame, relief = SUNKEN, padx = 3, pady = 3,
                     borderwidth = 2, width = 500)
self.chk1 = Checkbutton(self.cbframe, text = "Normal Checkbox",
                        variable=self.Chk1Val)
self.chk2 = Checkbutton(self.cbframe, text = "Checkbox",
                        variable=self.Chk2Val,indicatoron = False)
self.chk1.bind('<ButtonRelease-1>',lambda e: self.ChkBoxClick(1))
self.chk2.bind('<ButtonRelease-1>',lambda e: self.ChkBoxClick(2))
self.btnToggleCB = Button(self.cbframe,text="Toggle Cbs")
self.btnToggleCB.bind('<ButtonRelease-1>',self.btnToggle)
```

```
# Place the Checkboxes and toggle button
self.cbframe.grid(column = 0, row = 3, padx = 5, pady = 5,
                  columnspan = 5,sticky = 'WE')
l = Label(self.cbframe,text='Check Boxes |',width=15,
          anchor='e').grid(column=0,row=0)
self.btnToggleCB.grid(column = 1, row = 0, padx = 3, pady = 3)
self.chk1.grid(column = 2, row = 0, padx = 3, pady = 3)
self.chk2.grid(column = 3, row = 0, padx = 3, pady = 3)
```

```
def btnToggle(self,p1):
    self.chk1.toggle()
    self.chk2.toggle()
    print("Check box 1 value is {0}".format(self.Chk1Val.get()))
    print("Check box 2 value is {0}".format(self.Chk2Val.get()))

def ChkBoxClick(self,val):
    if val == 1:
        print("Check box 1 value is {0}".format(self.Chk1Val.get()))
    elif val == 2:
        print("Check box 2 value is {0}".format(self.Chk2Val.get()))
```

together. In this demo, the first group of buttons is grouped by the variable named self.RBVal. The second is grouped by the variable self.RBValue2. We also need to set the value attribute at design time. This ensures that the buttons will return a value that makes sense whenever they are clicked.

Back to BuildWidgets, and, just before the return statement, add the code shown on the following page.

One thing of note here. Notice the “last minute” label definitions in the PlaceWidget routine. These long lines are broken up to show how to use parens to allow our long lines to be formatted nicely in our code, and still function correctly.

In DefineVars add:

```
self.RBVal = IntVar()
```

Add the click routines:

```
def RBClick(self):
```

```
        # Radio Buttons
        self.rbframe = Frame(frame, relief = SUNKEN, padx = 3, pady = 3, borderwidth = 2, width = 500)
        self.rb1 = Radiobutton(self.rbframe, text = "Radio 1", variable = self.RBVal, value = 1)
        self.rb2 = Radiobutton(self.rbframe, text = "Radio 2", variable = self.RBVal, value = 2)
        self.rb3 = Radiobutton(self.rbframe, text = "Radio 3", variable = self.RBVal, value = 3)
        self.rb1.bind('<ButtonRelease-1>',lambda e: self.RBClick())
        self.rb2.bind('<ButtonRelease-1>',lambda e: self.RBClick())
        self.rb3.bind('<ButtonRelease-1>',lambda e: self.RBClick())
        self.rb4 = Radiobutton(self.rbframe, text = "Radio 4", variable = self.RBVal2, value = "1-1")
        self.rb5 = Radiobutton(self.rbframe, text = "Radio 5", variable = self.RBVal2, value = "1-2")
        self.rb6 = Radiobutton(self.rbframe, text = "Radio 6", variable = self.RBVal2, value = "1-3")
        self.rb4.bind('<ButtonRelease-1>',lambda e: self.RBClick2())
        self.rb5.bind('<ButtonRelease-1>',lambda e: self.RBClick2())
        self.rb6.bind('<ButtonRelease-1>',lambda e: self.RBClick2())
```

In PlaceWidgets, add this:

```
        # Place the Radio Buttons and select the first one
        self.rbframe.grid(column = 0, row = 4, padx = 5, pady = 5, columnspan = 5,sticky = 'WE')
        l = Label(self.rbframe,
            text='Radio Buttons |',
            width=15,anchor='e').grid(column=0,row=0)
        self.rb1.grid(column = 2, row = 0, padx = 3, pady = 3, sticky = 'EW')
        self.rb2.grid(column = 3, row = 0, padx = 3, pady = 3, sticky = 'WE')
        self.rb3.grid(column = 4, row = 0, padx = 3, pady = 3, sticky = 'WE')
        self.RBVal.set("1")
        l = Label(self.rbframe,text='| Another Set |',
            width = 15,
            anchor = 'e').grid(column = 5, row = 0)
        self.rb4.grid(column = 6, row = 0)
        self.rb5.grid(column = 7, row = 0)
        self.rb6.grid(column = 8, row = 0)
        self.RBVal2.set("1-1")
```

```
    print("Radio Button clicked - Value is {0}".format(self.RBVal.get()))

def RBClick2(self):

    print("Radio Button clicked - Value is {0}".format(self.RBVal2.get()))
```

and, finally, rework the geometry statement as follows.

```
root.geometry('750x220+150+150')
```

Save the project as widgetdemo1d.py, and run it. Now, we'll start working on standard textboxes (or entry widgets).

Entry

Again, we've used textboxes or entry widgets in various GUI flavors before. However this time, as I said earlier, we will show how to keep the user from making changes to the textbox by disabling it. This is helpful if you are showing some data, and allowing the user to change it only when in the "edit" mode. By now, you should be pretty sure that the first thing we need to do is add code (shown right) to the BuildWidget routine.

Listbox

Next we'll work our listbox. Starting in BuildWidgets, add the code from the following page, right side.

As usual, we create our frame. Then we create our vertical scroll bar. We do this before we create the list box, because we have to reference the scrollbar '.set' method. Notice the attribute 'height = 5'. This forces the listbox to show 5 items at a time. In the .bind statement, we use '<<ListboxSelect>>' as the event. It's called a virtual event, since it's not really an "official" event.

```
        # Textboxes
        self.tbframe = Frame(frame, relief = SUNKEN, padx = 3, pady = 3, borderwidth = 2, width = 500)
        self.txt1 = Entry(self.tbframe, width = 10)
        self.txt2 = Entry(self.tbframe, disabledbackground="#cccccc", width = 10)
        self.btnDisable = Button(self.tbframe, text = "Enable/Disable")
        self.btnDisable.bind('<ButtonRelease-1>', self.btnDisableClick)
```

Next, add this code to the PlaceWidget routine:

```
        # Place the Textboxes
        self.tbframe.grid(column = 0, row = 5, padx = 5, pady = 5, columnspan = 5,sticky = 'WE')
        l = Label(self.tbframe,text='Textboxes |',width=15, anchor='e').grid(column=0,row=0)
        self.txt1.grid(column = 2, row = 0, padx = 3, pady = 3)
        self.txt2.grid(column = 3, row = 0, padx = 3, pady = 3)
        self.btnDisable.grid(column = 1, row = 0, padx = 3, pady = 3)
```

Add this line to the bottom of the DefineVars routine:

```
        self.Disabled = False
```

Now, add the function that responds to the button click event:

```
    def btnDisableClick(self,p1):
        if self.Disabled == False:
            self.Disabled = True
            self.txt2.configure(state='disabled')
        else:
            self.Disabled = False
            self.txt2.configure(state='normal')
```

And finally, rework the geometry statement:

```
root.geometry('750x270+150+150')
```

Save it as widgetdemo1d.py, and run it.

```
        # Place the Listbox and support buttons
        self.lstframe.grid(column = 0, row = 6, padx = 5,
pady = 5, columnspan = 5,sticky = 'WE')
        l = Label(self.lstframe,text='List Box |',width=15,
anchor='e').grid(column=0,row=0,rowspan=2)
        self.lbox.grid(column = 2, row = 0,rowspan=2)
        self.VScroll.grid(column = 3, row = 0,rowspan = 2,
sticky = 'NSW')
        self.btnClearLBox.grid(column = 1, row = 0, padx =
5)
        self.btnFillLBox.grid(column = 1, row = 1, padx =
5)
```

In DefineVars add this...

```
        # List for List box items
        self.examples = ['Item One','Item Two','Item
Three','Item Four']
```

And add the following support routines:

```
    def ClearList(self):
        self.lbox.delete(0,END)

    def FillList(self):
        # Note, clear the listbox first...no check is done
        for ex in self.examples:
            self.lbox.insert(END,ex)
        # insert([0,ACTIVE,END],item)

    def LBoxSelect(self,p1):
        print("Listbox Item clicked")
        items = self.lbox.curselection()
        selitem = items[0]
        print("Index of selected item =
{0}".format(selitem))
        print("Text of selected item =
{0}".format(self.lbox.get(selitem)))
```

Finally, update the geometry line.

```
root.geometry('750x370+150+150')
```

Save this as widgetdemo1e.py, and run it. Now we will do our last modifications to our application.

```
        # List Box Stuff
        self.lstframe = Frame(frame,
            relief = SUNKEN,
            padx = 3,
            pady = 3,
            borderwidth = 2,
            width = 500
          )
          # Scrollbar for list box
          self.VScroll = Scrollbar(self.lstframe)
          self.lbox = Listbox(self.lstframe,
              height = 5,
              yscrollcommand = self.VScroll.set)
        # default height is 10

self.lbox.bind('<<ListboxSelect>>',self.LBoxSelect)
          self.VScroll.config(command =
self.lbox.yview)
          self.btnClearLBox = Button(
              self.lstframe,
              text = "Clear List",
              command = self.ClearList,
              width = 11
          )
          self.btnFillLBox = Button(
              self.lstframe,
              text = "Fill List",
              command = self.FillList,
              width = 11
          )
          # <<ListboxSelect>> is virtual event
          # Fill the list box
          self.FillList()
```

Now, we'll deal with the additional code for the PlaceWidgets routine, and that's shown on the following page, left side.

Message Dialogs

This section is simply a series of “normal” buttons that will call various types of Message Dialogs. We've done them before in a different GUI toolkit. We will explore only 5 different types, but there are more. In this section, we'll look at Info, Warning, Error, Question, and Yes/No dialogs. These are very useful when you need to pass some information to your user in a rather big way. In the BuildWidgets routine add the code shown below.

Here is the support routine. For the first three (Info, Warning, and Error), you simply call 'tkMessageBox.showinfo', or whichever you need, with two parameters. First is the title for the message dialog, and second is the actual message you want to show. The icon is handled for you by tkinter. For the dialogs that provide a response (question, yes/no), we provide a variable that receives the value of which button was clicked. In the case of the question dialog, the response is either “yes” or “no”, and, in the case of the yes/no dialog, the response is either “True” or “False”.

Finally, modify the geometry line:

```
root.geometry('750x490+550+150')
```

Save this as widgetdemo1f.py, and play away.

I've put the code for widgetdemo1f.py on pastebin at http://pastebin.com/ZqrgHcdG.

```
def ShowMessageBox(self,which):
    if which == 1:
        tkMessageBox.showinfo('Demo','This is an INFO messagebox')
    elif which == 2:
        tkMessageBox.showwarning('Demo','This is a WARNING messagebox')
    elif which == 3:
        tkMessageBox.showerror('Demo','This is an ERROR messagebox')
    elif which == 4:
        resp = tkMessageBox.askquestion('Demo','This is a QUESTION messagebox?')
        print('{0} was pressed...'.format(resp))
    elif which == 5:
        resp = tkMessageBox.askyesno('Demo','This is a YES/NO messagebox')
        print('{0} was pressed...'.format(resp))
```

```
# Buttons to show message boxes and dialogs
self.mbframe = Frame(frame,relief = SUNKEN,padx = 3, pady = 3, borderwidth = 2)
self.btnMBInfo = Button(self.mbframe,text = "Info")
self.btnMBWarning = Button(self.mbframe,text = "Warning")
self.btnMBError = Button(self.mbframe,text = "Error")
self.btnMBQuestion = Button(self.mbframe,text = "Question")
self.btnMBYesNo = Button(self.mbframe,text = "Yes/No")
self.btnMBInfo.bind('<ButtonRelease-1>', lambda e: self.ShowMessageBox(1))
self.btnMBWarning.bind('<ButtonRelease-1>', lambda e: self.ShowMessageBox(2))
self.btnMBError.bind('<ButtonRelease-1>', lambda e: self.ShowMessageBox(3))
self.btnMBQuestion.bind('<ButtonRelease-1>', lambda e: self.ShowMessageBox(4))
self.btnMBYesNo.bind('<ButtonRelease-1>', lambda e: self.ShowMessageBox(5))
```

Now, add the code for the PlaceWidgets routine:

```
# Messagebox buttons and frame
self.mbframe.grid(column = 0,row = 7, columnspan = 5, padx = 5, sticky = 'WE')
l = Label(self.mbframe,text='Message Boxes |',width=15, anchor='e').grid(column=0,row=0)
self.btnMBInfo.grid(column = 1, row = 0, padx= 3)
self.btnMBWarning.grid(column = 2, row = 0, padx= 3)
self.btnMBError.grid(column = 3, row = 0, padx= 3)
self.btnMBQuestion.grid(column = 4, row = 0, padx= 3)
self.btnMBYesNo.grid(column = 5, row = 0, padx= 3)
```

Program In Python - Part 27

If you've ever waited in line to buy a movie ticket, you've been in a queue. If you've ever had to wait in traffic at rush hour, you've been in a queue. If you've ever waited in a government office with one of those little tickets that says you’re number 98, and the sign says "Now serving number 42," you've been in a queue.

In the world of computers, queues are common. As a user, most times, you don't have to think about them. They are invisible to the user. But if you ever have to deal with realtime events, you will eventually have to deal with them. It's just data of one type or another, waiting in line for its turn to be processed. Once it's in the queue, it's there until it gets accessed, and then it's gone. You can't get the value of the next data item unless you pull it out of the queue. You can't, for example, get the value of the 15th item in the queue. You have to access the other 14 items first. Once it's accessed, it's out of the queue. It's gone, and unless you save it to a long-term variable, there's no way to get the data back.

There are multiple types of queues. The most common ones are FIFO (First In, First Out), LIFO (Last In, First Out), Priority, and Ring. We'll talk about ring queues another time.

FIFO queues are what we see in everyday life. All of the examples I listed above are FIFO queues. The first person in the line gets handled first, moves on, then everyone moves up one spot in the line. In a FIFO buffer, there is (within reason) no limit to the number of items it can hold. They just stack up in order. As an item is handled, it is pulled out (or dequeued) of the queue, and everything moves closer to the front of the queue by one position.

LIFO Queues are less common in life, but there are still real-world examples. The one that comes to mind most quickly is a stack of dishes in your kitchen cabinet. When the dishes are washed and dryed, they get stacked in the cabinet. The last one in on the stack is the first one that comes out to be used. All the rest have to wait, maybe for days, to be used. It's a good thing that the movie ticket queue is FIFO, isn't it? Like the FIFO queue, within reason, there is no limit to the size of a LIFO queue. The first item in the queue has to wait as newer items are pulled out of the buffer (plates pulled off the stack) until it's the only one left.

Priority queues are a bit harder for many people to imagine right off the bat. Think of a company that has one printer. Everyone uses that one printer. The print jobs are handled by department priority. Payroll has a higher priority (and thankfully so) than say, you, a programmer. You have a higher priority (and thankfully so) than the receptionist. So in short, the data that has a higher priority gets handled, and gets out of the queue, before data that has a lower priority.

There are multiple types of queues. The most common ones are FIFO (First In, First Out), LIFO (Last In, First Out), Priority, and Ring.

FIFO

FIFO queues are easy to visualize in terms of data. A python list is an easy mental representation. Consider this list...

```
[1,2,3,4,5,6,7,8,9,10]
```

There are 10 items in the list. As a list, you access them by index. However, in a queue, you can't access the items by index. You have to deal with the next one in the line and the list isn't static. It's VERY dynamic. As we request the next item in the queue, it gets removed. So using the example above, you request one item from the

```
import Queue
fifo = Queue.Queue()
for i in range(5):
    fifo.put(i)

while not fifo.empty():
    print fifo.get()
```

queue. It returns the first item (1) and the queue then looks like this.

```
[2,3,4,5,6,7,8,9,10]
```

Request two more and you get 2, then 3, returned, and then the queue looks like this.

```
[4,5,6,7,8,9,10]
```

I'm sure you get the idea. Python provides a simple library, surprisingly enough, called Queue, that works well for small-to-medium sized queues, up to about 500 items. Above is a simple example to show it.

In this example, we initialize the queue (fifo = Queue.Queue()) then put the numbers 0 through 4 into our queue (fifo.put(i)). We then use the internal method .get() to pull items off the queue until the queue is empty, .empty(). What is returned is 0,1,2,3,4. You can also set the maximum

```
import Queue

fifo = Queue.Queue(12)
for i in range(13):
    if not fifo.full():
        fifo.put(i)

while not fifo.empty():
    print fifo.get()
```

number of items that the queue can handle by initializing it with the size of the queue like this.

```
fifo = Queue.Queue(300)
```

Once the maximum number of items have been loaded, the Queue blocks any additional entries going into the queue. This has a side effect of making the program look like it's "locked" up, though. The easiest way to get around this is to use the Queue.full() check (above right).

In this case, the queue is set for a maximum of 12 items. As we put items into the queue, we start with '0' and get up to '11'. When we hit number 12, though, the buffer is already full. Since we check to see if the buffer is full before we try to put the item in, the last item is simply discarded.

There are other options, but they can cause other side-effects, and we will address this in a future article. So, for the majority of the time, the bottom line is either use a queue with no limit or make sure you have more space in your queue than you will need.

LIFO

```
import Queue
lifo = Queue.LifoQueue()
for i in range(5):
    lifo.put(i)
while not lifo.empty():
    print lifo.get()
```

The Queue library also supports LIFO queues. We'll use the above list as a visual example. Setting up our queue, it looks like this:

```
[1,2,3,4,5,6,7,8,9,10]
```

Pulling three items from the queue, it then looks like this:

```
[1,2,3,4,5,6,7]
```

Remember that in a LIFO queue, items are removed in a LAST-in FIRST-out order. Here's the simple example modified for a LIFO queue:

When we run it, we get "4,3,2,1,0".

As with the FIFO queue, you have the ability to set the size of the queue, and you can use the .full() check.

```
pq = Queue.PriorityQueue()
pq.put((3,'Medium 1'))
pq.put((4,'Medium 2'))
pq.put((10,'Low'))
pq.put((1,'high'))

while not pq.empty():
    nex = pq.get()
    print nex
    print nex[1]
```

PRIORITY

While it's not often used, a Priority queue can sometimes be helpful. It's pretty much the same as the other queue structures, but we need to pass a tuple that holds both the priority and the data. Here's an example using the Queue

```
(1, 'high')
high
(3, 'Medium')
Medium
(4, 'Medium')
Medium
(10, 'Low')
Low
```

library:

First, we initialize the queue. Then we put four items into the queue. Notice we use the format (priority, data) to put our data. The library sorts our data in a ascending order based on the priority value. When we pull the data, it comes back as a tuple, just like we put it in. You can address by index the data. What we get back is...

In our first two examples, we simply printed the data that comes out of our queue. That's fine for these examples, but in real-world programming, you probably need to do something with that information as soon as it comes out of the queue, otherwise it's lost. When we use the 'print fifo.get', we send the data to the terminal and then it's destroyed. Just something to keep in mind.

Now let's use some of what we've already learned about tkinter to create a queue demo program. This demo will have two frames. The first will contain (to the user) three buttons. One for a FIFO queue, one for a LIFO queue, and one for a PRIORITY queue. The second frame will contain an entry widget, two buttons, one for adding to the queue, and one for pulling from the queue, and three labels, one showing when the queue is empty, one showing when the queue is full, and one to display what has been pulled from the queue. We'll also be writing some code to automatically center the window within the screen. Above left is the beginning of the code.

Here we have our imports and the beginning of our class. As before, we create the __init__ routine with the DefineVars, BuildWidgets, and PlaceWidgets routines. We also have a routine called ShowStatus (above right) which

```
import sys
from Tkinter import *
import ttk
import tkMessageBox
import Queue

class QueueTest:
    def __init__(self,master = None):
        self.DefineVars()
        f = self.BuildWidgets(master)
        self.PlaceWidgets(f)
        self.ShowStatus()
```

```
    def DefineVars(self):
        self.QueueType = ''
        self.FullStatus = StringVar()
        self.EmptyStatus = StringVar()
        self.Item = StringVar()
        self.Output = StringVar()
        # Define the queues
        self.fifo = Queue.Queue(10)
        self.lifo = Queue.LifoQueue(10)
        self.pq = Queue.PriorityQueue(10)
        self.obj = self.fifo
```

```
    def BuildWidgets(self,master):
        # Define our widgets
        frame = Frame(master)
        self.f1 = Frame(frame,
            relief = SUNKEN,
            borderwidth=2,
            width = 300,
            padx = 3,
            pady = 3
        )
        self.btnFifo = Button(self.f1,
            text = "FIFO"
        )
        self.btnFifo.bind('<ButtonRelease-1>',
            lambda e: self.btnMain(1)
        )
        self.btnLifo = Button(self.f1,
            text = "LIFO"
        )
        self.btnLifo.bind('<ButtonRelease-1>',
            lambda e: self.btnMain(2)
        )
        self.btnPriority = Button(self.f1,
            text = "PRIORITY"
        )
        self.btnPriority.bind('<ButtonRelease-1>',
            lambda e: self.btnMain(3)
        )
```

will... well, show the status of our queue.

We now create our DefineVars routine. We have four StringVar() objects, an empty variable called QueueType, and three queue objects - one for each of the types of queues that we are going to play with. We have set the maximum size of the queues at 10 for the purposes of the demo. We also have created an object called obj, and assigned it to the FIFO queue. When we select a queue type from the buttons, we will set this object to the queue that we want. This way, the queue is maintained when we switch to another queue type (code is on previous page, bottom right).

Here we start the widget definitions. We create our first frame, the three buttons, and their bindings. Notice we are using the same routine to handle the binding callback. Each button sends a value to the callback routine to denote which button was clicked. We could just as easily have created a dedicated routine for each button. However, since all three buttons are dealing with a common task, I thought it would be good to work them as a group (code shown right).

Next (below right), we set up the second frame, the entry widget, and the two buttons. The only thing here that is out of the ordinary is the binding for the entry widget. Here we bind the self.AddToQueue routine to the <Return> key. This way, the user doesn't have to use the mouse to add the data. They can just enter the data into the entry widget, and press <Return> if they want to.

Here (next page, bottom) is the last three widget definitions. All three are labels. We set the textvariable attribute to the variables we defined earlier. If you remember, when that variable changes, so does the text in the label. We also do something a bit different on the lblData label. We will use a different font to make it stand out when we display the data pulled from the queue. Remember that we have to return the frame object so it can be used in the

```
    self.f2 = Frame(frame,
        relief = SUNKEN,
        borderwidth=2,
        width = 300,
        padx = 3,
        pady = 3
    )
    self.txtAdd = Entry(self.f2,
        width=5,
        textvar=self.Item
    )
    self.txtAdd.bind('<Return>',self.AddToQueue)
    self.btnAdd = Button(self.f2,
        text='Add to Queue',
        padx = 3,
        pady = 3
    )
    self.btnAdd.bind('<ButtonRelease-1>',self.AddToQueue)
    self.btnGet = Button(self.f2,
        text='Get Next Item',
        padx = 3,
        pady = 3
    )
    self.btnGet.bind('<ButtonRelease-1>',self.GetFromQueue)
```

```
        self.lblEmpty = Label(self.f2,
            textvariable=self.EmptyStatus,
            relief=FLAT
        )
        self.lblFull = Label(self.f2,
            textvariable=self.FullStatus,
            relief=FLAT
        )
        self.lblData = Label(self.f2,
            textvariable=self.Output,
            relief = FLAT,
            font=("Helvetica", 16),
            padx = 5
        )

        return frame
```

PlaceWidget routine.

This (next page, middle) is the beginning of the PlaceWidgets routine. Notice here that we put five empty labels at the very top of the root window. I'm doing this to set spacing. This is an easy way to “cheat” and make your window placement much easier. We then set the first frame, then another “cheater” label, then the three buttons.

Here we place the second frame, another “cheater” label, and the rest of our widgets.

```
def Quit(self):
    sys.exit()
```

Next we have our “standard” quit routine which simply calls sys.exit() (above right).

Now our main button callback routine, btnMain. Remember we are sending in (through the p1 parameter) which button was clicked. We use the self.QueueType variable as a reference to which queue type we are dealing with, then we assign self.obj to the proper queue, and finally change the title of our root window to display the queue type we are using. After that, we print the queue type to the terminal

```
    def btnMain(self,p1):
        if p1 == 1:
            self.QueueType = 'FIFO'
            self.obj = self.fifo
            root.title('Queue Tests - FIFO')
        elif p1 == 2:
            self.QueueType = 'LIFO'
            self.obj = self.lifo
            root.title('Queue Tests - LIFO')
        elif p1 == 3:
            self.QueueType = 'PRIORITY'
            self.obj = self.pq
            root.title('Queue Tests - Priority')

        print self.QueueType
        self.ShowStatus()
```

```
        self.f2.grid(column = 0,row = 2,sticky='nsew',columnspan=5,padx = 5, pady = 5)
        l = Label(self.f2,text='',width = 15,anchor = 'e').grid(column = 0, row = 0)
        self.txtAdd.grid(column=1,row=0)
        self.btnAdd.grid(column=2,row=0)
        self.btnGet.grid(column=3,row=0)
        self.lblEmpty.grid(column=2,row=1)
        self.lblFull.grid(column=3,row = 1)
        self.lblData.grid(column = 4,row = 0)
```

```
    def PlaceWidgets(self, master):
        frame = master
        # Place the widgets
        frame.grid(column = 0, row = 0)
        l = Label(frame,text='',relief=FLAT,width = 15, anchor = 'e').grid(column = 0, row = 0)
        l = Label(frame,text='',relief=FLAT,width = 15, anchor = 'e').grid(column = 1, row = 0)
        l = Label(frame,text='',relief=FLAT,width = 15, anchor = 'e').grid(column = 2, row = 0)
        l = Label(frame,text='',relief=FLAT,width = 15, anchor = 'e').grid(column = 3, row = 0)
        l = Label(frame,text='',relief=FLAT,width = 15, anchor = 'e').grid(column = 4, row = 0)

        self.f1.grid(column = 0,row = 1,sticky='nsew',columnspan=5,padx = 5,pady = 5)
        l = Label(self.f1,text='',width = 25,anchor = 'e').grid(column = 0, row = 0)
        self.btnFifo.grid(column = 1,row = 0,padx = 4)
        self.btnLifo.grid(column = 2,row = 0,padx = 4)
        self.btnPriority.grid(column = 3, row = 0, padx = 4)
```

window (you don't really have to do that), and call the ShowStatus routine. Next (following page, top right) we'll make the ShowStatus routine.

As you can see, it's pretty simple. We set the label variables to their proper state so they display if the queue we are using is either full, empty, or somewhere in between.

The AddToQueue routine (next page, bottom right) is also fairly straight-forward. We get the data from the entry box using the .get() function. We then check to see if the current queue type is a priority queue. If so, we need to make sure it's in the correct format. We do that by checking for the presence of a comma. If it isn't, we complain to the user via an error message box. If everything seems correct, we then check to see if the queue that we are currently using is full. Remember, if the queue is full, the put routine is blocked and the program will hang. If everything is fine, we add the item to the queue and update the status.

```
if __name__ == '__main__':
    def Center(window):
        # Get the width and height of the screen
        sw = window.winfo_screenwidth()
        sh = window.winfo_screenheight()
        # Get the width and height of the window
        rw = window.winfo_reqwidth()
        rh = window.winfo_reqheight()
        xc = (sw-rw)/2
        yc = (sh-rh)/2
        window.geometry("%dx%d+%d+%d"%(rw,rh,xc,yc))
        window.deiconify()
```

```
    def ShowStatus(self):
        # Check for Empty
        if self.obj.empty() == True:
            self.EmptyStatus.set('Empty')
        else:
            self.EmptyStatus.set('')
        # Check for Full
        if self.obj.full() == True:
            self.FullStatus.set('FULL')
        else:
            self.FullStatus.set('')
```

The GetFromQueue routine (middle right) is even easier. We check to see if the queue is empty so as not to run into a blocking issue, and, if not, we pull the data from the queue, show the data, and update the status.

We are getting to the end of our application. Here is the center window routine (above left). We first get the screen width and screen height of the screen we are on. We then get the width and height of the root window by using the winfo_reqwidth() and winfo_reqheight() routines built into tkinter. These routines, when called at the

```
    def GetFromQueue(self,p1):
        self.Output.set('')
        if not self.obj.empty():
            temp = self.obj.get()
            self.Output.set("Pulled
{0}".format(temp))
        self.ShowStatus()
```

```
    def AddToQueue(self,p1):
        temp = self.Item.get()
        if self.QueueType == 'PRIORITY':
            commapos = temp.find(',')
            if commapos == -1:
                print "ERROR"
                tkMessageBox.showerror('Queue Demo',
                    'Priority entry must be in format\r(priority,data)')
            else:
                self.obj.put(self.Item.get())
        elif not self.obj.full():
            self.obj.put(self.Item.get())
        self.Item.set('')
        self.ShowStatus()
```

right time, will return the width and height of the root window based on the widget placement. If you call it too early, you'll get data, but it won't be what you really need. We then subtract the required window width from the screen width, and divide it by two, and do the same thing for the height information. We then use that information to set the geometry call. In MOST instances, this works wonderfully. However, there might be times that you need to set the required width and height by hand.

```
    root = Tk()
    root.title('Queue Tests - 
FIFO')
    demo = QueueTest(root)
    root.after(3,Center,root)
```

Finally, we instantiate the root window, set the base title, instantiate the QueueTest class. We then call root.after, which waits x number of milliseconds (in this case 3) after the root window is instantiated, and then calls the Center routine. This way, the root window has been completely set up and is ready to go, so we can get the root window width and height. You might have to tweak the delay time a bit. Some machines are much faster than others. 3 works fine on my machine, your mileage may vary. Last but not least, we call the root window mainloop to get the application to run.

As you play with the queues, notice that if you put some data in one queue (let's say the FIFO queue) then switch to another queue (let's say the LIFO queue), the data that was put into the FIFO queue is still there and waiting for you. You can completely or partially fill all three queues, then start playing with them.

Well, that's it for this time. Have fun with your queues. The QueueTest code can be found at http://pastebin.com/5BBUiDce.

Program In Python - Part 28

We are going to explore even more widgets provided by tkinter. This time we will look at menus, combo boxes, spin boxes, separator bar, progress bars and notebooks. Let's talk about them one at a time.

You've seen menus in almost every application that you have ever used. Tkinter makes it VERY easy for us to make menus. Combo Boxes are similar to the list box that we explored in the last widget demo article, except the list "pops down" instead of being visible at all times. Spin box controls are great for giving a fixed range of values that can "scroll" up or down. For example, if we want the user to be able to choose from integers between 1 and 100, we can easily use a spin box. Progress bars are a wonderful way to show that your application hasn't locked up when something takes a lot of time, like reading records from a database. It can show the percentage of completion of a task. There are two types of progress bars, Determinate and Indeterminate. You use a determinate progress bar when you know just how many items you are dealing with. If you don't know the number of items or the percentage of how done your task is at any point, you would use the Indeterminate version. We will work with both. Finally a notebook widget (or tabbed widget) is used many times for things like configuration screens. You can logically group a series of widgets on each tab.

So, let's get started. As usual, we will create a base application and build on to it with each extra widget we add. Shown right is the first part of our application. You've seen most of this before.

Save all of this as widgetdemo2a.py. Remember we will use this as the base to build the full demo. Now we will start the process of creating the

```
import sys
from Tkinter import *
import ttk
# Shows how to create a menu
class WidgetDemo2:

    def __init__(self,master = None):
        self.DefineVars()
        f = self.BuildWidgets(master)
        self.PlaceWidgets(f)

    def DefineVars(self):
        pass
```

And here is the bottom of our program. Again, you have seen this before. Nothing new here.

```
if __name__ == '__main__':
    def Center(window):
        # Get the width and height of the screen
        sw = window.winfo_screenwidth()
        sh = window.winfo_screenheight()
        # Get the width and height of the window
        rw = window.winfo_reqwidth()
        rh = window.winfo_reqheight()
        xc = (sw-rw)/2
        yc = (sh-rh)/2
        print "{0}x{1}".format(rw,rh)
        window.geometry("%dx%d+%d+%d"%(rw,rh,xc,yc))
        window.deiconify()

    root = Tk()
    root.title('More Widgets Demo')
    demo = WidgetDemo2(root)
    root.after(13,Center,root)
    root.mainloop()
```

menu. Here are the steps we need to do. First, we define a variable to hold the menu instance. Like most any widget we use, the format is...

```
OurVariable = Widget(parent, options).
```

In this case, we are using the Menu widget and we will assign it to master as the parent. We do this under the BuildWidgets routine. Next we create another menu item, this time calling it filemenu. We add commands and separators as needed. Finally we add it to the menu bar and do it all over again until we are done. In our example, we'll have the menubar, a File pulldown, an Edit pulldown and a Help pulldown (top right). Let's get started.

Next (middle right) we concentrate on the File Menu. There will be five elements. New, Open, Save, a separator and Exit. We'll use the .add_command method to add the command. All we really need to do is call the method with the text (label =) and then provide a callback function to handle when the user clicks the item. Finally we use the menubar.add_cascade function to attach the menu to the bar.

Notice that the Exit command uses “root.quit” to end the program. No call back needed for that. Next we'll do the same thing for the Edit and Help menus.

Notice the part in each of the menu group definitions that says “tearoff=0”. If you were to change the “=0” to “=1”, the menu would start with what looks like a dashed line and if you drag it, it “tears off” and creates its own window. While this might be helpful sometime in the future, we don't want that here.

Last but not least, we need to place the menu. We don't do a normal placement with the .grid() function. We simply add it by using the parent.config function (bottom right).

All of this has gone in the BuildWidgets routine. Now (next page, top right) we need

```
    def BuildWidgets(self,master):
        frame = Frame(master)
        #==============================
        #       MENU STUFF
        #==============================
        # Create the menu bar
        self.menubar = Menu(master)
```

```
# Create the File Pull Down, and add it to the menu bar
  filemenu = Menu(self.menubar, tearoff = 0)
  filemenu.add_command(label = "New", command = self.FileNew)
  filemenu.add_command(label = "Open", command = self.FileOpen)
  filemenu.add_command(label = "Save", command = self.FileSave)
  filemenu.add_separator()
  filemenu.add_command(label = "Exit", command = root.quit)
  self.menubar.add_cascade(label = "File", menu = filemenu)
```

```
 # Create the Edit Pull Down
 editmenu = Menu(self.menubar, tearoff = 0)
 editmenu.add_command(label = "Cut", command = self.EditCut)
 editmenu.add_command(label = "Copy", command = self.EditCopy)
 editmenu.add_command(label = "Paste", command = self.EditPaste)
 self.menubar.add_cascade(label = "Edit", menu = editmenu)
 # Create the Help Pull Down
 helpmenu = Menu(self.menubar, tearoff=0)
 helpmenu.add_command(label = "About", command = self.HelpAbout)
 self.menubar.add_cascade(label = "Help", menu = helpmenu)
```

```
         # Now, display the menu
        master.config(menu = self.menubar)
         #========================================
         #           End of Menu Stuff
         #========================================
```

to add a generic frame and set the return statement before we move on to the PlaceWidgets routine.

Finally (next page, bottom right) we need to create all the callbacks we defined earlier. For the demo, all we'll do is print something in the terminal used to launch the program.

That's it. Save and run the program. Click on each of the menu options (saving File|Exit for last).

Now (below) we'll deal with the combo box. Save your file as widgetdemo2b.py and we'll get started. The imports, class definition and the def __init__ routines are all the same, as is the bottom part of the program. We'll add two lines to the DefineVars routine. Either comment out the "pass" statement or erase it and put in the following code. (I included the definition line just for clarity.)

First we define a label, which we've done before. Next we define the combo box. We use "ttk.Combobox", define the parent and set the height to 19,

```
        self.f1 = Frame(frame,
                        relief = SUNKEN,
                        borderwidth = 2,
                        width = 500,
                        height = 100
                        )

         return frame
```

Next we (as we have done multiple times) deal with placing our other widgets.

```
    def PlaceWidgets(self,master):
        frame = master
        frame.grid(column = 0, row = 0)

        self.f1.grid(column = 0,
                     row = 0,
                     sticky = 'nsew'
                      )
```

```
    def DefineVars(self):
        self.cmbo1Val = StringVar()
        self.c1Vals = ['None','Option 1','Option 2','Option 3']
```

After our the self.f1 definition in BuildWidgets and before the "return frame" line insert the following code.

```
        # Combo Box
        self.lblcb = Label(self.f1, text = "Combo Box: ")
        self.cmbo1 = ttk.Combobox(self.f1,
                                  height = "19",
                                  width = 20,
                                  textvariable = self.cmbo1Val
                                 )
        self.cmbo1['values'] = self.c1Vals
        # Bind the virtual event to the callback
        self.cmbo1.bind("<<ComboboxSelected>>",self.cmbotest)
```

```
    def FileNew(self):
        print "Menu - File New"

    def FileOpen(self):
        print "Menu - File Open"

    def FileSave(self):
        print "Menu - File Save"

    def EditCut(self):
        print "Menu - Edit Cut"

    def EditCopy(self):
        print "Menu - Edit Copy"

    def EditPaste(self):
        print "Menu - Edit Paste"

    def HelpAbout(self):
        print "Menu - Help About"
```

the width to 20 and the textvariable to “self.cmbo1Val”. Remember that we set textvariables in the last widget demo, but just in case you forgot...this is changed anytime the value in the combo box is changed. We defined it in DefineVars as a StringVar object. Next we load the values that we want the user to choose from, again we defined that in DefineVars. Finally we bind the virtual event <<ComboboxSelected>> to the cmbotest routine that we will flesh out in a minute.

Next let's place the combo box and the label into our form (top right).

Save everything and test it out.

Now save as widgetdemo2c.py and we'll start with the separator bar. This is SO super easy. While the updated tkinter provides a separator bar widget, I've never been able to get it to work. Here's an easy work around. We use a frame with a height of 2. The only changes to our program will be the definition of the frame in BuildWidgets after the combo box bind statement and placing the frame in the Place Widgets routine. So, in BuildWidgets put in the following lines (shown middle right)...

Once again, you've seen all this before. Save and test it. You'll probably have to expand the topmost window to see the separator, but it will become much more evident in the next demo. Save as widgetdemo2d.py and we'll add the spin control.

Under DefineVars, add the following line...

```
self.spinval = StringVar()
```

By now, you know that this is so we can get the value at any time we want. Next, we'll add some code to the BuildWidgets routine...just before the “return frame” line (bottom right).

Here we define a label and the spin control. The spin control definition is as follows:

```
ourwidget =
Spinbox(parent,low value,
high value, width,
textvariable, wrap)
```

```
        self.lblcb.grid(column = 0,row = 2)
        self.cmbo1.grid(column = 1,
                        row = 2,
                        columnspan = 4,
                        pady = 2
                        )
```

And finally we put in the callback which simply prints what the user selected into the terminal window.

```
    def cmbotest(self,p1):
        print self.cmbo1Val.get()
```

```
        self.fsep = Frame(self.f1,
                          width = 140,
                          height = 2,
                          relief = RIDGE,
                          borderwidth = 2
                          )
```

And in PlaceWidgets put in this ...

```
        self.fsep.grid(column = 0,
                       row = 3,
                       columnspan = 8,
                       sticky = 'we',
                       padx = 3,
                       pady = 3
                       )
```

```
        self.lblsc = Label(self.f1, text = "Spin Control:")
        self.spin1 = Spinbox(self.f1,
                             from_ = 1.0,
                             to = 10.0,
                             width = 3,
                             textvariable = self.spinval,
                             wrap=True
                             )
```

The low value must be called as "from_" since the word "from" is a keyword and using that would simply confuse everyting. The values "from_" and "to" must be defined as float values. In this case we want it to have a low value of 1 and a high value of 10. Finally the wrap option says that if the value is (in our case) 10 and the user clicks on the up arrow, we want it to wrap around to the low value and keep going. The same works for the low value. If the user clicks the down arrow of the control and the value is 1, it wraps to 10 and keeps going. If you set "wrap=False", the control simply stops at whichever direction the user is going.

Now we'll place the widgets in PlaceWidgets (below).

Again, that's it. Save and play. You'll really notice the separator now.

Save as widgetdemo2e.py

```
self.lblsc.grid(column = 0, row = 4)
self.spin1.grid(column = 1,
                row = 4,
                pady = 2
                )
```

and we'll do the progress bars.

Again, we need to define some variables, so in the DefineVars routine add the following code...

```
self.spinval2 = StringVar()
self.btnStatus = False
self.pbar2val = StringVar()
```

It should be pretty obvious what the two StringVar variables are. We'll discuss the "self.btnStatus" in a moment. For now, let's go and define the widgets for this portion in BuildWidgets (right).

Again this goes before the "return frame" line. What we are doing is setting up a frame for us to put the widgets into. Then we set up two labels as guides. Next we define the first progress bar. Here the only things that might be strange are length, mode and maximum. Length is the size in pixels of our bar. Maximum is the highest value that will be seen. In this case it's 100 since

```
#========================================
# Progress Bar Stuff
#========================================
self.frmPBar = Frame(self.f1,
                relief = SUNKEN,
                borderwidth = 2
                )

self.lbl0 = Label(self.frmPBar,
                text = "Progress Bars"
                )
self.lbl1 = Label(self.frmPBar,
                text = "Indeterminate",
                anchor = 'e'
                )
self.pbar = ttk.Progressbar(self.frmPBar,
                orient = HORIZONTAL,
                length = 100,
                mode = 'indeterminate',
                maximum = 100
                )
self.btnptest = Button(self.frmPBar,
                text = "Start",
                command = self.TestPBar
                )
self.lbl2 = Label(self.frmPBar,
                text = "Determinate"
                )
self.pbar2 = ttk.Progressbar(self.frmPBar,
                orient = HORIZONTAL,
                length = 100,
                mode = 'determinate',
                variable = self.pbar2val
                )
self.spin2 = Spinbox(self.frmPBar,
                from_ = 1.0,
                to = 100.0,
                textvariable = self.spinval2,
                wrap = True,
                width = 5,
                command = self.Spin2Do
                )
```

we are looking at percentage. Mode in this case is 'indeterminate'. Remember, we use this mode when we don't know how far we've gotten in a task so we just want to let the user know that something is happening.

Next we add a button (you've done this before), another label another progress bar and another spin control. The mode for the second progress bar is “determinate”. We will use the spin control to set the “percentage” of completion. Next add the following lines (next page, top left) into the PlaceWidgets routine.

Lastly, we add two routines to control our progress bars (botom right).

The TestPBar routine controls the indeterminate progress bar. Basically, we are starting and stopping an internal timer that is built into the progress bar.

```
        #========================================
        #              NOTEBOOK
        #========================================
        self.nframe = Frame(self.f1,
                            relief = SUNKEN,
                            borderwidth = 2,
                            width = 500,
                            height = 300
                            )
        self.notebook = ttk.Notebook(self.nframe,
                                     width = 490,
                                     height = 290
                                     )
        self.p1 = Frame(self.notebook)
        self.p2 = Frame(self.notebook)
        self.notebook.add(self.p1,text = 'Page One')
        self.notebook.add(self.p2,text = 'Page Two')
        self.lsp1 = Label(self.p1,
                          text = "This is a label on
  page number 1",
                          padx = 3,
                          pady = 3
                          )
```

```
        # Progress Bar
        self.frmPBar.grid(column = 0,
                          row = 5,
                          columnspan = 8,
                          sticky = 'nsew',
                          padx = 3,
                          pady = 3
                          )
        self.lbl0.grid(column = 0, row = 0)
        self.lbl1.grid(column = 0,
                       row = 1,
                       pady = 3
                       )
        self.pbar.grid(column = 1, row = 1)
        self.btnptest.grid(column = 3, row = 1)
        self.lbl2.grid(column = 0,
                       row = 2,
                       pady = 3
                       )
        self.pbar2.grid(column = 1, row = 2)
        self.spin2.grid(column = 3, row = 2)
```

```
    def TestPBar(self):
        if self.btnStatus == False:
            self.btnptest.config(text="Stop")
            self.btnStatus = True
            self.pbar.start(10)
        else:
            self.btnptest.config(text="Start")
            self.btnStatus = False
            self.pbar.stop()

    def Spin2Do(self):
        v = self.spinval2.get()
        print v
        self.pbar2val.set(v)
```

The line "self.pbar.start(10)" sets the timer to 10 milliseconds. This makes the bar move fairly quickly. Feel free to play with this value up and down on your own. The Spin2Do routine simply sets the progress bar to whatever value the spin control has. We print it as well to the terminal.

That's all the changes for this. Save and play.

Now save as widgetdemo2f.py and we'll deal with the tabbed notebook widgets. In BuildWidgets put the following code (below) before the "return frame" line...

```
        self.nframe.grid(column = 0,
                         row = 6,
                         columnspan = 8,
                         rowspan = 7,
                         sticky = 'nsew'
                         )
        self.notebook.grid(column = 0,
                           row = 0,
                           columnspan = 11,
                           sticky = 'nsew'
                           )
        self.lsp1.grid(column = 0,row = 0)
        self.lsp2 = Label(self.p2,
                          text = 'This is a label on PAGE 2',
                          padx = 3,
                          pady = 3
                          ).grid(
                                 column = 0,
                                 row = 1
                                 )
```

Let's look at what we did. First, we define a frame for our notebook widget. Now we define the widget. All the options are ones we've seen before. Next we define two frames named self.p1 and self.p2. These act as our pages. The next two lines (self.notebook.add) attach the frames to the notebook widget and they get a tab attached to them. We also set the text for the tabs. Finally, we put a label on page number one. We'll put one on page number two when we place the controls just for fun.

In the PlaceWidgets routine put the following code (below).

The only thing that might possibly be strange is the label on page two. We combine the definition and placement in the grid with the same command. We did that when we did our first widget demo app.

That's it. Save and play.

As always the full code for the full application is up on pastebin at http://pastebin.com/qSPkSNU1.

Enjoy. Next time we'll deal with some more database stuff.

Program In Python - Part 29

A little while ago, I was asked to convert a MySQL database to SQLite. Looking around the web for a quick and easy (and free) solution, I found nothing that worked with the current version of MySQL for me. So I decided to go ahead and "roll my own".

The MySQL Administrator program allows you to backup a database into a flat text file. Many SQLite browsers allow you to read a flat sql definition file and create the database from there. However, there are many things that MySQL supports that SQLite doesn't. So this month, we'll write a conversion program that reads a MySQL dump file and creates a SQLite version.

Let's start by looking at the MySQL dump file. It consists of a section that creates the database, and then sections that create each table within the database followed by the data for that table, if it's included in the dump file. (There's an option to export the table schema(s) only). Shown above right is an example of one of the create table sections.

The first thing that we would need to get rid of is in the last line. Everything after the ending parenthesis needs to go away. (SQLite does not support an InnoDB database). In addition to that, SQLite doesn't support the "PRIMARY KEY" line. In SQLite, we set a primary key by using "INTEGER PRIMARY KEY AUTOINCREMENT" when we define the field. The other thing that SQLite doesn't support is the "unsigned" keyword.

When it comes to the data, the "INSERT INTO" statements are also non-compatible. The problem here is that SQLite doesn't allow multiple inserts within the same statement. Here's a short example from the MySql dump file. Notice (right) that the end-of-line

```
DROP TABLE IF EXISTS `categoriesmain`;
CREATE TABLE `categoriesmain` (
  `idCategoriesMain` int(10) unsigned NOT NULL
auto_increment,
  `CatText` char(100) NOT NULL default '',
  PRIMARY KEY  (`idCategoriesMain`)
) ENGINE=InnoDB AUTO_INCREMENT=40 DEFAULT
CHARSET=latin1;
```

```
INSERT INTO `categoriesmain`
(`idCategoriesMain`,`CatText`) VALUES
 (1,'Appetizer'),
 (2,'Snack'),
 (3,'Barbecue'),
 (4,'Cake'),
 (5,'Candy'),
 (6,'Beverages');
```

To make this compatible, we need to change this from a single statement format to a series of single statements like this:

```
INSERT INTO `categoriesmain`
(`idCategoriesMain`,`CatText`) VALUES (1,'Appetizer');
INSERT INTO `categoriesmain`
(`idCategoriesMain`,`CatText`) VALUES (2,'Snack');
INSERT INTO `categoriesmain`
(`idCategoriesMain`,`CatText`) VALUES (3,'Barbecue');
INSERT INTO `categoriesmain`
(`idCategoriesMain`,`CatText`) VALUES (4,'Cake');
INSERT INTO `categoriesmain`
(`idCategoriesMain`,`CatText`) VALUES (5,'Candy');
INSERT INTO `categoriesmain`
(`idCategoriesMain`,`CatText`) VALUES (6,'Beverages');
```

marker is a semicolon.

We will also ignore any comment lines, and the CREATE DATABASE and USE statements. Once we have the converted SQL file, we'll use a program similar to the public domain program SQLite Database Browser to actually deal with the process of creating the database, tables, and data.

Let's get started. Start a new project folder and a new python file. Name it MySQL2SQLite.py.

Shown above right is the import statement, the class definition, and the __init__ routine.

This will be a commandline driven program, so we'll need to create the "if __name__" statement, a command line argument handler, and a usage routine (if the user doesn't know how to use the program). This goes at the very end of the program. All other code we create will go above this:

```
def error(message):

    print >> sys.stderr, str(message)
```

Below is the handler that does the printing of the usage statement.

The DoIt() routine is called if our program is being run stand-alone from the command line, which is the design. However, if we want to keep this as a library to be included in another program at another time, we

```
#!/usr/bin/env python
#=====================================
# MySQL2SQLite.py
#=====================================
#              IMPORTS
import sys
#=====================================

#=====================================
#      BEGIN CLASS MySQL2SQLite
#=====================================
class MySQL2SQLite:
    def __init__(self):
        self.InputFile = ""
        self.OutputFile = ""
        self.WriteFile = 0
        self.DebugMode = 0
        self.SchemaOnly = 0
        self.DirectMode = False
```

```
def DoIt():
    #========================================
    #             Setup Variables
    #========================================
    SourceFile = ''
    OutputFile = ''
    Debug = False
    Help = False
    SchemaOnly = False
    #========================================
```

```
if len(sys.argv) == 1:
    usage()
else:
    for a in sys.argv:
        print a
        if a.startswith("Infile="):
            pos = a.find("=")
            SourceFile = a[pos+1:]
        elif a.startswith("Outfile="):
            pos = a.find("=")
            OutputFile = a[pos+1:]
        elif a == 'Debug':
            Debug = True
        elif a == 'SchemaOnly':
            SchemaOnly = True
        elif a == '-Help' or a == '-H' or a == '-?':
            Help = True
    if Help == True:
        usage()
    r = MySQL2SQLite()
    r.SetUp(SourceFile,OutputFile,Debug,SchemaOnly)
    r.DoWork()
```

```
def usage():
    message = (
       '===========================================================================\n'
        'MySQL2SQLite - A database converter\n'
        'Author: Greg Walters\n'
        'USAGE:\n'
        'MySQL2SQLite Infile=filename [Outfile=filename] [SchemaOnly] [Debug] [-H-Help-?\n'

        '   where\n'
        '         Infile is the MySQL dump file\n'
        '         Outfile (optional) is the output filename\n'
        '            (if Outfile is omitted, assumed direct to SQLite\n'
        '         SchemaOnly (optional) Create Tables, DO NOT IMPORT DATA\n'
        '         Debug (optional) - Turn on debugging messages\n'
        '         -H or -Help or -? - Show this message\n'
        'Copyright (C) 2011 by G.D. Walters\n'
        '===========================================================================\n'
        )
    error(message)
    sys.exit(1)

if __name__ == "__main__":
    DoIt()
```

can just use the class. Here we set up a number of variables to make sure that everything works correctly. The code shown bottom right then parses the command line arguments passed to our program, and gets things ready for the main routines.

When we start the program, we need to provide at least two variables on the command line. These are the Input file, and the Output file. We also will provide support for the user to see what is happening as the program is running, an option to just create the tables and not stuff the data, and for the user to call for help. Our "normal" command line to start the program looks like this:

```
MySQL2SQLite Infile=Foo
Outfile=Bar
```

where "Foo" is the name of the MySQL dump file, and "Bar" is the name of the SQLite sql file we want the program to create.

You can also call it like this:

```
MySQL2SQLite Infile=Foo
Outfile=Bar Debug SchemaOnly
```

Which will add the option to show the debug messages and to ONLY create the tables and not import the data.

Finally if the user asks for help, we just go to the usage portion of the program.

Before we continue, let's take another look at how the command line argument support works.

When a user enters the program name from the command line (terminal), the operating system keeps track of the information entered and passes it to the program just in case there are any options entered. If no options (also called arguments) are entered, the number of arguments is one, which is the name of the application - in our case MySQL2SQLite.py. We can access these arguments by calling the sys.arg command. If the count is greater than one, we will access them in a for loop. We will step through the list of arguments and check each one. Some programs require you to enter the arguments in a specific order. By using the for loop approach, the arguments can be entered in any order. If the user doesn't supply any arguments, or uses the help arguments, we show the usage screen. Shown above is the routine for that.

Moving on, once we have

parsed the argument set, we instantiate the class, call the setup routine, which fills certain variables and then call the DoWork routine. We'll start our class now (which is shown on the next page, bottom right).

This (next page, top right) is the definition and the __init__ routine. Here we setup the variables that we will need as we go through the code. Remember that right before we call the DoWork routine, we call the Setup routine. We take our empty variables and assign the correct values to them here.

Notice that there is the ability to not write to a file, useful for debugging purposes. We also have the ability to simply write the schema, or database structure, without writing the data. This is helpful if you are taking a database and starting a new project without wanting to use any existing data.

We start off by opening the SQL Dump file, then setting some internal scope variables.

```
    def SetUp(self, In, Out = '', Debug = False, Schema = 0):
        self.InputFile = In
        if Out == '':
            self.writeFile = 0
        else:
            self.WriteFile = 1
            self.OutputFile = Out
        if Debug == True:
            self.DebugMode = 1
        if Schema == 1:
            self.SchemaOnly = 1
```

Now, we'll deal with the DoWork routine, which is where the actual “magic” happens.

```
    def DoWork(self):
        f = open(self.InputFile)
        print "Starting Process"
        cntr = 0
        insertmode = 0
        CreateTableMode = 0
        InsertStart = "INSERT INTO "
        AI = "auto_increment"
        PK = "PRIMARY KEY "
        IPK = " INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL"
        CT = "CREATE TABLE "
        # Begin
        if self.WriteFile == 1:
            OutFile = open(self.OutputFile,'w')
```

```
        while 1:
            line = f.readline()
            cntr += 1
            if not line:
                break
            # Ignore blank lines, lines that start with
 "--" or comments (/*!)
            if line.startswith("--"): #Comments
                pass
            elif len(line) == 1: # Blank Lines
                pass
            elif line.startswith("/*!"): # Comments
                pass
            elif line.startswith("USE"):
                #Ignore USE lines
                pass
            elif line.startswith("CREATE DATABASE "):
                pass
```

```
#======================================
#     BEGIN CLASS MySQL2SQLite
#======================================
class MySQL2SQLite:
    def __init__(self):
        self.InputFile = ""
        self.OutputFile = ""
        self.WriteFile = 0
        self.DebugMode = 0
        self.SchemaOnly = 0
```

We also define some strings to save us typing later on. Then, if we are to write to an output file, we open it and then we start the entire process. We will read each line of the input file, process it, and potentially write it to the output file. We use a forced while loop to assist reading each line, with a break command when there is nothing left in the input file. We use f.readline() to get the line to work, and assign it to the variable “line”. Some lines, we can safely ignore. We'll simply use an if/elif statement followed by a pass statement to accomplish this (below).

Next we can stop ignoring things and actually do something. If we have a CreateTable statement, we'll start that process. Remember we defined CT to be equal to “Create Table”. Here (above right), we set a variable “CreateTableMode” to be equal to 1, so we know that's what we are doing, since each field definition is on a separate line. We then take our line, remove the carriage return, and get that ready to write to our out file, and, if required, write it.

Now (middle right) we need to start dealing with each line within the create table statements - manipulating each line to keep SQLite happy. There are many things that SQLite won't deal with. Let's look at a Create Table statement from MySQL again.

One thing that SQLite will absolutely have an issue with is the entire last line after the closing parenthesis. Another is the line just above that, the Primary Key line. Yet another thing is the unsigned keyword in the second line. It will take a bit of code (below) to work around these issues, but we can make it happen.

First, (third down on the right) we check to see if the line contains “auto increment”. We will assume that

```
        elif line.startswith(CT):
            CreateTableMode = 1
            l1 = len(line)
            line = line[:l1-1]
            if self.DebugMode == 1:
                print "Starting Create Table"
                print line
            if self.WriteFile == 1:
                OutFile.write(line)
```

```
CREATE TABLE `categoriesmain` (
  `idCategoriesMain` int(10) unsigned NOT NULL auto_increment,
  `CatText` char(100) NOT NULL default '',
  PRIMARY KEY  (`idCategoriesMain`)
) ENGINE=InnoDB AUTO_INCREMENT=40 DEFAULT CHARSET=latin1;
```

```
        p1 = line.find(AI)
        if line.startswith(") "):
            CreateTableMode = 0
            if self.DebugMode == 1:
                print "Finished Table Create"
            newline = ");\n"
            if self.WriteFile == 1:
                OutFile.write(newline)
                if self.DebugMode == 1:
                    print "Writing Line {0}".format(newline)
```

```
        elif p1 != -1:
            # Line is primary key line
            l = line.strip()
            fnpos = l.find(" int(")
            if fnpos != -1:
                fn = l[:fnpos]
            newline = fn + IPK #+ ",\n"
            if self.WriteFile == 1:
                OutFile.write(newline)
                if self.DebugMode == 1:
                    print "Writing Line {0}".format(newline)
```

```
        elif CreateTableMode == 1:
            # Parse the line...
            if self.DebugMode == 1:
                print "Line to process - {0}".format(line)
```

this will be the primary key line. While this might be true 98.6% of the time, it won't always be. However, we'll keep it simple. Next we check to see if the line starts with ") ". This will signify this is the last line of the create table section. If so, we simply set a string to close the statement properly in the variable "newline", turn off the CreateTableMode variable, and, if we are writing to file, write it out.

Now (bottom right) we use the information we found about the auto increment key word. First, we strip the line of any spurious spaces, then check to see where (we are assuming it is there) the phrase " int(" is within the line. We will be replacing this with the phrase " INTEGER PRIMARY KEY AUTOINCREMENT NOT NULL". The length of the integer doesn't matter to SQLite.

Again, we write it out if we should.

Now we look for the phrase "PRIMARY KEY " within the line. Notice the extra space at the end - that's on purpose. If it arises, we ignore the line.

```
elif
line.strip().startswith(PK):

    pass
```

Now (top right) we look for the phrase " unsigned " (again keep the extra spaces) and replace it with " ".

That's the end of the create table routine. Now (below) we move on to the insert statements for the data. The InsertStart variable is the phrase "INSERT INTO ". We check for that because MySQL allows for multiple insert statements in a single

```
    elif line.startswith(InsertStart):
        if insertmode == 0:
            insertmode = 1
            # Get tablename and field list here
            istatement = line
            # Strip CR/LF from istatement line
            l = len(istatement)
            istatement = istatement[:l-2]
```

```
        elif line.find(" unsigned ") != -1:
            line = line.replace(" unsigned "," ")
            line = line.strip()
            l1 = len(line)
            line = line[:l1-1]
            if self.WriteFile == 1:
                OutFile.write("," + line)
                if self.DebugMode == 1:
                    print "Writing Line {0}".format(line)
```

Otherwise, we can deal with the line.

```
        else:
            l1 = len(line)
            line = line.strip()
            line = line[:l1-4]
            if self.DebugMode == 1:
                print "," + line
            if self.WriteFile == 1:
                OutFile.write("," + line)
```

```
        if posx != -1:
            l1 = line[:posx+3]
            insertmode = 0
            if self.DebugMode == 1:
                print istatement + l1
                print "--------------------------------"
            if self.WriteFile == 1:
                OutFile.write(istatement + l1+"\n")
```

Otherwise, we join the prelude to the value statement and end it with a semicolon.

```
        elif pos1 != -1:
            l1 = line[:pos1+2]
            if self.DebugMode == 1:
                print istatement + l1 + ";"
            if self.WriteFile == 1:
                OutFile.write(istatement + l1 + ";\n")
```

The line “self.pbar.start(10)” sets the timer to 10 milliseconds. This makes the bar move fairly quickly. Feel free to play with this value up and down on your own. The Spin2Do routine simply sets the progress bar to whatever value the spin control has. We print it as well to the terminal.

That's all the changes for this. Save and play.

Now save as widgetdemo2f.py and we'll deal with the tabbed notebook widgets. In BuildWidgets put the following code (below) before the “return frame” line...

Let's look at what we did. First, we define a frame for our notebook widget. Now we define the widget. All the options are ones we've seen before. Next we define two frames named self.p1 and self.p2. These act as our pages. The next two lines (self.notebook.add) attach the frames to the notebook widget and they get a tab attached to them. We also set the text for the tabs. Finally, we put a label on page number one. We'll put one on page number two when we place the controls just for fun.

In the PlaceWidgets routine put the following code (below).

The only thing that might possibly be strange is the label on page two. We combine the definition and placement in the grid with the same command. We did that when we did our first widget demo app.

That's it. Save and play.

As always the full code for the full application is up on pastebin at http://pastebin.com/qSPkSNU1.

Enjoy. Next time we'll deal with some more database stuff.

```
else:
    if self.DebugMode == 1:
        print "Testing line {0}".format(line)
    pos1 = line.find("),")
    posx = line.find(");")
    if self.DebugMode == 1:
        print "pos1 = {0}, posx = {1}".format(pos1,posx)
    if pos1 != -1:
        l1 = line[:pos1+1]
        if self.DebugMode == 1:
            print istatement + l1 + ";"
        if self.WriteFile == 1:
            OutFile.write(istatement + l1 + ";\n")
    else:
        insertmode = 0
        l1 = line[:posx+1]
        if self.DebugMode == 1:
            print istatement + l1 + ";"
        if self.WriteFile == 1:
            OutFile.write(istatement + l1 + ";\n")
```

Greg Walters is owner of RainyDay Solutions, LLC, a consulting company in Colorado and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family. His website is www.thedesignatedgeek.com.

Written by Greg D. Walters

Beginning Python - Part 30

This month, we'll explore yet another GUI designer, this time for Tkinter. Many people have an issue with Tkinter because it doesn't offer a built-in designer. While I've shown you how to easily design your applications without a designer, we will examine one now. It's called Page. Basically it's a version of Visual TCL with Python support on top. The current version is 3.2 and can be found at http://sourceforge.net/projects/page/files/latest/download.

Prerequisites

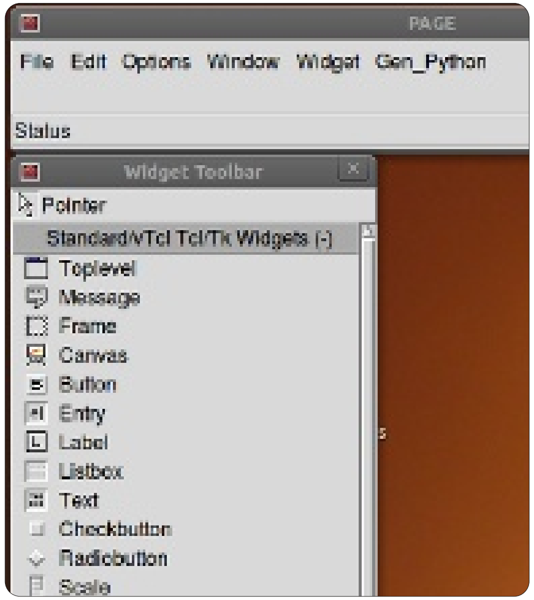
You need TCK/TK 8.5.4 or later, Python 2.6 or later, and pyttk - which you can get (if you don't already have it) from http://pypi.python.org/pypi/pyttk. You probably have all of these with the possible exception of pyttk.

Installation

You can't really ask for an easier installation routine. Simply unpack the distribution file into a folder of your choice. Run the script called "configure" from the folder where you just unpacked everything. This will create your launch script called "page" which you use to get everything going. That's it.

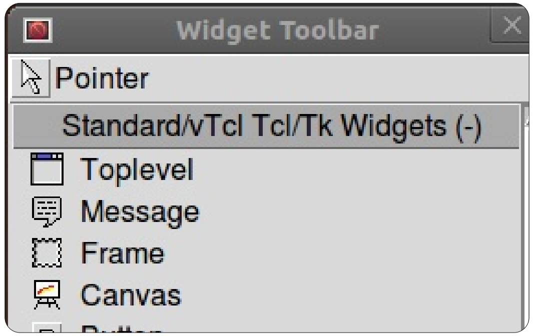
Learning Page

When you start Page, you'll get three windows (forms). One is a "launch pad", one is a

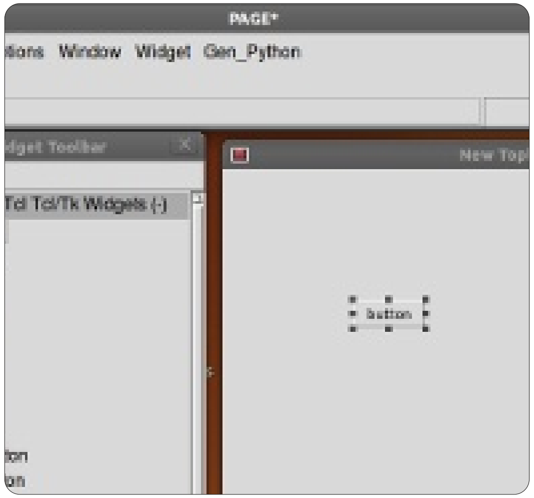


toolbox, and one shows the Attribute Editor.

To start a new project, click on the Toplevel button in the toolbox.



This creates your main form. You can move it wherever you wish on your screen. Next, and from now on, click on a widget



in the tool box and then click where you want it on the main form.

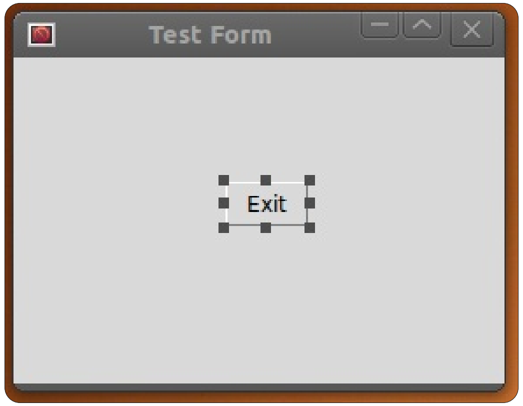
For now, let's do a button. Click on the Button button on the toolbox, and then click somewhere on the main form.

Next, in the launch pad form, click on Window and select Attribute Editor (if it's not already showing). Your single button should be highlighted already, so move it around the form and when you release the mouse button you should see the position change in the attribute editor form under 'x position' and 'y position'.

Here we can set other attributes such as the text on the button (or most any other widget), the alias for the widget (the name we will refer to in our code), color, the name we will call it and more. Near the bottom of the attribute editor is the text field. This is the text that appears to the user for, in this case, the button widget.

Let's change this from “button” to “Exit”. Notice that now the button says “Exit”. Now resize the form to just show the button and recenter the button in the form.

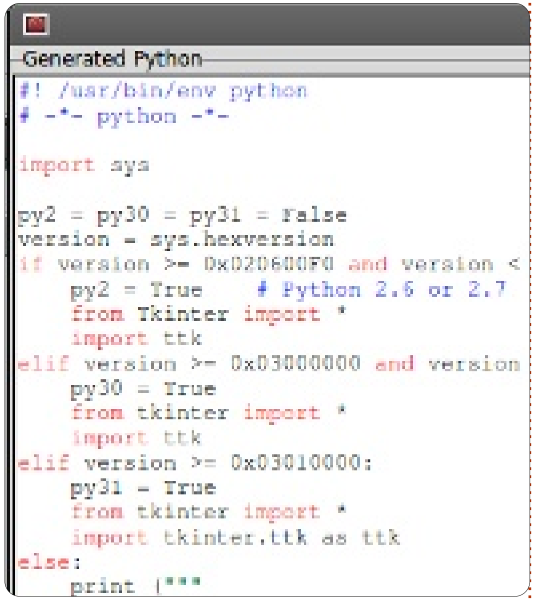
Next click in the main form someplace where the button isn't. The attribute editor form now shows the attributes for the main form. Find the “title” field and change this from “New Toplevel 1” to “Test Form”.



Now, before we save our project, we need to create a folder to hold our project files. Create a folder somewhere on your drive called “PageProjects”. Now, in the launch pad window, select File then Save As. Navigate to your PageProjects folder, and, in the dialog box, type TestForm.tcl and click the Save button. Notice this is saved as a TCL file, not a Python file. We'll create the python file next.

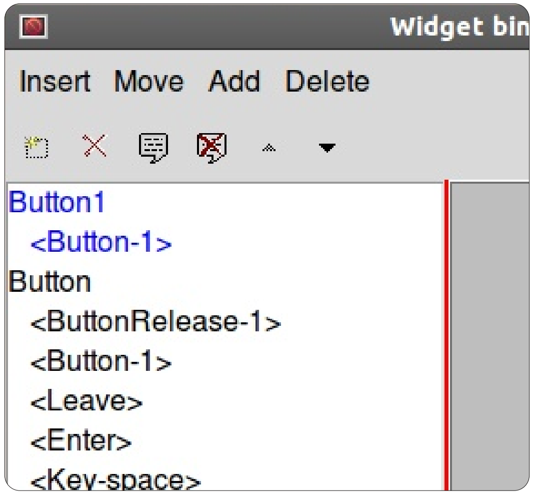
In the launch pad, find the Gen_Python menu item and click it. Select Generate Python and a new form appears.

Page has generated (as the name suggests) our python code for us and placed it in a window for us to view. At the bottom of this form, are three buttons...Save, Run, and Close.

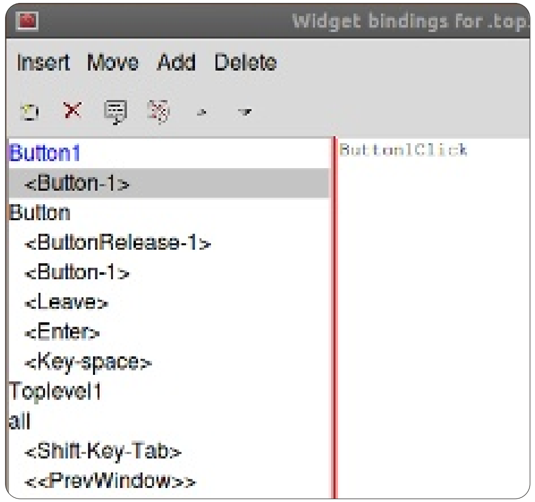


Click Save. If, at this point, you were to look in your PageProjects folder, you will see the python file (TestForm.py). Now click on the Run button. In a few seconds, you'll see the project start up. The button is not connected to anything yet, so it won't do anything if you click on it. Simply close the form with the “X” in the corner of the window. Now close the Python Console window with the close button at the bottom right.

Back at our main form, highlight the Exit button and right click on it. Select “Bindings...”. Under the menu is a set of buttons.



The first on the left allows you to create a new binding. Click on “Button-1”. This allows us to enter the binding for the left mouse button. In the window on the right, type “Button1Click”.



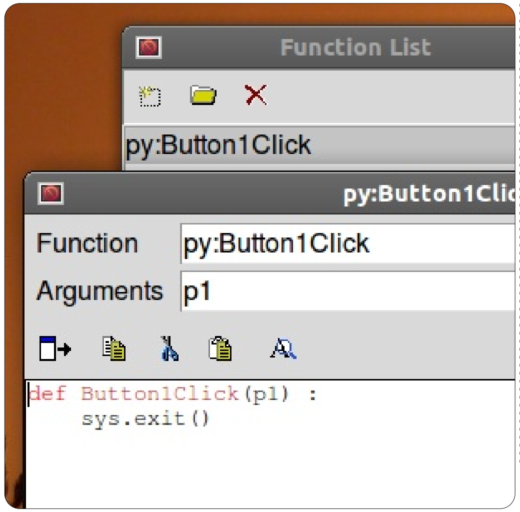
Save and generate the python code again. Scroll down in the Python Console to the bottom of the file. Above the “class Test_Form” code is the function we just asked to be created. Notice that at this point, it simply is passed. Look further down and you'll see the code that creates and controls our button. Everything is done for us already. However, we still have to tell the button what to do. Close the Python Console and we'll continue.

On the launch pad, click

Window then select Function List. Here we will write our method to close the window.

The first button on the left is the Add button. Click it. In the Function box, type “py:Button1Click” and, in the Arguments box, type “p1”, and change the text in the lower box to…

```
def Button1Click(p1):
        sys.exit()
```



Click on the checkmark and we are done with this.

Next we have to bind this routine to the button. Select the button in the form, right click it, and select “Bindings...”. As before, click on the far left button on the toolbar and select Button-1. This is the event for the left mouse button click. In the right text box, enter “Button1Click”. Make sure you use the same case that you did for the Function we just created. Click the checkmark on the right side.

Now save and generate your python code.

You should see the following code near the bottom, but OUTSIDE of the Test_Form class...

```
def Button1Click(p1) :

sys.exit()
```

And the last line of the class should be...

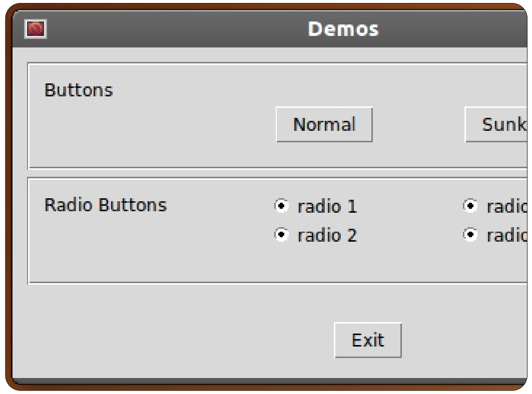
```
self.Button1.bind('<Button-1>',Button1Click)
```

Now, if you run your code and click on the Exit button, the form should close properly.

Moving Forward

Now let's do something more complicated. We'll create a demo showing some of the widgets that are available. First close Page and restart it. Next, create a new Toplevel form. Add two frames, one above the other and expand them to pretty much take up the entire width of the form. In the top frame, place a label, and, using the attributes editor, change the text to “Buttons:”. Next, add two buttons along the horizontal plane. Change the text of the left one to “Normal”, and the right one to “Sunken”. While the sunken button is selected, change the relief to “sunken” and name it btnSunken. Name the “Normal” button “btnNormal”. Save this project as “Demos.tcl”.

Next, place in the lower frame a label saying “Radio Buttons” and four radio buttons like in the image below. Finally, place an Exit button below the bottom frame.



Before we work on the bindings, let's create our click functions. Open the Function List and create two functions. The first should be called btnNormalClicked and the other btnSunkenClicked. Make sure you set the arguments box to include p1. Here's the code you should have for them...

```
def btnNormalClicked(p1):

print "Normal Button Clicked"

def btnSunkenClicked(p1) :

print "Sunken Button Clicked"
```

Let's add our button bindings. For each button, right click it, select “Bindings...”, and add, as before, a binding to the functions we created. For the normal button, it would be “btnNormalClicked”, and for the sunken button it would be btnSunkenClicked. Save and generate your code. Now, if you were to test the program under the “Run” option of the Python Console, and click any of the buttons, you won't see anything happen. However, when you close the application, you should see the print responses. This is normal for Page and if you simply run it from the command line as you normally do, things should work as expected.

Now for our radio buttons. We have grouped them in two “clusters”. The first two (Radio 1 and Radio 2) will be cluster 1 and the other two will be cluster 2. Click on Radio1 and in the Attribute Editor, set the value to 0 and the variable to “rbc1”. Set the variable for Radio 2 to “rbc1” and the value to 1. Do the same thing for Radio 3 and Radio 4 but for both of these set the variable to “rbc2”. If you want, you can deal with the click of the radiobuttons and print something to the terminal, but for now, the important thing is that the clusters work. Clicking Radio1 will deselect Radio2 and not influence Radio3 or Radio4,

```
def set_Tk_var():
# These are Tk variables passed to Tkinter and must
# be defined before the widgets using them are created.
global rbc1
rbc1 = StringVar()
global rbc2
rbc2 = StringVar()
def btnExitClicked(p1) :
sys.exit()
def btnNormalClicked(p1) :
print "Normal Button Clicked"
def btnSunkenClicked(p1) :
print "Sunken Button Clicked"
```

and the same for Radio2 and so on.

Finally, you should create a function for the Exit button, and bind it to the button like we did in the first example.

If you've been following along as we have done our other Tkinter applications, you should be able to understand the code shown above right. If not, please go back a few issues for a full discussion of this code.

You can see that using Page makes the basic design process much easier than doing it yourself. We've only scratched the surface of what Page can do, and we'll start doing something much more realistic next time.

The python code can be found on pastebin at http://pastebin.com/qq0YVgTb.

One note before we go for this month. You might have noticed that I've missed a couple of issues. This is due to my wife being diagnosed with cancer last year. As hard as I have tried to keep things from falling through the cracks, a number of things have. One of these things is my old domain/web site at ~~www.thedesignatedgeek.com~~. I blew it and missed the renewal. Due to this, the domain was sold out from under me. I have set up www.thedesignatedgeek.**net** with all the old stuff. I will be working hard the next month to bring it all up to date.

See you next time.

Greg Walters is owner of RainyDay Solutions, LLC, a consulting company in Colorado and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family. His website is www.thedesignatedgeek.net.

Beginning Python - Part 31

After our last meeting you should have a fairly good idea of how to use Page. If not, please read last month's article. We'll continue this time by creating a file list application with a GUI. The goal here is to create a GUI application that will recursively walk through a directory, looking for files with a defined set of extensions, and display the output in a treeview. For this example we will look for media files with the extensions of ".avi", ".mkv", ".mv4", ".mp3" and ".ogg".

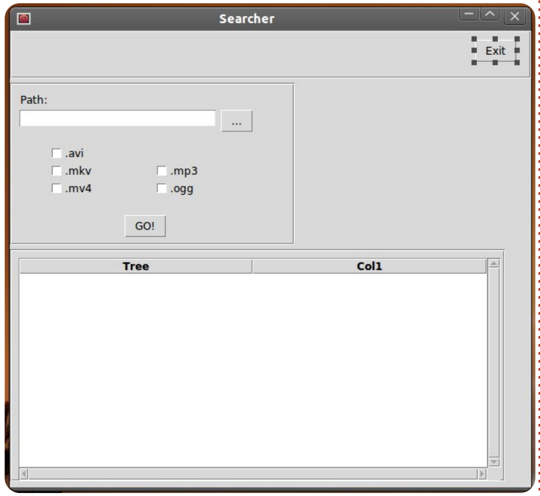
This time, the text might seem a bit terse in the design portion. All I'm going to do is give you directions for placement of widgets and the required attributes and values like this...

```
Widget

Attribute: Value
```

I will only quote text string when it is needed. For example for one of the buttons, the text should be set to "...".

Here's what the GUI of our application will look like...



As you can see, we have our main form, an exit button, a text entry box with a button that will call up an ask for directory dialog box, 5 check boxes for extension selecting extension types, a "GO!" button to actually start the processing and a treeview to display our output.

So, let's get started. Fire up Page and create a new top level widget. Using the Attribute Editor set the following attributes.

```
Alias: Searcher
Title: Searcher
```

Be sure to save often. When you save the file, save it as "Searcher". Remember, Page puts the .tcl extension for you and when you finally generate the python code, it will be saved in the same folder.

Next add a frame. It should go at the very top of the main frame. Set the attributes as follows.

```
Width: 595
Height: 55
x position: 0
y position: 0
```

In this frame, add a button. This will be our Exit button.

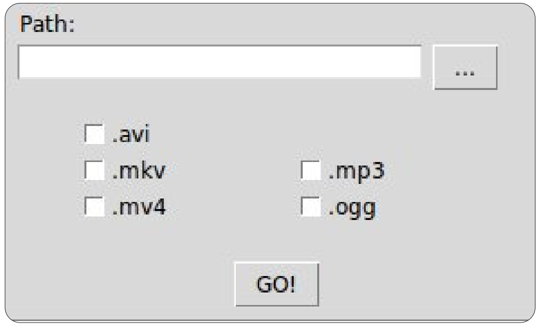
```
Alias: btnExit
Text: Exit
```

Move this close to the center of the frame or close to the frame's right side. I set mine to X 530 and Y 10.

Create another frame.

```
Width: 325
Height: 185
y position: 60
```

Here is what this frame will look like, to give you a guide going forward through this section.



In this frame, add a label. Set the text attribute to "Path:". Move it close to the top left of the frame.

In the same frame, add an entry widget.

```
Alias: txtPath
Text: FilePath
Width: 266
Height: 21
```

Add a button to the right of the entry widget.

```
Alias: btnSearchPath
Text: "..." (no quotes)
```

Add five (5) check buttons. Put them in the following order...

```
x
x  x
x  x
```

The three check buttons on the left are for video files and the two on the right are for audio files. We will deal with the three on the left first, then the two on the right.

```
Alias: chkAVI
Text: ".avi" (no quotes)
Variable: VchkAVI

Alias: chkMKV
Text: ".mkv" (no quotes)
Variable: VchkMKV

Alias: chkMV4
Text: ".mv4" (no quotes)
Variable: VchkMV4

Alias: chkMP3
Text: ".mp3" (no quotes)
Variable: VchkMP3

Alias: chkOGG
Text: ".ogg" (no quotes)
Variable: VchkOGG
```

Finally, in this frame add a button somewhere below the five check boxes and somewhat centered within the frame.

```
Alias: btnGo
Text: GO!
```

Now add one more frame below our last frame.

```
Width: 565
Height: 265
```

I placed mine around X 0 Y 250. You might have to resize your main form to have the entire frame show. Within this frame, add a Scrolledtreeview widget.

```
Width: 550
Height: 254
X Position: 10
Y Position: 10
```

There. We've designed our GUI. Now all that is left to do is create our function list and bind the functions to our buttons.

In the Function list window, click the New button (the far left button). This brings up the new function editor. Change the text in the Function entry box from "py: xxx" to "py:btnExitClick()". In the arguments entry box type "p1". In the bottom multiline entry box, change the text to:

```
def btnExitClick(p1):

    sys.exit()
```

Notice that this is not indented. Page will do that for us when it creates the python file.

Next create another function called btnGoClick. Remember to add a passed parameter of "p1". Leave the "pass" statement. We'll change that later.

Finally, add another function called "btnSearchPath". Again, leave the pass statement.

Lastly, we need to bind the buttons to the functions we just created.

Right-click on the exit button we created, select Bind. A large box will pop up. Click on the New binding button, Click on Button-1 and change the word "TODO" in the right text entry box to "btnExitClick". Do NOT include the parens () here.

Bind the GO button to btnGoClick and the "..." button to btnSearchPathClick.

Save your GUI and generate the python code.

Now all we have left is to create the code that "glues" the GUI together.

Open up the code we just generated in your favorite editor. Let's start off by examining what Page created for us.

At the top of the file is our standard python header and a single import statement to import the sys library. Next is some rather confusing (at first glance) code. This basically looks at the version of python you are trying to run the application in and then to import the correct versions of the tkinter libraries. Unless you are using python 3.x, you can basically ignore the last two.

We'll be modifying the 2.x code portion to import other tkinter modules in a few moments.

Next is the "vp_start_gui()" routine. This is the program's main routine. This sets up our gui, sets the variables we need, and then calls the tkinter main loop. You might notice the line "w = None" below this. It is not indented and it isn't supposed to be.

Next are two routines (create_Searcher and destroy_Searcher) that are used to replace the main loop routine if we are calling this application as a library. We don't need to worry about these.

Next is the "set_Tk_var" routine. We define the tkinter variables used that need to be set up before we create the widgets. You might recognize these as the text variable for the FilePath entry widget and the variables for our check boxes. The next three routines here are the functions we created using the function editor and an "init()" function.

Run the program now. Notice that the check buttons have grayed out checks in them. We don't want that in our "release" app, so we'll create some code to clear them before the form is displayed to the user. The only functioning thing other than the check boxes is the Exit button.

Go ahead and end the program.

Now, we'll take a look at the class that actually holds the GUI definition. That would be "class Searcher". Here is where all the widgets are defined and placed in our form. You should be familiar with this by now.

Two more classes are created for us that hold the code to support the scrolled tree view. We don't have to change any of this. It was all created by Page for us.

Now let's go back to the top of the code and start modifying.

We need to import a few more library modules, so under the "import sys" statement, add...

```
import os

from os.path import join,
getsize, exists
```

Now find the section that has the line "py2 = True". As we said before, this is the section that deals with the tkinter imports for Python version 2.x. Below the "import ttk", we need to add the following to support the FileDialog library. We also need to import the tkFont module.

```
import tkFileDialog

import tkFont
```

Next we need to add some variables to the "set_Tk_var()" routine. At the bottom of the routine, add the following lines...

```
global exts, FileList

exts = []

FileList=[]
```

Here we create two global variables (exts and FileList) that will be accessed later on in our code. Both are lists. "exts" is a list of the extensions that the user selects from the GUI. "FileList" holds a list of lists of the matching files found when we do our search. We'll use that to populate the treeview widget.

Since our "btnExitClick" is already done for us by Page, we'll deal with the "btnGoClick" routine. Comment out the pass statement and add the code so it looks like this...

```
def btnGoClick(p1) :

#pass

BuildExts()

fp = FilePath.get()

e1 = tuple(exts)

Walkit(fp,e1)

LoadDataGrid()
```

This is the routine that will be called when the user clicks the "GO!" button. We call a routine called "BuildExts" which creates the list of the extensions that the user has selected. Then we get the path that the user has selected from the AskDirectory dialog and assign that to the fp variable. We then create a tuple from the extension list, which is needed when we check for files. We then call a routine called "Walkit", passing the target directory and the extension tuple.

Finally we call a routine called "LoadDataGrid".

Next we need to flesh out the "btnSearchPathClick" routine. Comment out the pass statement and change the code to look like this...

```
def btnSearchPathClick(p1) :

    #pass

    path =
tkFileDialog.askdirectory()
#**self.file_opt)

    FilePath.set(path)
```

The init routine is next. Again, make the code look like this...

```
def init():

    #pass

    # Fires AFTER Widgets
and Window are created...

    global treeview

    BlankChecks()

    treeview =
w.Scrolledtreeview1

    SetupTreeview()
```

Here we create a global called "treeview". We then call a routine that will clear the gray checks from the check boxes, assign the "treeview" variable to point to the Scrolled treeview in our form and call "SetupTreeview" to set the headers for the columns.

Here's the code for the BlankChecks routine which needs to be next.

```
def BlankChecks():

    VchkAVI.set('0')

    VchkMKV.set('0')

    VchkMP3.set('0')

    VchkMV4.set('0')

    VchkOGG.set('0')
```

Here, all we are doing is setting the variables (which automatically sets the check state in our check boxes) to "0". If you remember, whenever the check box is clicked, this variable is automatically updated. If the variable is changed by our code, the check box responds as well. Now (above right) we'll deal with the routine that builds the list of extensions from what the user has clicked.

Cast your memory back to my ninth article in FCM#35. We wrote some code to create a catalog of MP3 files. We'll use a shortened version of that routine (middle right). Refer back to FCM#35 if you have questions about this routine.

Next (bottom right) we call the SetupTreeview routine. It's fairly straightforward. We define a variable "ColHeads" with the headings we want in each column of the treeview. We do this as a list. We then set the heading attribute for each column. We also set the column width to the size of this header.

Finally we have to create the "LoadDataGrid" routine (next page, top right) which is where we load our data into the treeview. Each row of the treeview is one entry in the FileList list variable. We also adjust the width of each column (again) to match the size of the column data.

That's it for the first blush of the application. Give it a run

```
def BuildExts():
    if VchkAVI.get() == '1':
        exts.append(".avi")
    if VchkMKV.get() == '1':
        exts.append(".mkv")
    if VchkMP3.get() == '1':
        exts.append(".mp3")
    if VchkMV4.get() == '1':
        exts.append(".mv4")
    if VchkOGG.get() == '1':
        exts.append(".ogg")
```

```
def Walkit(musicpath,extensions):
    rcntr = 0
    fl = []
    for root, dirs, files in os.walk(musicpath):
        rcntr += 1 # This is the number of folders we have walked
        for file in [f for f in files if f.endswith(extensions)]:
            fl.append(file)
            fl.append(root)
            FileList.append(fl)
            fl=[]
```

```
def SetupTreeview():
    global ColHeads
    ColHeads = ['Filename','Path']
    treeview.configure(columns=ColHeads,show="headings")
    for col in ColHeads:
        treeview.heading(col, text = col.title(),
            command = lambda c = col: sortby(treeview, c, 0))
    ## adjust the column's width to the header string
    treeview.column(col, width =
tkFont.Font().measure(col.title()))
```

and see how we did. Notice that if you have a large number of files to go through, the program looks like it's not responding. This is something that needs to be fixed. We'll create routines to change our cursor from the default to a "watch" style cursor and back so when we do something that takes a long time, the user will notice.

In the "set_Tk_var" routine, add the following code at the bottom.

```
global
busyCursor,preBusyCursors,bus
yWidgets

busyCursor = 'watch'

preBusyCursors = None

busyWidgets = (root, )
```

What we do here is set up global variables, assign them and then we set the widget(s) (in busyWidgets) we wish to respond to the cursor change. In this case we set it to root which is our full window. Notice that this is a tuple.

Next we create two routines to set and unset the cursor. First the set routine, which we will call "busyStart". After our "LoadDataGrid" routine, insert the code shown middle right.

We first check to see if a value was passed to "newcursor". If not, we default to the busyCursor. Then we walk through the busyWidgets tuple and set the cursor to whatever we want.

Now put the code shown bottom right below it.

In this routine, we basically reset the cursor for the widgets in our busyWidget tuple back to our default cursor.

Save and run your program. You should find that the cursor changes whenever you have a long list of files to go through.

While this application doesn't really do much but show you how to use Page to create really fast code development. From today's article, you can see how having a good design of your GUI ahead of time can make the development process easy and fairly painless.

The tcl file is saved in pastebin at http://pastebin.com/AA1kE4Dy and the python code is saved at http://pastebin.com/VZm5un3e.

See you next time.

```
def LoadDataGrid():
    global ColHeads
    for c in FileList:
        treeview.insert('','end',values=c)
        # adjust column's width if necessary to fit each value
        for ix, val in enumerate(c):
            col_w = tkFont.Font().measure(val)
            if treeview.column(ColHeads[ix],width=None)<col_w:
                treeview.column(ColHeads[ix], width=col_w)
```

```
def busyStart(newcursor=None):
    global preBusyCursors
    if not newcursor:
        newcursor = busyCursor
    newPreBusyCursors = {}
    for component in busyWidgets:
        newPreBusyCursors[component] = component['cursor']
        component.configure(cursor=newcursor)
        component.update_idletasks()
        preBusyCursors = (newPreBusyCursors, preBusyCursors)
```

```
def busyEnd():
    global preBusyCursors
    if not preBusyCursors:
        return
    oldPreBusyCursors = preBusyCursors[0]
    preBusyCursors = preBusyCursors[1]
    for component in busyWidgets:
        try:
            component.configure(cursor=oldPreBusyCursors[component])
        except KeyError:
            pass
        component.update_idletasks()
```

HOW-TO

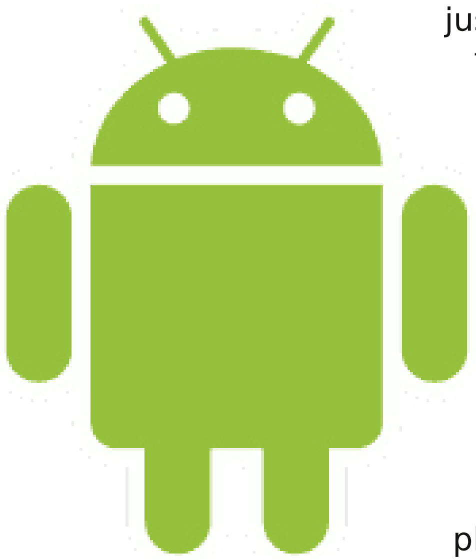
Written by Greg D. Walters

Beginning Python - Part 32

I must say, I love my Android tablet. While I use it every day, it's not yet a replacement for my desktop. And I must also admit, most of what I use it for is pretty much what everyone uses theirs for: web browsing, listening to music, watching videos, playing games, and so on. I try to justify it by having apps that deal with grocery and todo lists, finding cheap gas, fun things for our grandson, etc. It's really a toy for me right now. Why use a fancy touch-screen tablet to do your grocery list? Let's face it... it's the cool looks of envy that people give me in the store when they see me rolling the cart down the aisle and I tap my tablet to mark items off the list. Ahh--- the geek factor RULES! Of course, I can use the back of an old envelope to hold my list. But that wouldn't be cool and geeky, now, would it?

Like 99% of geeky married men in the world, I am married to a non-geek woman. A wonderful loving woman, to be sure, but a non-geek who, when I start drooling at the latest gadget, sighs, and says something like “Well, if you REALLY think we need that...”. Then she gives me the same look I give her as she is lovingly fondles the 50th pair of shoes at the store.

In all honesty, it wasn't hard to get the first tablet into our house. I bought it for my wife while she was going through chemotherapy. She tried to use a laptop for a while, but the heat and weight on her lap was too much after a while. E-books on a laptop for her wasn't an option, so when she tried to read, she had to juggle the book, and the laptop, and the mp3 player. All while being tied to a recliner with tubes running into her arm filling her with nasty chemicals. When I got her the tablet, it was the best of all worlds. She could read an e-book, listen to music, watch a TV show, browse the web, check her E-mail, update her cancer blog, follow her friends on facebook, and play games - all on a device that was light and cool. If she got tired, she could just slip it off to the side between her and the recliner (or bed when she was home trying to regain strength). MUCH better than a bulky laptop, and book, mp3 player, remote control, and more.



As she was getting pumped full of noxious chemicals, I would commandeer a table and chair in the corner of the treatment room, near a power outlet, and try to work on my six-year old laptop. In between projects, I would do research on Android programming. I found out that most programming for Android is done in Java. I had almost resigned myself to re-learning Java when I stumbled across a few tools that allow Python programming for the Android Operating system. One of these tools is called “SL4A”. SL4A stands for Scripting Layer for Android. That's what we will concentrate on in the next couple of articles. We'll really focus on getting SL4A set up on Android in this one.

You might ask, why in the world I would be talking about Android programming in a magazine designed for Linux. Well, the simple reason is that the core of Android is Linux. Everything that Android is, sits on top of Linux!

Many web pages show how to load SL4A into the Android Emulator for Desktops. We'll look at doing that another time, but for now we'll deal with the Android device itself. To install SL4A on your Android device, go to http://code.google.com/p/android-scripting/; you'll find the installation file for SL4A. Don't be absolutely confused here. There's a square High Density barcode that you tap to download the APK. Be sure that you have the “Unknown Sources” option enabled in the Application settings. It's a quick download. Once you have it downloaded and installed, go ahead and find the icon, and tap it. What you will see is a rather disappointing black screen saying “Scripts...No matches found”. That's OK. Hit the menu button and select View. You'll see a menu. Select Interpreters. Then select menu again, and select Add. From the next menu, select Python 2.6.2. This should ask you to start a browser session to download Python for Android. Once this is installed, select Open. You'll get a screen menu with the options to Install, Import Modules, Browse Modules, and Uninstall modules. Select Install. Now Python will download and install along with other extra

you'll see a rather disappointing black screen [...] That's OK.

modules. In addition, you'll get some sample scripts. Finally, tap the back button and you'll see Python 2.6.2 installed in the interpreters screen. Tap again on the back button and you'll see a list of some sample python scripts.

That's all we are going to do this time. All I wanted to do is whet your appetite. Explore Python on Android. You might also want to visit http://developer.android.com/sdk/index.html to get the Android SDK (Software Development Kit) for your desktop. It includes an Android Emulator so you can play along. Setting up the SDK is really pretty easy on Linux, so you shouldn't have too much trouble.

How to Include Accents from the Keyboard

by Barry Smith

If your Linux system is in French, German, or Spanish, and, therefore, requiring accents, or if, occasionally, you need to use accents which do not appear in English words, many users do not know that there is a very easy way to do this from the keyboard. The following applies to only the UK keyboard.

Acute accent

Press Alt Gr + ; (semi-colon) Lift hand then press the desired vowel é

Circumflex

Press Alt Gr + ' (apostrophe) Lift hand then press the desired vowel î

Grave accent

Press Alt Gr + # (hache) Lift hand then press the desired vowel è

Umlaut

Press Alt Gr + [Lift hand then press u ü

ñ - Press Alt Gr +] Lift hand then press n ñ

œ - Press Shift + Alt Gr Lift hand then press o then press e œ
The œ will not appear until after the e is keyed.

To get ¿ and ¡ (inverted exclamation mark) which I use all the time in Spanish before questions, and exclamations, press Alt Gr + Shift, keeping both keys pressed, then hit _ (underscore) for ¿ or hit ! (exclamation mark) for ¡.

Beginning Python - Part 33

This time, we'll set up the Android SDK on our Linux desktop. We'll also create a virtual Android device, install SL4A and python on it, and do a quick test.

Please be aware, this is not something you would want to do for machines that have less than 1 GB of ram. The emulator eats up a huge amount of memory. I've tried it on a laptop running Ubuntu with only 512 MB of ram. It WILL work, but it is REALLY slow.

Here's a quick list of what we'll do. We'll go step-by-step in a minute.

- Install the Java JDK6.
- Install the Android SDK starter pack.
- Create and setup AVDs.
- Test AVD, and install SL4A and Python.

In reality, we should also install Eclipse and the Android ADT plugin for Eclipse, but, since we won't be dealing with Eclipse in this set of articles, we can bypass that. If you want to include those steps, head over to http://developer.android.com/sdk/installing.html to see all the steps in the suggested order. Let's get started.

STEP 1 - Java JDK 6

From everything I've read and tried, it must be the actual Sun release. OpenJDK is not supposed to work. You can find information on this on the web, but here's the steps that I did. In a terminal, type the following...

```
sudo add-apt-repository
ppa:ferramroberto/java

sudo apt-get update

sudo apt-get install sun-
java6-jdk
```

Once everything here is done, you will want to edit your .bashrc file to set "JAVA_HOME" so everything runs correctly. I used gedit and, at the bottom of the file, I added the following line...

```
export
JAVA_HOME="/usr/lib/jvm/java-
6-sun-1.6.0.06"
```

Save the file and move on to step 2.

STEP 2 - Android SDK Starter Pack

Now the actual "fun" begins. You'll want to go to developer.android.com/sdk/index.html. This is where the SDK is located. Download the latest version for Linux, which, at the time of this writing, is android-sdk_r18-linux.tgz. Using Archive Manager, unpack it somewhere convenient. I put it in my home directory. Everything runs directly from this folder, so you really don't have to install anything. So the path for me is /home/greg/android-sdk-linux. Navigate to this folder, then go to the tools folder. There you will find a file called "android". This is what runs the actual SDK. I created a launcher on my desktop to make it easy to get to.

Now the boring part. Run the android file, and the Android SDK Manager will start. It will go out and update the platforms that are available. I will warn you now that this process will take some time, so don't bother if you don't have a lot of time to deal with it. For the sake of brevity, I would suggest you get only one platform to start. A good one to begin with is the Android 2.1 platform, since, for the most part, if you develop for an older platform, there should be no problem running on a newer platform. You also need to get the Tools set as well. Simply check the box next to those two items, then click on the install button. Once you get the platform of your choice, and the tool set, you are almost ready to create your first virtual machine.

STEP 3 - Create and set up your first AVD

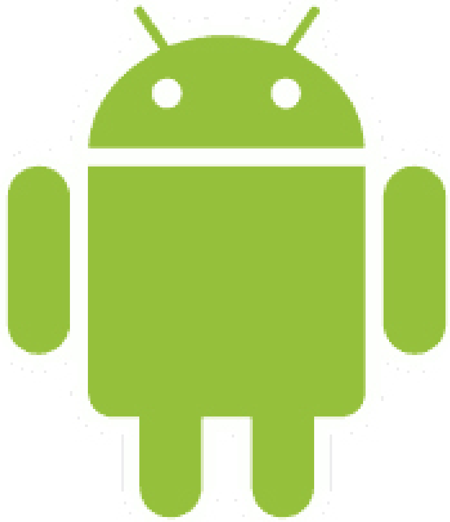
Back in the Android SDK Manager, select Tools from the main menu, then select Manage AVDs. This will open a new window. Since this is the first time, there won't be any virtual devices set up. Click on the "New" button. This opens yet another window where we define the properties of the virtual Android device. Here's the steps that you should use to set up a simple Android emulator device:

• Set the name of the device. This is important if you have more than one device.
• Set the target platform level.
• Set the size of the SD card (see below).
• Set the skin resolution.
• Create the device.

So, In the name text box, type "Test1". Under the target combo-box, select Android 2.1 - API Level 7. In the text box for "SD Card:" enter 512 and make sure the dropdown shows "MiB". Under "Skin", set the resolution to 800x600. (You can play with the other built-in sizes on your own.) Finally, click the "Create AVD" button. Soon, you'll see a message box saying that the AVD was created.

STEP 4 - Testing the AVD and installing SL4A and Python

Now, finally, we can have a bit of fun. Highlight the AVD you just created and click on the Start button. In the dialog box that pops up, simply click the "Launch" button. Now, you have to wait a few minutes for the virtual device to be created in memory, and the Android platform to be loaded and started. (We'll talk about speeding this process up in later runs.)



Once the AVD starts up and you have the "home" screen up, you will install SL4A. Using the browser or the google web search box on the home screen, search for "sl4a". Go to the downloads page, and you'll eventually find the web page for the downloads at http://code.google.com/p/android-scripting/downloads/list.

Scroll down the page until you get to the sl4a_r5 link. Open the link and tap on the "sl4a_r5.apk" link. Notice I said "tap" rather than "click". Start thinking about using your finger to tap the screen rather than clicking the mouse. It will make your programming transition easier. You'll see the download start. You may have to pull down the notification bar at the top to get to the downloaded file. Tap on that, then tap the install button.

Once the file is downloaded, you'll be presented with the option to open the downloaded app or to tap "Done" to exit the installer. Here we will want to tap "Open".

Now SL4A will start. You'll probably see a dialog asking if you will agree to usage tracking. Either accept or refuse this - it's up to you. Before we go any farther, you should know some keyboard shortcuts that will help you move around. Since we don't have a "real" Android device, buttons like Back, Home, and Menu, aren't available. You'll need them to navigate around. Here's a few important shortcuts.

Back - Escape
Home - Home
Menu - F2

Now we will want to download and install python into SL4A. To do this, first tap Menu (press F2). Select "View" from the menu. Now select "Interpreters". It looks like nothing happened, but tap Menu again (F2), then select "Add" from the popup. Now scroll down and select "Python 2.6.2". This will download the base package for Python for Android. Install the package, then open it. You will be presented with four options. Install, Import Modules, Browse Modules, and Uninstall Module. Tap on Install. This will start downloading and installing all the pieces of the latest Python for Android. This can take a few minutes.

Once everything is done, tap Back (escape key) until you get to the SL4A Interpreters screen. Now everything is loaded for us to play in Python on Android. Tap Python 2.6.2, and you'll be in the "standard" Python shell. This is just like the shell on your desktop. Type the following three lines, one at a time, into the shell. Be sure to wait for the ">>>" prompt each time.

```
import android

droid = android.Android()

droid.makeToast("Hello from Python on Android")
```

After you type the last line and press Enter, you'll see a rounded corner box at the center bottom of the shell that says "Hello from Python on Android". That's what the "droid.makeToast" command does.

You've written your first Python script for Android. Neat, huh?

Now let's create a shortcut on the Android home screen. Tap the Home key (Home button). If you chose the 2.1 platform, you should see a slider bar on the far right of the screen. If you chose another platform, it might be a square or rectangle consisting of small squares. Either way, this gets you to the Apps screen. Tap that, and find the SL4A icon. Now perform a "long tap" (long click), which will create a shortcut on the Home screen. Move the shortcut wherever you want it.

Next, we will create our first saved script. Go back into SL4A. You should be presented with the sample scripts that come with Python 4 Android. Tap the Menu button and select "Add". Select "Python 2.6.2" from the list. You'll be presented with the script editor. At the top is the filename box with ".py" already filled out. Below that is the editor window that already has the first two lines of our program entered for us. (I included them below in italics so you can check it. We also used these two lines in our first sample.)

```
import android

droid = android.Android()
```

Now, enter the following two lines to the python script.

```
uname = droid.dialogGetInput("What's your name?")

droid.makeToast("Hello %s from Python on Android") % uname.result
```

The first new line will create a dialog box (droid.dialogGetInput()) that asks for the user's name. The response is returned to our program in uname.result. We've already used the droid.makeToast() function.

Name the file andtest1.py, then tap Done, and tap "Save & Run". If everything worked, you should see a dialog box asking for your name. After you enter it, you should see the alert at the bottom of the screen saying "Hello Your Name from Python on Android".

That's all for this time. For now, there's a TON of documentation about SL4A for free on the web. You can play a bit on your own until next time. I'd suggest that you start by going to http://code.google.com/p/android-scripting/wiki/Tutorials.

Greg is the owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family. His website is www.thedesignatedgeek.net.

Beginning Python - Part 34

This time, we'll finish up using SL4A. We'll make a larger program and then send it to the virtual machine via ADB.

Let's deal with our code first. In this, we'll simply be trying out some of the "widgets" that are available to us when using SL4A. Start on your desktop using your favorite editor.

Enter the code shown top right and save it (but don't try to run it) as "atest.py".

The first line imports the android library. We create an instance of it in the second line. Line 3 creates and displays a dialog box with the title "Hello", the prompt of "What's your name?", a text box for the user to enter their name, and two buttons, "OK" and "Cancel". Once the user presses "OK", the response is returned in the variable uname. The last line (so far) then says "Hello {username} from python on Android!". This isn't new, we did this before. Now we'll add more code (above).

```
import android

droid = android.Android()
uname = droid.dialogGetInput("Hello","What's your name?")
droid.makeToast("Hello %s from python on Android!" % uname.result)


droid.dialogCreateAlert(uname.result,"Would you like to play a game?")
droid.dialogSetPositiveButtonText('Yes')
droid.dialogSetNegativeButtonText('No')
droid.dialogShow()
while True: #wait for events for up to 10 seconds...
      response = droid.eventWait(10000).result
      if response == None:
      break
      if response["name"] == "dialog":
      break
droid.dialogDismiss()
```

Save your code as atest1.py. We'll be sending this to our virtual machine after we discuss what it does.

Take a look at the first four lines we just entered. We create an alert type dialog asking "Would you like to play a game?". In the case of an alert type dialog, there's no text box to enter anything. The next two lines say to create two buttons, one with the text "Yes", which is a "positive" button, and one with the text "No", a "negative" button. The positive and negative buttons refer to the response returned - either "positive" or "negative". The next line then shows the dialog. The next seven lines wait for a response from the user.

We create a simple loop (while True:) then wait for a response for up to 10 seconds by using the droid.eventWait(value) call. The response (either "positive" or "negative") will be returned in - you guessed it - the response variable. If response has the name of "dialog", then we will break out of the loop and return the response. If nothing happens before the timeout occurs, we simply break out of the loop. The actual information returned in the response variable is something like this (assuming the "positive" or "Yes" button is pressed)...

```
{u'data': {u'which':
u'positive'}, u'name':
u'dialog', u'time':
1339021661398000.0}
```

You can see that the value is passed in the 'data' dictionary, the dialog key is in the 'name' dictionary, and there is a 'time' value that we don't care about here.

Finally we dismiss the dialog box.

Before we can send our code to the virtual machine, we have to start the virtual machine. Start your Android emulator. Once it starts up, notice that the title bar has four digits at the start of the title. This is the port that the machine is listening on. In my case (and probably yours) it's 5554.

Now, let's push it to our virtual machine. Open a terminal window and change to the folder you saved the code in. Assuming you have set your path to include the SDK, type

```
adb devices
```

This asks adb to show any devices that are connected. This can include not only the Android emulator but also any smartphones, tablets, or other Android devices. You should see something like this...

```
List of devices attached
emulator-5554    device
```

Now that we are sure that our device is attached, we want to push the application to the device. The syntax is...

```
adb push source_filename
destination_path_and_filename
```

So, in my case it would be...

```
adb push atest1.py
/sdcard/sl4a/scripts/atest1.p
y
```

If everything works correctly, you'll get a rather disappointing message similar to this...

```
11 KB/s (570 bytes in 0.046s)
```

Now, on the Android emulator, start SL4A. You should see all the python scripts, and, in there you should see atest1.py. Tap (click) on 'atest1.py', and you'll see a popup dialog with 6 icons. From left to right, they are "Run in a dialog window", "Run outside of a window", "Edit", "Save", "Delete", and "Open in an external editor". Right now, tap (click) on the far left icon "Run in a dialog window" so you can see what happens.

You'll see the first dialog asking for your name. Enter something in the box and tap (click) the 'Ok' button. You'll see the hello message. Next, you'll see the alert dialog. Tap (click) on either button to dismiss the dialog. We aren't looking at the responses yet so it doesn't matter which one you choose. Now we'll add some more code (top right).

```
    if response==None:
        print "Timed out."
    else:
        rdialog=response["data"]
```

I'm sure you can figure out that this set of code simply checks the response, and, if it's 'None' due to a timeout, we simply print "Timed out." And, if it's actually something we want, then we assign the data to the variable rdialog. Now add the next bit of code (below)...

This part of the code will look at the data passed back by the button-press event. We check to see if the response has a "which" key, and, if so, it's a legitimate button press for us. We then check to see if the result is a "positive" ('Ok' button) response. If so, we'll create another alert dialog, but this time, we will add a list of items for the user to choose from. In this case, we offer the

```
        if rdialog.has_key("which"):
        result=rdialog["which"]
        if result=="positive":
            droid.dialogCreateAlert("Play a Game","Select a game to play")
            droid.dialogSetItems(['Checkers','Chess','Hangman','Thermal
Nuclear War']) # 0,1,2,3
            droid.dialogShow()
            resp = droid.dialogGetResponse()
```

user to select from a list including Checkers, Chess, Hangman, and Thermal Nuclear War, and we assign the values 0 to 3 to each item. (Is this starting to seem familiar? Yes, it’s from a movie.) We then display the dialog and wait for a response. The part of the response we are interested in is in the form of a dictionary. Assuming the user tapped (clicked) on Chess, the resulting response comes back like this...

```
Result(id=12,
result={u'item':1},
error=None)
```

In this case, we are really interested in the result portion of the returned data. The selection is #1 and is held in the ‘item’ key. Here’s the next part of the code (above right)...

```
if resp.result.has_key("item"):
    sel = resp.result['item']
    if sel == 0:
        droid.makeToast("Enjoy your checkers game")
    elif sel == 1:
        droid.makeToast("I like Chess")
    elif sel == 2:
        droid.makeToast("Want to 'hang around' for a while?")
    else:
        droid.makeToast("The only way to win is not to play...")
```

Here we check to see if the response has the key “item”, and, if so, assign it to the variable “sel”. Now we use an if/elif/else loop to check the values and deal with whichever is selected. We use the droid.makeToast function to display our response. Of course, you could add your own code here. Now for the last of the code (bottom right)...

```
            elif result=="negative":
                droid.makeToast("Sorry.  See you later.")
      elif rdialog.has_key("canceled"):
          print "Sorry you can't make up your mind."
      else:
          print "unknown response=",response
print "Done"
```

As you can see, we simply respond to the other types of button-presses here.

Save, push, and run the program.

As you can see, SL4A gives you the ability to make “GUIfied” applications, but not full gui apps. This however, should not keep you from going forward and starting to write your own programs for Android. Don’t expect to put these up on the “market”. Most people really want full GUI type apps. We’ll look at that next time. For more information on using SL4A, simply do a web search and you’ll find lots of tutorials and more information.

By the way, you can push directly to your smartphone or tablet in the same way.

As usual, the code has been put up on pastebin at http://pastebin.com/REkFYcSU

See you next time.

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Beginning Python - Part 35

This time, we are going to take a short detour from our exploration of Android programming, and look at a new framework for GUI programming called ***Kivy***. You'll want to head over to http://kivy.org and download and install the package – before getting too far into this month's installment. The Ubuntu installation instructions can be found at http://kivy.org/docs/installation/installation-ubuntu.html.

First off, Kivy is an open source library that makes use of multi-touch displays. If that isn't cool enough, it's also cross-platform, which means that it will run on Linux, Windows, Mac OSX, IOS and Android. Now you can see why we are talking about this. But remember, for the most part, anything you code using Kivy, can run on any of the above platforms without recoding.

Before we go too far, let me make a couple of statements. Kivy is VERY powerful. Kivy gives you a new set of tools to make your GUI programming. All that having been said, Kivy is also fairly complicated to deal with. You are limited to the widgets that they have provided. In addition, there is no GUI designer for Kivy, so you have to do a GREAT deal of pre-planning before you try to do anything complicated. Also remember, Kivy is continually under development so things can change quickly. So far, I haven't found any of my test code that has broken by a new version of Kivy, but that's always a possibility.

Rather than jump in and create our own code this month, we'll look at some of the examples that come with Kivy, and, next month, we'll "roll our own".

Once you've unpacked Kivy into its own folder, use a terminal and change to that folder. Mine is in /home/greg/Kivy-1.3.0. Now change to the examples folder, then to the widgets folder. Let's look at the accordion_1.py example.

It's very simple, but shows a really neat widget. Below is their code.

```
from kivy.uix.accordion import Accordion, AccordionItem
from kivy.uix.label import Label
from kivy.app import App

class AccordionApp(App):
      def build(self):
            root = Accordion()
            for x in xrange(5):
                  item = AccordionItem(title='Title %d' % x)
                  item.add_widget(Label(text='Very big content\n' * 10))
                  root.add_widget(item)
            return root

if __name__ == '__main__':
      AccordionApp().run()
```

As you can see, the first three lines are import statements. Any widget you use must be imported, and you must always import App from kivy.app.

The next eight lines are the main application class. The class is defined, then a routine called build is created. You will almost always have a build routine somewhere in your Kivy programs. Next we set a root object from the Accordion widget. Next we create five AccordionItems and set their title. We then add ten labels with the text "Very big content". We then add each label to the root widget (the Accordion) and then finally we return the root object. This, in essence, displays the root object in the window that Kivy creates for us. Finally we have the "if __name__" statement and then run the application.

Go ahead and run it to see what it does.

You will see that in a moment or two, a window opens up with five vertical bars in it. Clicking on a bar causes it to open up revealing the ten labels. Of course, each bar has the same text in the ten labels, but you can figure out how to fix that.

The Accordion widget can be used for any number of things, but the thing that has always jumped to my mind is for a configuration screen... each bar being a different configuration set.

Next we'll look at the textalign.py example. It's not as "sexy" as the last one, but it's a good example that gives you some important information for later on.

Before we look at the code, run the program.

What you should see is a label at the top of the window, a set of nine red boxes with text in a 3x3 grid, and four buttons along the bottom of the window. As you click (tap) each of the buttons, the alignment of the text within the red boxes will change. The main reason you would want to pay attention to this example is how to use and control some of the important widgets as well as how to change the alignment in your widgets, which is not completely intuitive.

Above right is their code for this one. I'll break it into pieces. First the import code (above right).

Below is something special. They created a class with no code in it. I'll discuss that in a few minutes:

```
from kivy.app import App
from kivy.uix.label import Label
from kivy.uix.gridlayout import GridLayout
from kivy.uix.floatlayout import FloatLayout
from kivy.properties import ObjectProperty
```

```
class BoundedLabel(Label):

  pass
```

Next a class called "Selector" (below) is created:

```
class Selector(FloatLayout):

app = ObjectProperty(None)
```

Now the Application class is created.

Here the routine select is created. A GridLayout widget is created (called grid) which has 3 rows and 3 columns. This grid is going to hold the nine red boxes.

```
for valign in ('bottom',
'middle', 'top'):

for halign in ('left',
'center', 'right'):
```

Here we have two loops, one inner and one outer.

```
label = BoundedLabel(text='V:
%s\nH: %s' % (valign,
halign),

size_hint=(None, None),

halign=halign, valign=valign)
```

In the code above, an instance of the BoundedLabel widget is created, once for each of the nine red boxes. You might want to stop here and say "But wait! There isn't a BoundedLabel widget. It just has a pass statement in it." Well, yes, and no. We are creating an instance of a custom widget. As I said a little bit above, we'll talk more about that in a minute.

```
class TextAlignApp(App):

    def select(self, case):

    grid = GridLayout(rows=3, cols=3, spacing=10, size_hint=(None, None),
                 pos_hint={'center_x': .5, 'center_y': .5})
```

In the code block (top right, next page), we examine the variable 'case' which is passed into the select routine.

Here, the grid is removed, to clear the screen.

```
if self.grid:

self.root.remove_widget(self.grid)
```

The bind method here sets the size, and the grid is added to the root object.

```
grid.bind(minimum_size=grid.setter('size'))

self.grid = grid

self.root.add_widget(grid)
```

Remember in the last example I said that you will almost always use a build routine. Here is the one for this example. The root object is created with a FloatLayout widget. Next (middle right) we call the Selector class to create a Selector object, then it's added to the root object, and we initialize the display by calling self.select(0).

Finally the application is allowed to run.

```
TextAlignApp().run()
```

Now, before we can go any further, we need to clear up a few things. First, if you look in the folder that holds the .py file, you'll notice another file called textalign.kv. This is a special file that Kivy uses to allow you to create your own widgets and rules. When your Kivy application starts, it looks in the same directory for the .kv helper file. If it is there, then it loads it first. Here's the code in the .kv file.

This first line tells Kivy what minimum version of Kivy that must be used to run this app.

```
#:kivy 1.0
```

Here the BoundedLabel widget is created. Each of the red boxes in the application is a BoundedLabel.

Color sets the background color of the box to red (rgb: 1,0,0). The Rectangle widget creates a (you guessed it) rectangle. When we call the BoundedLabel widget in the actual application code, we are passing a label as the parent. The size and position (here in the .kv file) are set to whatever the size and position of the label are.

```
if case == 0:
                      label.text_size = (None, None)
          elif case == 1:
                      label.text_size = (label.width, None)
          elif case == 2:
          label.text_size = (None, label.height)
          else:
          label.text_size = label.size
                      grid.add_widget(label)

     def build(self):
     self.root = FloatLayout()
          self.selector = Selector(app=self)
     self.root.add_widget(self.selector)
     self.grid = None
          self.select(0)
     return self.root

<BoundedLabel>:
     canvas.before:
          Color:
               rgb: 1, 0, 0
     Rectangle:
          pos: self.pos
               size: self.size
```

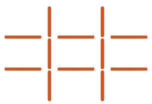
Here (right, next page) the Selector widget is created. This is the four buttons that appear at the bottom of the window as well as the label across the top of the window.

Notice that the label that makes up the title at the top of the window has a position (pos_hint) as top, has a height of 50 pixels and a font size of 16. Each of the buttons has an alignment for the text of center. The on_release statement is a bind-like statement so that, when the button is released, it calls (in this case) root.app.select with a case value.

Hopefully, this is beginning to make sense now. You can see why Kivy is so powerful.

Let's talk for a moment about two widgets that I have passed over in the discussion of the application code, The GridLayout and the FloatLayout.

The GridLayout is a parent widget that uses a row and column description to allow widgets to be placed in each cell. In this case, it is a 3x3 grid (like a Tic-Tac-Toe (or Naughts and Crosses) board).



When you want to place a widget into a GridLayout, you use the add_widget method. Here lies a problem. You can't specify which control goes into which grid cell other than the order in which you add them. In addition, each widget is added from left to right, top to bottom. You can't have an empty cell. Of course, you can cheat. I'll leave that up to you to figure out.

The FloatLayout widget seems to be just a parent container for other child widgets.

I've glossed over a few points for now. My intent this time was simply to get you somewhat excited about the possibilities that Kivy has to offer. In the next couple of articles, we'll continue to explore what Kivy has for us, how to use various widgets, and how to create an APK to publish our applications to Android.

Until then, explore more of the examples in Kivy, and be sure to go to the documentation page for Kivy at http://kivy.org/docs/.

```
<Selector>:
    Label:
    pos_hint: {'top': 1}
        size_hint_y: None
    height: 50
        font_size: 16
    text: 'Demonstration of text valign and halign'
    BoxLayout:
        size_hint_y: None
    height: 50
        ToggleButton:
            halign: 'center'
        group: 'case'
            text: 'label.text_size =\n(None, None)'
            on_release: root.app.select(0)
            state: 'down'
    ToggleButton:
            halign: 'center'
        group: 'case'
            text: 'label.text_size =\n(label.width, None)'
            on_release: root.app.select(1)
    ToggleButton:
            halign: 'center'
            group: 'case'
        text: 'label.text_size =\n(None, label.height)'
            on_release: root.app.select(2)
    ToggleButton:
            halign: 'center'
            group: 'case'
        text: 'label.text_size =\n(label.width, label.height)'
        on_release: root.app.select(3)
```

Greg is the owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family. His website is

Beginning Python - Part 36

Before I begin, I want to note that this article marks three years of the Beginning Programming using Python series. I want to thank Ronnie and the entire staff of Full Circle Magazine for all their support and especially, you, the readers. I NEVER thought that this would continue this long.

I also want to take a second to note that there has been some comments floating around the ether that, after three years, the word "Beginning" might be misplaced in the title of this series. After all, after three years, would you still be a beginner? Well, on some levels, I agree. However, I still get comments from readers saying that they just found the series and Full Circle Magazine, and that they are now running back to the beginning of the series. So, those people ARE beginners. So, as of part 37, we'll drop "Beginning" from the series title.

Now to the actual meat of this article... more on Kivy.

Imagine you play guitar. Not air guitar, but an actual guitar. However, you aren't the best guitar player, and some chords are problematical for you. For example, you know the standard C, E, G, F type chords, but some chords – like F# minor or C# minor – while doable, are hard to get your fingers set in a fast song. What do you do, especially if the gig is only a couple of weeks away and you HAVE to be up to speed TODAY? The workaround for this is to use the Capo (that funny clippy thing that you see sometimes on the neck of the guitar). This raises the key of the guitar and you use different chords to match the rest of the band. This is called transposing. Sometimes, you can transpose on the fly in your head. Sometimes, it's easier to sit down on paper and work out that if, for example, the chord is F# minor and you put the capo on fret 2, you can simply play an E minor. But that takes time. Let's make an app that allows you to simply scroll through the fret positions to find the easiest chords to play.

Our app will be fairly simple. A title label, a button with our basic scale as the text, a scrollview (a wonderful parent widget that holds other controls and allows you to "fling" the inside of the control to scroll) holding a number of buttons that have repositioned scales as the text, and an exit button. It will look SOMETHING like the text below.

Start with a new python file named main.py. This will be important if/when you decide to create an Android app from Kivy. Now we'll add our import statements which are shown on the next page, top right.

Notice the second line, "kivy.require('1.0.8')". This allows you to make sure that you can use the latest and greatest goodies that Kivy provides. Also notice that we are including a system exit (line 3). We'll eventually include an exit button.

Here is the beginning of our class called "Transpose".

```
--------------------------------------------------------------------
                       Transposer Ver 0.1

       C   C#/Db   D   D#/Eb    E     F    F#/Gb    G   G#/Ab   A    A#/Bb   B      C
   ______________________________________________________________________
  1| C#/Db   D   D#/Eb   E       F   F#/Gb    G    G#/Ab   A   A#/Bb   B          C    C#/Db
  2|   D   D#/Eb   E       F    F#/Gb   G    G#/Ab   A    A#/Bb   B     C   C#/Db D
--------------------------------------------------------------------
```

```
class Transpose(App):

    def exit(instance):

        sys.exit()
```

Now we work on our build routine (middle right). This is needed for every Kivy app.

This looks rather confusing. Unfortunately, the editor doesn't always keep spaces correct even in a mono-spaced font. The idea is that the text1 string is a simple scale starting with the note "C". Each should be centered within 5 spaces. Like the text shown bottom right.

The text2 string should be the same thing but repeated. We will use an offset into the text2 string to fill in the button text within the scrollview widget.

Now we create the root object (which is our main window) containing a GridLayout widget. If you remember WAY back when we were doing other GUI development for Glade, there was a grid view widget. Well, the GridLayout here is pretty much the same. In this case, we have a grid that has one column and three rows. In each of the cells created in the grid, we can put other widgets. Remember, we can't define which widget goes where other than in the order in which we place the widgets.

```
root =
GridLayout(orientation='verti
cal', spacing=10,
cols=1,rows=3)
```

In this case, the representation is as follows....

```
-----------------------------
(0)              title label
-----------------------------
(1)              main button
-----------------------------
(2)              scrollview
-----------------------------
```

The scrollview contains multiple items – in our case buttons. Next, we create the label which will be at the top of our application.

```
import kivy
kivy.require('1.0.8')
from sys import exit
from kivy.app import App
from kivy.core.window import Window
from kivy.uix.button import Button
from kivy.uix.label import Label
from kivy.uix.anchorlayout import AnchorLayout
from kivy.uix.scrollview import ScrollView
from kivy.uix.gridlayout import GridLayout
```

```
lbl = Label(text='Transposer
Ver 0.1',
      font_size=20,
      size_hint=(None,None),
      size=(480,20),
      padding=(10,10))
```

The properties that are set should be fairly self-explanatory. The only ones that might give you some trouble would be the padding and size_hint properties. The padding is the number of pixels around the item in an x,y reference. Taken directly from the Kivy documentation size_hint (for X which is same as Y) is defined as:

X size hint. Represents how much space the widget should use in the direction of the X axis, relative to its parent's width. Only Layout and Window make use of the hint. The value is in percent as a float from 0. to 1., where 1. means the full size of

```
    def build(self):
        #-------------------------------------------------------------
        text1 = "  C  C#/Db  D  D#/Eb  E    F  F#/Gb  G  G#/Ab  A  A#/Bb  B  C"
        text2 = "  C  C#/Db  D  D#/Eb  E    F  F#/Gb  G  G#/Ab  A  A#/Bb  B  C  C#/Db  D
D#/Eb  E    F  F#/Gb  G  G#/Ab  A  A#/Bb  B     C  C#/Db"
        #-------------------------------------------------------------
```

```
|    |    |    |    |    |    |    |    |    |    |    |
12345678901234567890123456789012345678901234567890123456
  C  C#/Db  E    F  F#/Gb  G  G#/Ab  A  A#/Bb  B    C
```

his parent. 0.5 represents 50%.

In this case, size_hint is set to none, which defaults to 100% or 1. This will be more important (and convoluted) later on.

Now we define our "main" button (next page, top right). This is a static reference for the scale.

Again, most of this should be fairly clear.

Now we add the widgets to the root object, which is the GridLayout widget. The label (lbl) goes in the first cell, the button (btn1) goes in the second.

```
#---------------------------
root.add_widget(lbl)
root.add_widget(btn1)
#---------------------------
```

Now comes some harder-to-understand code. We create another GridLayout object and call it "s". We then bind it to the height of the next widget which, in this case, will be the ScrollView, NOT the buttons.

```
s = GridLayout(cols=1,
spacing = 10, size_hint_y =
None)
s.bind(minimum_height=s.sette
r('height'))
```

Now (middle right) we create 20 buttons, fill in the text property, and then add it to the GridLayout.

Now we create the ScrollView, set its size, and add it to the root GridLayout.

```
sv =
ScrollView(size_hint=(N
one, None),
size=(600,400))

sv.center =
Window.center

root.add_widget(sv)
```

Lastly, we add the GridLayout that holds all our buttons into the ScrollView, and return the root object to the application.

```
sv.add_widget(s)

return root
```

Finally, we have our "if __name__" routine. Notice that we are setting ourselves up for the possibility of using the application as an android app.

```
if __name__ in
('__main__','__android__'):

    Transpose().run()
```

```
    btn1 = Button(text = "   " + text1,size=(680,40),
            size_hint=(None, None),
            halign='left',
            font_name='data/fonts/DroidSansMono.ttf',
            padding=(20,20))
```

```
for i in range(0,19):
    if i <= 12:
        if i < 10:
            t1 = " " + str(i) + "| "
        else:
            t1 = str(i) + "| "
    else:
        t1 = ''
        text2 = ''
    btn = Button(text = t1 + text2[(i*5):(i*5)+65],
            size=(680, 40),
            size_hint=(None,None),
            halign='left',
            font_name='data/fonts/DroidSansMono.ttf')
    s.add_widget(btn)
#---------------------------------------------------------------
```

Now you might wonder why I used buttons instead of labels for all our textual objects. That's because labels in Kivy don't have any kind of visible border by default. We will play with this in the next installment. We will also add an exit button and a little bit more.

The source code can be found on PasteBin at http://pastebin.com/hsicnyt1

Until next time, enjoy and thank you for putting up with me for three years!

Greg is the owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family. His website is

Programming in Python - Part 37

This month, we'll finish up the transposer program that we wrote in Kivy. Hopefully, you saved the code from last time, because we'll be building upon it. If not, grab the code from FCM#64.

Let's start by recapping what we did last month. We created an application that allows for a guitarist to quickly transpose from one key to the other. The ultimate goal is to be able to run this app not only on your Linux or Windows box, but on an android device as well. I take mine on my tablet whenever I go to band practice. I was going to deal with packaging our project for Android, but some things have changed in the method to do that, so we'll work on that next month.

The app, as we left it last time, looked like that shown below left.

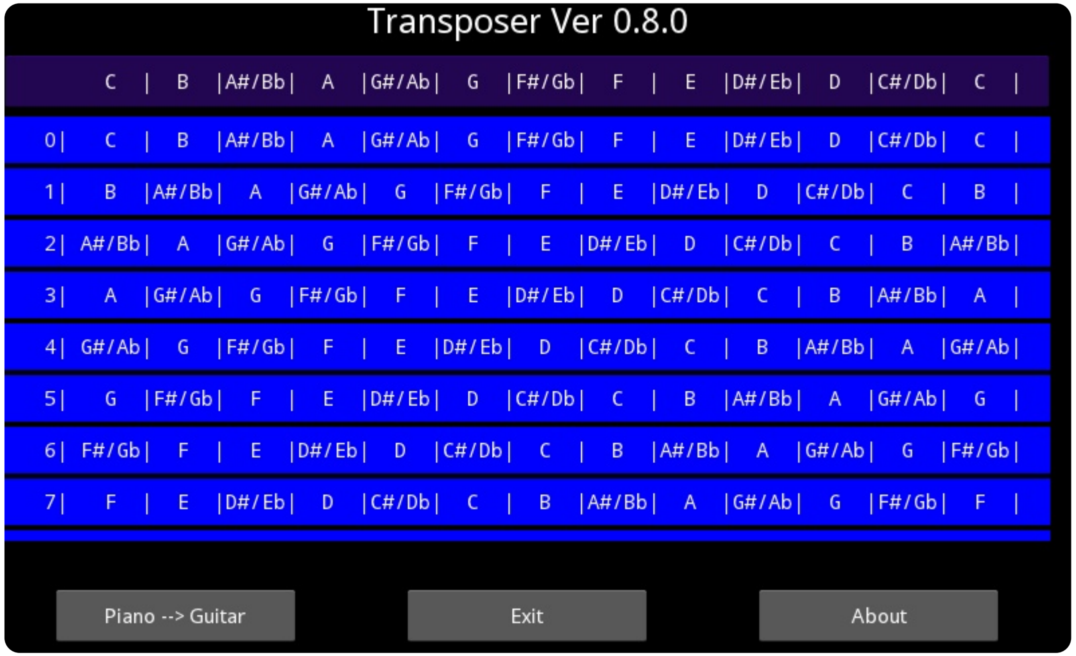
When we are done, it should look like the screen below right.

The first thing you will notice is that there are blue labels rather than boring gray ones. The next is that there are three buttons. Finally the scrollable labels are closer to the entire width of the window. Other than that, it's pretty much (visually) the same. One of the buttons is an "about" button that will pop up simple information, but it explains how to make a simple popup. One of the buttons is an exit button. The other button will swap the label text to make it easy to transpose from piano to guitar or guitar to piano.

```
#:kivy 1.0
#:import kivy kivy

<BoundedLabel>:
      canvas.before:
      Color:
            rgb: 0, 0, 1
      Rectangle:
            pos: self.pos
            size: self.size
```

Let's get started by creating a .kv file (above right). This is what will give us the colored labels. It's a very simple file.



The first two lines are required. They basically say what version of Kivy to expect. Next we create a new type of label called 'BoundedLabel'. The color is set with RGB values (between 0 and 1, which can be considered as 100 percent), and as you can see the blue value is set at 100 percent. We will also create a rectangle which is the actual label. Save this as "transpose.kv". You must use the name of the class that will be using it.

Now that you have that completed, add the following lines just before the transpose class to the source file from last time:

```
class BoundedLabel(Label):

    pass
```

To make it work, all we need is a definition. Before we go any further, add the following line to the import section:

```
from kivy.uix.popup import
Popup
```

This allows us to create the popup later on. Now, in the Transpose class, just inside the def build routine, place the code shown above right.

```
def LoadLabels(w):
    if w == 0:
            tex0 = self.text1
            tex1 = self.text2
        else:
            tex0 = self.text3
            tex1 = self.text4
        for i in range(0,22):
            if i <= 12:
                if i < 10:
                    t1 = " " + str(i) + "| "
                else:
                    t1 = str(i) + "| "
                    t = tex1
            else:
                t1 = ''
                t = ''
            l = BoundedLabel(text=t1+t[(i*6):(i*6)+78], size=(780, 35),
                size_hint=(None,None),halign='left',
                font_name='data/fonts/DroidSansMono.ttf')
            s.add_widget(l)
```

The LoadLabels routine will give us the colored labels (BoundedLabel) and the swap ability. You saw most of this last time. We pass a value to the "w" parameter to determine which text is being displayed. The l=BoundedLabel line is pretty much the same line from last time, with the exception that, this time, we are using a BoundedLabel widget instead of a Button widget. The LoadLabels will mainly be called f

```
def Swap(instance):
    if self.whichway == 0:
        self.whichway = 1
        btnWhich.text = "Guitar --> Piano"
        btn1.text = "    " + self.text3
        s.clear_widgets()
        LoadLabels(1)
    else:
        self.whichway = 0
        btnWhich.text = "Piano --> Guitar"
        btn1.text = "    " + self.text1
        s.clear_widgets()
        LoadLabels(0)
```

```
self.whichway=0

self.text1 = "  C   |   B   |A#/Bb|   A   |G#/Ab|   G   |F#/Gb|   F   |   E   |D#/Eb|   D   |C#/Db|   C   |"

self.text2 = "  C   |   B   |A#/Bb|   A   |G#/Ab|   G   |F#/Gb|   F   |   E   |D#/Eb|   D   |C#/Db|   C   |   B   |A#/Bb|   A   |G#/Ab|   G   |F#/Gb|   F   |   E   |D#/Ab|   D   |C#/Db|   C   |"

self.text3 = "  C   |C#/Db|   D   |D#/Eb|   E   |   F   |F#/Gb|   G   |G#/Ab|   A   |A#/Bb|   B   |   C   |"

self.text4 = "  C   |C#/Db|   D   |D#/Eb|   E   |   F   |F#/Gb|   G   |G#/Ab|   A   |A#/Bb|   B   |   C   |C#/Db|   D   |D#/Eb|   E   |   F   |F#/Gb|   G   |G#/Ab|   A   |A#/Bb|   B   |   C   |C#/Db|"
```

rom the next routine, Swap. Place this code (shown right) below LoadLabels.

You can see that this routine is pretty self explanatory. We use a variable (self.whichway) to determine "which way" the labels are displaying... from Guitar to Piano or Piano to Guitar.

Be sure to save your work at this point, since we are going to be making a lot of changes from here on.

Replace the lines defining text1 and text two with the lines shown above.

We set self.whichway to 0 which will be our default for the swap procedure. Then we define four strings instead of the two we had last time. You might notice that strings text3 and text4 are simple reversals of text1 and text2.

Now we will tweak the root line definition. Change it from...

```
root = GridLayout(orientation='vertical', spacing=10, cols=1,rows=3)
```

to

```
root = GridLayout(orientation='vertical', spacing=6, cols=1, rows=4, row_default_height=40)
```

We've changed the spacing from 10 to 6 and set the default row height to 40 pixels. Change the text for the label (next line) to "text='Transposer Ver 0.8.0'". Everything else stays the same on this line.

Now change the button definition line from...

```
btn1 = Button(text = "   " + text1,size=(680,40),
    size_hint=(None,None),
    halign='left',
font_name='data/fonts/DroidSansMono.ttf',
    padding=(20,20))
```

to:

```
btn1 = Button(text = "      " + self.text1,size=(780,20),
    size_hint=(None, None),
    halign='left',
font_name='data/fonts/DroidSansMono.ttf',
    padding=(20,2),
background_color=[0.39,0.07,.92,1])
```

Notice that I've changed the formatting of the first definition for clarity. The big changes are the size change from 680,40 to 780,20 and the background color for the button. Remember, we can change the background color for buttons, not "standard" labels.

Next, we will define three AnchorLayout widgets for the three buttons that we will add in later. I named them al0 (AnchorLayout0), al1 and al2. We also add the code for the About Popup, and define our buttons along with the bind statements. This is shown on the next page, top left.

Find the "s = GridLayout" line and change the spacing from 10 to 4. Next, add the following line after the s.bind line (right before the for loop):

```
LoadLabels(0)
```

This calls the LoadLabels routine with our default "which" of 0.

Next, comment out the entire for loop code. This starts with "for i in range(0,19):" and ends with "s.add_widget(btn)". We don't need this since the LoadLabels routine does this for us.

```
al0 = AnchorLayout()
al1 = AnchorLayout()
al2 = AnchorLayout()
popup = Popup(title='About Transposer',
        content=Label(text='Written by G.D. Walters'),
        size_hint=(None,None),size=(400,400))
btnWhich = Button(text = "Piano --> Guitar",
           size=(180,40),size_hint=(None,None))
btnWhich.bind(on_release=Swap)
btnAbout = Button(text="About",size=(180,40),
           size_hint=(None,None))
btnAbout.bind(on_release=ShowAbout)
btnExit = Button(text="Exit", size=(180,40),
          size_hint=(None,None))
btnExit.bind(on_release=exit)
```

Now, save your code and try to run it. You should see a deep purple button at the top, and our pretty blue BoundLabels. Plus, you will notice that the BoundLabels in the scroll window are closer together, which makes it much easier to read.

We are almost through with our code, but we still have a few things to do. After the “sv = ScrollView” line add the following line...

```
sv.size = (720, 320)
```

This sets the size of the ScrollView widget to 720 by 320 – which makes it wider within the root window. Now, before the “return root” line, add the code shown top right.

Here we add the three buttons to the AnchorLayout widgets, create a GridLayout to hold the AnchorLayouts, and then finally add the AnchorLayouts to the GridLayout.

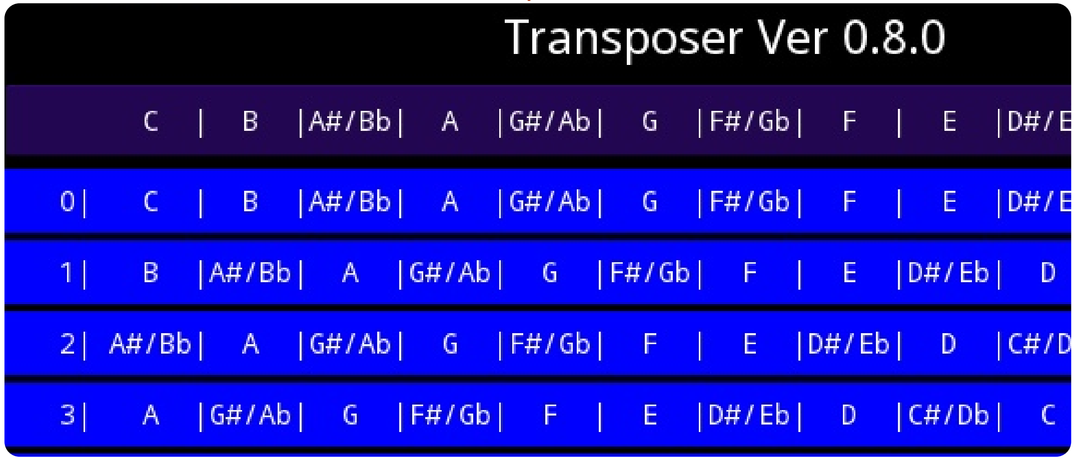
Go back just below the “def Swap” routine and add the following...

```
def ShowAbout(instance):

  popup.open()
```

That’s it. Save and run the code. If you click on the About

```
        al0.add_widget(btnWhich)
        al1.add_widget(btnExit)
        al2.add_widget(btnAbout)
        bgl = GridLayout(orientation='vertical',
              spacing=6, cols=3,rows=1,
              row_default_height=40)
        bgl.add_widget(al0)
        bgl.add_widget(al1)
        bgl.add_widget(al2)
```



button, you will see the simple popup. Just click anywhere outside of the popup to make it go away.

Now our code is written. You can find the full code at http://pastebin.com/GftmjENs

Next, we need to create our android package... but that will have to wait for next time.

If you want to get set up and try packaging for Android before next month, you should go to http://kivy.org/docs/guide/packaging-android.html for the documentation on this. Be sure to follow the documentation carefully.

See you next month.

Programming In Python: Pt 38

As I promised in part 37, we will take the transposer app that we created, and create an APK to install it on your android device.

Before we get started, let's make sure we have everything ready. First thing we need is the two files we created last time in a folder that you can easily access. Let's call it "transposer". Create it in your home directory. Next, copy the two files (transpose.kv and transpose.py) into that folder. Now rename transpose.py to main.py. This part is important.

Next, we need to reference the kivy packaging instructions in a web browser. The link is http://kivy.org/docs/guide/packaging-android.html. We will be using this for the next steps, but not exactly as the Kivy people intended. You should have the android SDK from our earlier lesson. Ideally, you will go through and get all the software that is listed there, but for our purposes, you can just follow along here. You will need to download the python-for-android software. Open a terminal window and type the following...

```
git clone
git://github.com/kivy/python-for-android
```

This will download and set up the software that we need to continue. Now, in a terminal window, change your directory to the python-for-android/dist/default folder.

Now you will find a file called build.py. This is what will do all the work for us. Now comes the magic.

The build.py program will take various command-line arguments and create the APK for you. Shown above is the syntax for build.py taken directly from the Kivy documentation.

```
./build.py --dir <path to your app>
           --name "<title>"
           --package <org.of.your.app>
           --version <human version>
           --icon <path to an icon to use>
           --orientation <landscape|portrait>
           --permission <android permission like VIBRATE> (multiple allowed)
           <debug|release> <installd|installr|...>
```

For our use, we will use the following command (the "\" is a line continuation character):

```
./build.py --dir ~/transposer
--package
org.RainyDay.transposer \
 --name "RainyDay Transposer"
--version 1.0.0 debug
```

Let's look at the pieces of the command...

./build.py - this is the application
--dir ~/transposer - this is the directory where our application code lives.
--package org.RainyDay.transposer - This is the name of the package
--name "RainyDay Transposer" - this is the name of the application that will show up in the apps drawer.
--version 1.0.0 - the version of our application
debug - this is the level of release (debug or release)

Once you execute this, assuming that everything worked as expected, you should have a number of files in the /bin folder. The one you are looking for is titled "RainyDayTransposer-1.0.0-debug.apk". You can copy this to your android device using your favorite file manager app, and install it just like any other application from the various app stores.

That's all I have time for this month.

Programming In Python: Pt 39

Many, many months ago, we worked with API calls for Weather Underground. Actually, it was in part 11 which was back in issue #37. Well, we are going to deal with APIs again, this time for a website named TVRage (http://tvrage.com). If you aren't familiar with this site, it deals with television shows. So far, every TV show that I could think of has been in their system. In this series of articles, we are going to revisit XML, APIs, and ElementTree to create a wrapper library that will allow us to create a small library which simplifies our retrieval of TV information on our favorite shows.

Now, I mentioned a wrapper library. What's that? In simple terms, when you create or use a wrapper library, you are using a set of code that "wraps" the complexity of the website's API into an easy-to-use library. Before we get started, I need to make a few things clear. First, this is a free service. However, they do request donations for use of their API. If you feel that this is a worthwhile service, please consider donating $10 US or more. Second, you should register at their website and get your own API key. It's free, so there's really no reason not to, especially if you are going to use the information provided here. In addition, you have access to a few other fields of information like series and episode summaries that are not included in the unregistered version. Third, they are hard at work at updating the API. This means that when you get to seeing this article, their API might have changed. We'll be using the public feeds, which are free for everyone to use as of December 2012. The API website is located at http://services.tvrage.com/info.php?page=main and shows a few examples of the types of information that are available.

Now, let's begin looking at the API and how we can use it.

Using their API, we can get very specific information about the show itself and/or we can get episode level information. There are basically three steps to finding information about TV Shows. Here are the steps:

- Search their database looking for the show name to get the specific Show ID which must be used to get more data. Think of the showid value as a key directly into a record set in a database, which in this case it is.
- Once you have the Show ID, obtain the show level information.
- Finally, gather the information about a specific episode. This comes from a list of each and every episode that the show has had to date.

There are three basic web calls we will make to get this information. First is the search call, second the show information call, and finally the the episode list call.

Here are the base calls that we will use...

- Search for ShowID based on a show name - **http://services.tvrage.com/feeds/search.php?show={SomeShow}**
- Pull the show level data based on the Show ID (sid) - **http://services.tvrage.com/feeds/showinfo.php?sid={SomeShowID}**
- Pull the episode list for Show ID (sid) - **http://services.tvrage.com/feeds/episode_list.php?sid={SomeShowID}**

```
<?xml version="1.0" encoding="UTF-8" ?>
<ROOT TAG>
   <PARENT TAG>
      <CHILD TAG 1>DATA</CLOSING CHILD TAG 1>
      <CHILD TAG 2>DATA</CLOSING CHILD TAG 2>
      <CHILD TAG 3>DATA</CLOSING CHILD TAG 3>
   </CLOSING PARENT TAG>
</CLOSING ROOT TAG>
```

What gets returned is a stream of data in XML format. Let's take a moment to review what XML looks like. The first line should always be similar to the one shown below to be considered a proper XML data stream (below).

Every piece of data is enclosed within a defining tag and end-tag. Sometimes you will have a child tag that is a parent tag in itself like this...

```
<CHILD PARENT TAG>

<CHILD TAG 1>DATA</CLOSING
CHILD TAG 1>

</CLOSING CHILD PARENT TAG>
```

You also may see a tag that has an attribute associated with it:

```
<TAG INFORMATION = VALUE>

<CHILD TAG>DATA</CLOSING
CHILD TAG>

</CLOSING TAG>
```

Sometimes, you might see a tag with no data associated with it. It would come across like this...

```
<prodnum/>
```

Sometimes, if there is no information for a specific tag, the tag itself just won't be there. Your program will have to deal with these possibilities.

So, when we go through and deal with the XML data, we start with the root tag, and parse each tag – looking for the data we care about. In some instances we want everything; in others, we care about only certain pieces of the information.

Now, let's look at the first call and see what gets returned. Assume the show we are looking for is Buffy the Vampire Slayer. Our search call would look like this:

```
http://services.tvrage.com/fe
eds/search.php?show=buffy
```

The returned XML file would look like this: http://pastebin.com/Eh6ZtJ9N.

Note that I put the indents in myself to make it easier for you to read. Now let's break down the XML file to see what we actually have.

<Results> - This is the ROOT of the XML data. The last line of the stream we get back should be the closing tag </Results>. Basically, this marks the beginning and end of the XML stream. There could be zero results or fifty results.

<show> This is the parent node that says "What follows (until the end show tag) is the information about a single tv show". Again, it's ended by its end tag </show>. Anything within these two tags should be considered one show's worth of information.

<showid>2930</show> This is the showid tag. This holds the sid that we have to use to get the show information, in this case 2930.

<name>Buffy the Vampire Slayer</name> This is the name of the show

<link>...</link> This would be the link to the show itself (or, in the case of an episode, the episode information) on the TVRage website.

<country>...</country> The country of origin for the show.

...

</show>

</Results>

In the case of our program, we would be really interested in only the two fields <showid> and <name>. We might also consider paying attention to the <started> field as well. This is because we rarely get back just one set of data, especially if we didn't give the absolutely complete show name. For example, if we were interested in the show "The Big Bang Theory," and searched using only the string "Big Bang", we would get twenty or so data sets back because anything that even remotely matched "big" or "bang" would be returned. However, if we were interested in the show "NCIS," and we searched for that, we would get back many responses. Some not what we would expect right away. Not only would we get “NCIS”, “NCIS: Los Angeles”, “The Real NCIS”, but also “The Streets of San Francisco” and “Da Vinci’s Inquest”, and many more, since the letters “N” “C” “I” and “S” are in all of those, pretty much in that order.

Once we know the show id that we want, then we can request the show information for that ID. The data is similar to the data we just got back in the search response, but more detailed. Again, using Buffy as our example request, here (next page, right) is an abbreviated version of the XML file.

You can see that much of the data is included in the original search response stream. However, things like network, network country, runtime, air day and time, are specific to this response set.

Next, we would request the episode list. If the show is only one season long and has/had only six episodes, this stream would be short. However, let’s take the case of one of my favorite TV shows, Doctor Who. Doctor Who is a British TV show that, in its original form, started in 1963 and ran for 26 seasons (‘series’ for our friends in the UK) until 1989. Its first season alone had 42 episodes, while other seasons/series have around 24 episodes. You can see where you might have a HUGE stream to parse through.

What we get back from the episode list request is as shown on the next page (again using Buffy as our example); I’m going to just use part of the stream so you get a good idea of what comes back.

So to recap, the information we really want/need in the search for show id by name stream would be...

```
<showid>
<name>
<started>
```

In the Show

```
<Showinfo>
   <showid>2930</showid>
   <showname>Buffy the Vampire Slayer</showname>
   <showlink>http://tvrage.com/Buffy_The_Vampire_Slayer</showlink>
   <seasons>7</seasons>
   <started>1997</started>
   <startdate>Mar/10/1997</startdate>
   <ended>May/20/2003</ended>
   <origin_country>US</origin_country>
   <status>Canceled/Ended</status>
   <classification>Scripted</classification>
   <genres>
      <genre>Action</genre>
      <genre>Adventure</genre>
      <genre>Comedy</genre>
      <genre>Drama</genre>
      <genre>Mystery</genre>
      <genre>Sci-Fi</genre>
   </genres>
   <runtime>60</runtime>
   <network  country="US">UPN</network>
   <airtime>20:00</airtime>
   <airday>Tuesday</airday>
   <timezone>GMT-5 -DST</timezone>
   <akas>
      <aka country="SE">Buffy &amp; vampyrerna</aka>
      <aka country="DE">Buffy - Im Bann der Dämonen</aka>
      <aka country="NO">Buffy - Vampyrenes skrekk</aka>
      <aka country="HU">Buffy a vámpírok réme</aka>
      <aka country="FR">Buffy Contre les Vampires</aka>
      <aka country="IT">Buffy l'Ammazza Vampiri</aka>
      <aka country="PL">Buffy postrach wampirów</aka>
      <aka country="BR">Buffy, a Caça-Vampiros</aka>
      <aka country="PT">Buffy, a Caçadora de Vampiros</aka>
      <aka country="ES">Buffy, Cazavampiros</aka>
      <aka country="HR">Buffy, ubojica vampira</aka>
      <aka country="FI">Buffy, vampyyrintappaja</aka>
      <aka country="EE">Vampiiritapja Buffy</aka>
      <aka country="IS">Vampírubaninn Buffy</aka>
   </akas>
</Showinfo>
```

Information stream we would (normally) want...

```
<seasons>
<started>
<start date>
<origin_country>
<status>
<genres>
<runtime>
<network>
<airtime>
<airday>
<timezone>
```

and from the episode list stream...

```
<Season>
<episode number>
<season number>
<production number>
<airdate>
<link>
<title>
```

A word of “warning” here. Season number and Episode number data are not what you might think right away. In the case of the data from TVRage, the season number is the number of the episode within the season. The episode number is the number for that episode within the total life span of the series. The production number is a number that was used internally to the series, that, for many people, means little if anything.

```
<Show>
   <name>Buffy the Vampire Slayer</name>
   <totalseasons>7</totalseasons>
   <Episodelist>
      <Season no="1">
         <episode>
            <epnum>1</epnum>
            <seasonnum>01</seasonnum>
            <prodnum>4V01</prodnum>
            <airdate>1997-03-10</airdate>
            <link>http://www.tvrage.com/Buffy_The_Vampire_Slayer/episodes/28077</link>
            <title>Welcome to the Hellmouth (1)</title>
         </episode>
         <episode>
            <epnum>2</epnum>
            <seasonnum>02</seasonnum>
            <prodnum>4V02</prodnum>
            <airdate>1997-03-10</airdate>
            <link>http://www.tvrage.com/Buffy_The_Vampire_Slayer/episodes/28078</link>
            <title>The Harvest (2)</title>
         </episode>
         <episode>
            <epnum>3</epnum>
            <seasonnum>03</seasonnum>
            <prodnum>4V03</prodnum>
            <airdate>1997-03-17</airdate>
            <link>http://www.tvrage.com/Buffy_The_Vampire_Slayer/episodes/28079</link>
            <title>Witch</title>
         </episode>
         ...
      </Season>
   </Episodelist>
</Show>
```

Now that we have refreshed our memory on XML file structures and examined the TVRage API calls, we are ready to start our coding, but that will have to wait until next time.

Until then, have a good holiday season.

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Programming In Python: Pt 40

Last time, we had a gross discussion about the TVRAGE web API. Now we will start to look at writing code to work with it.

The goal of this part is to begin the process of creating code that will be a reusable module that can be imported into any python program and will provide access to the API easily.

While the TVRAGE API gives us a number of things we can do, and the registered version even more, we will concentrate on only three calls:
1 - Search for show by show name, and get the ShowID
2 - Get show information based on ShowID
3 - Get episode specific information based on ShowID

Last time, I showed you the “unregistered” and accessible-by-anyone API calls. This time we will use the registered calls – based on a registration key I have. I'm going to share this key with you (TVRAGE knows that I'm going to do this). However, I ask that, if you are going to use the API, that you please register and get your own key, and that you don't abuse the site. Please also consider donating to them to support their continuing efforts.

We will create three main routines to make the calls and return the information, three routines that will be used to display the returned information (assuming that we are running in the “stand alone” mode), and a main routine to do the work – again assuming that we are running in the “stand alone” mode.

Here is the list of routines we will be creating (although not all of them this time. I want to leave room for others in this issue.)

```
def FindIdByName(self,
showname, debug = 0)

def GetShowInfo(self, showid,
debug = 0)

def GetEpisodeList(self,
showid, debug = 0)

def DisplaySearchResult(self,
ShowListDict)

def DisplayShowInfo(self,
dict)

def DisplayEpisodeList(self,
SeriesName, SeasonCount,
EpisodeList)

def main()
```

The routine FindIdByName takes a string (showname), makes the API call, parses the XML response, and returns a list of shows that match with the information in a dictionary, so this will be a list of dictionaries. GetShowInfo takes the showid from the above routine and returns a dictionary of information about the series. GetEpisodeList also uses the showid from the above routine and returns a list of dictionaries containing information for each episode.

We will use a series of strings to hold the key and the base URL, and then append to those what we need. For example consider the following code (we'll expand these later).

```
self.ApiKey =
"Itnl8IyY1hsR9n0IP6zI"

self.FindSeriesString =
"http://services.tvrage.com/m
yfeeds/search.php?key="
```

The call we need to send (to get back a list of series information with the series id) would be:

http://services.tvrage.com/myfeeds/search.php?key=Itnl8IyY1hsR9n0IP6zI&show={ShowName}

We combine the string like this...

```
strng = self.FindSeriesString
+ self.ApiKey + "&show=" +
showname
```

For the purposes of testing, I will be using a show named “Continuum” which, if you've never seen it, is a wonderful science fiction show on the Showcase network out of Canada. I'm using this show for a few reasons. First, there are only (as of this writing) two shows that match the search string "Continuum", so that makes your debug easy, and secondly, there's currently only one season of 10 episodes for you to deal with.

You should have an idea what you will be looking for in your parsing routines, so I've placed the full URL calls below for you to test, before you get started with your coding.

Search using a show name...
http://services.tvrage.com/myfeeds/search.php?key=Itnl8IyY1hsR9n0IP6zI&show=continuum

Retrieve Series information using the ShowID (sid)
http://services.tvrage.com/myfeeds/showinfo.php?key=Itnl8IyY1hsR9n0IP6zI&sid=30789

Retrieve Episode list and information using the ShowID (sid)
http://services.tvrage.com/myfeeds/episode_list.php?key=Itnl8IyY1hsR9n0IP6zI&sid=30789

Now that we have all that out of the way, let's get started with our code.

You'll create a file with the name of "tvrage.py". We'll be using this for the next issue or two.

We'll start with our imports shown above right.

You can see that we will be using ElementTree to do the XML parsing, and urllib for the internet communication. The sys library is used for sys.exit.

We'll set up the main loop now so we can test things as we go (bottom right). Remember this is the last thing in our source file.

As I said earlier, the first four lines are our partial strings to build the URL for the function that we want to use. (GetEpisodeListString should all be on one line.) The last four lines are the initialization of the lists we will be using later.

First (middle right), we set up the string that will be used as the URL. Next, we set up the

```
#======================================================
#                       IMPORTS
#======================================================
from xml.etree import ElementTree as ET
import urllib
import sys
```

```
    def FindIdByName(self,showname,debug = 0):
        strng = self.FindSeriesString + self.ApiKey + "&show=" + showname
        urllib.socket.setdefaulttimeout(8)
        usock = urllib.urlopen(strng)
        tree = ET.parse(usock).getroot()
        usock.close()
        foundcounter = 0
```

```
#======================================================
#     Main loop
#======================================================
if __name__ == "__main__":
     main()
```

Now we start our class. The name of the class is "TvRage". We'll also make our __init__ routine now.

```
class TvRage:
    def __init__(self):
        self.ApiKey = "Itnl8IyY1hsR9n0IP6zI"
        self.FindSeriesString = "http://services.tvrage.com/myfeeds/search.php?key="
        self.GetShowInfoString = "http://services.tvrage.com/myfeeds/showinfo.php?key="
        self.GetEpisodeListString =
"http://services.tvrage.com/myfeeds/episode_list.php?key="
        self.ShowList = []
```

socket with an 8 second default timeout. Then we call urllib.urlopen with our generated URL and (hopefully) receive our xml file in the usock object. We call ElementTree setup so we can parse the xml information. (If you are lost here, please re-read my articles on XML (parts 10, 11 and 12 appearing in FCM #36, 37 and 38)). Next, we close the socket, and initialize the counter for the number of matches found, and reset the list ‘showlist’ to an empty list.

Now we will step through the xml information using the tag ‘show’ as the parent for what we want. Remember the returned information looks something like that shown top right.

We will be going through each group of information for the parent ‘show’ and parsing out the information. In practice, all we really need is the show name (<name>) and the showid (<showid>) shown bottom left, but we’ll handle all of the results.

I’ll discuss the first one and you’ll understand the rest. As we go through the information, we look for tags (bottom right) that match what we want. If we find any, we assign each to a temporary variable and then put that into the dictionary as a value with a key that matches what we are putting in. In the case of the above, we are looking for the tag ‘showid’ in the XML data. When we find it, we assign that as a value to the dictionary key ‘ID’.

The next portion (next page, top right) deals with the genre(s) of the show. As you can see from the above XML snippet, this show has four different genres that it fits into. Action, Crime, Drama, and Sci-

```
        for node in tree.findall('show'):
            showinfo = []
            genrestring = None
            dict = {}
            for n in node:
                if n.tag == 'showid':
                    showid = n.text
```

```
<Results>
    <show>
        <showid>30789</showid>
        <name>Continuum</name>
        <link>http://www.tvrage.com/Continuum</link>
        <country>CA</country>
        <started>2012</started>
        <ended>0</ended>
        <seasons>2</seasons>
        <status>Returning Series</status>
        <classification>Scripted</classification>
        <genres>
            <genre>Action</genre>
            <genre>Crime</genre>
            <genre>Drama</genre>
            <genre>Sci-Fi</genre>
        </genres>
    </show>
```

```
                elif n.tag == 'name':
                     showname = n.text
                     dict['Name'] = showname
                 elif n.tag == 'link':
                     showlink = n.text
                     dict['Link'] = showlink
                 elif n.tag == 'country':
                     showcountry = n.text
                     dict['Country'] = showcountry
                 elif n.tag == 'started':
                     showstarted = n.text
                     dict['Started'] = showstarted
                 elif n.tag == 'ended':
                     showended = n.text
                     dict['Ended'] = showended
                 elif n.tag == 'seasons':
                     showseasons = n.text
                     dict['Seasons'] = showseasons
                 elif n.tag == 'status':
                     showstatus = n.text
                     dict['Status'] = showstatus
                 elif n.tag == 'classification':
                     showclassification = n.text
```

Fi. We need to handle each.

Finally, we increment the foundcounter variable, and append this dictionary into the list 'showlist'. Then we start the entire thing over until there is no more XML data. Once everything is done, we return the list of dictionaries (bottom right).

Most of the code is pretty self explanatory. We'll concentrate on the for loop we use to print out the information. We loop through each item in the list of dictionaries and print a counter variable, the show name (c['Name']), and the id. The result looks something like this...

```
Enter Series Name ->
continuum
2 Found
------------------------
1 - Continuum - 30789
2 - Continuum (Web series) -
32083
Enter Selection or 0 to exit
->
```

Please remember that the list of items is zero based, so when the user enters '1', they are really asking for dictionary number 0. We do this, because "regular" people think that counting should start with '1' not 0. And we can then use 0 to escape the routine and not make them use 'Q' or 'q' or '-1'.

Now, the "main" routine that pulls it all together for us.

For today, we'll just start the routine (middle right) and continue it next time.

Next time, we'll add the other routines. For now, the code can be found at http://pastebin.com/6iw5NQrW

See you soon.

```
elif n.tag == 'genres':
    for subelement in n:
        if subelement.tag == 'genre':
            if subelement.text != None:
                if genrestring == None:
                    genrestring = subelement.text
                else:
                    genrestring += " | " + subelement.text
```

```
def main():
    tr = TvRage()
    #--------------------
    # Find Series by name
    #--------------------
    nam = raw_input("Enter Series Name -> ")
    if nam != None:
        sl = tr.FindIdByName(nam)
        which = tr.DisplayShowResult(sl)
        if which == 0:
            sys.exit()
        else:
            option = int(which)-1
            id = sl[option]['ID']
            print "ShowID selected was %s" % id
```

```
            foundcounter += 1
            self.showlist.append(dict)
        return self.showlist
#=========================================================
```

The next thing we will do is create the routine to display all of our results.

```
        def DisplayShowResult(self, ShowListDict):
            lcnt = len(ShowListDict)
            print "%d Found" % lcnt
            print "------------------------"
            cntr = 1
            for c in ShowListDict:
                print "%d - %s - %s" % (cntr,c['Name'],c['ID'])
                cntr += 1
```

Programming In Python: Pt 41

Last month, we started our command line version of a library to talk to the TVRAGE web API. This month we will continue adding to that library. If you don't have the code from last month, please get it now from pastebin (http://pastebin.com/6iw5NQrW) because we will be adding to that code.

The way we left the code, you would run the program and enter in the terminal window the name of a TV show you want information on. Remember, we used the show Continuum. Once you pressed <Enter>, the program would call the api and search by the name of the show, and then return a list of show names that matches your input. You then would select from the list by entering a number and it would show "ShowID selected was 30789". Now, we will create the code that will use that ShowID to get the series information. One other thing to keep in mind: the display routines are there pretty much to prove the routine works. The ultimate goal here is to create a reusable library that can be used in something like a GUI program. Feel free to modify the display routines if you want to do more with the standalone capabilities of the library.

```
def GetShowInfo(self,showid,debug=0):
    showidstr = str(showid)
    strng = self.GetShowInfoString + self.ApiKey + "&sid=" + showidstr
    urllib.socket.setdefaulttimeout(8)
    usock = urllib.urlopen(strng)
    tree = ET.parse(usock).getroot()
    usock.close()
    dict = {}
```

The last routine we created in the class was "DisplayShowResult". Right after that, and before the routine "main," is where we will put our next routine. The information that will be returned (there is other information, but we will use only the list below) will be in a dictionary and will contain (if available):

• Show ID
• Show Name
• Show Link
• Origin Country of network
• Number of seasons
• Series image
• Year Started
• Date Started
• Date Ended
• Status
(canceled, returning, current, etc)
• Classification
(scripted, reality, etc)
• Series Summary
• Genre(s)
• Runtime in minutes
• Name of the network that originally aired the show
• Network country
(pretty much the same thing as Origin Country)
• Air time
• Air Day (of week)
• TimeZone

Shown above is the

```
for child in tree:
    if child.tag == 'showid':
        dict['ID'] = child.text
    elif child.tag == 'showname':
        dict['Name'] = child.text
    elif child.tag == 'showlink':
        dict['Link'] = child.text
    elif child.tag == 'origin_country':
        dict['Country'] = child.text
    elif child.tag == 'seasons':
        dict['Seasons'] = child.text
    elif child.tag == 'image':
        dict['Image'] = child.text
    elif child.tag == 'started':
        dict['Started'] = child.text
    elif child.tag == 'startdate':
```

```
        elif child.tag == 'ended':
            dict['Ended'] = child.text
        elif child.tag == 'status':
            dict['Status'] = child.text
        elif child.tag == 'classification':
            dict['Classification'] = child.text
        elif child.tag == 'summary':
```

beginning of the code.

You should recognize most of the code from last time. There’s really not much changed. Here’s more code (shown below).

As you can see (above), there’s nothing really new in this bit of code either, if you’ve been keeping up with the series. We are using a for loop, checking each tag in the XML file for a specific value. If we find it, we assign it to a dictionary item.

Now things get a bit more complicated. We are going to check for the tag “genres”. This has child tags underneath it with the name of “genre”. For any given show, there can be multiple genres. We’ll have to append the genres to a string as they come up and separate them with a vertical bar and two spaces like this “ | “ (shown top right).

Now we are pretty much back to “normal” code (shown middle right) that you’ve already seen. The only thing that’s a bit different is the tag “network” which has an attribute “country”. We grab the attribute data by looking for “child.attrib[‘attributetag’]” instead of “child.text”.

That’s the end of this routine. Now (below) we’ll need some way to display the information we worked so hard to get. We’ll create a routine called “DisplayShowInfo”.

```
elif child.tag == 'genres':
    genrestring = None
    for subelement in child:
        if subelement.tag == 'genre':
            if subelement.text != None:
                if genrestring == None:
                    genrestring = subelement.text
                else:
                    genrestring += " | " + subelement.text
```

```
        elif child.tag == 'runtime':
            dict['Runtime'] = child.text
        elif child.tag == 'network': # has attribute
            dict['NetworkCountry'] = child.attrib['country']
            dict['Network'] = child.text
        elif child.tag == 'airtime':
            dict['Airtime'] = child.text
        elif child.tag == 'airday':
            dict['Airday'] = child.text
        elif child.tag == 'timezone':
            dict['Timezone'] = child.text
```

Now, we must update the “main” routine (next page, shown top right) to support our two new routines. I’m giving the entire routine below, but

```
    def DisplayShowInfo(self,dict):
        print "Show: %s" % dict['Name']
        print "ID: %s  Started: %s  Ended: %s  Start Date: %s  Seasons: %s" %
(dict['ID'],dict['Started'],dict['Ended'],dict['StartDate'],dict['Seasons'])
        print "Link: %s" % dict['Link']
        print "Image: %s" % dict['Image']
        print "Country: %s  Status: %s   Classification: %s" %
(dict['Country'],dict['Status'],dict['Classification'])
        print "Runtime: %s  Network: %s   Airday: %s   Airtime: %s" %
(dict['Runtime'],dict['Network'],dict['Airday'],dict['Airtime'])
        print "Genres: %s" % dict['Genres']
```

the new code is shown **in black**.

Next page, bottom left, is what the output of “DisplayShowInfo” should look like, assuming you chose “Continuum” as the show.

Please notice that I’m not displaying the time zone information here, but feel free to add it if you wish.

Next, we need to work on the episode list routines for the series. The “worker” routine will be called “GetEpisodeList” and will provide the following information...

- Season
- Episode Number
- Season Episode Number (the number of the episode within the season)
- Production Number
- Air Date
- Link
- Title
- Summary
- Rating
- Screen Capture Image of Episode (if available)

Before we start with the code, it would be helpful to revisit what the episode list request to the API returns. It looks something like that shown on the next page, top

```
ShowID selected was 30789
Show: Continuum
ID: 30789  Started: 2012  Ended: None  Start Date:
May/27/2012  Seasons: 2
Link: http://www.tvrage.com/Continuum
Image: http://images.tvrage.com/shows/31/30789.jpg
Country: CA  Status: Returning Series   Classification:
Scripted
Runtime: 60  Network: Showcase   Airday: Sunday
Airtime: 21:00
Genres: Action | Crime | Drama | Sci-Fi
Summary:
Continuum is a one-hour police drama centered on Kiera
Cameron, a regular cop from 65 years in the future who
finds herself trapped in present day Vancouver. She is
alone, a stranger in a strange land, and has eight of the
most ruthless criminals from the future, known as Liber8,
loose in the city.

Lucky for Kiera, through the use of her CMR (cellular
memory recall), a futuristic liquid chip technology
implanted in her brain, she connects with Alec Sadler, a
seventeen-year-old tech genius. When Kiera calls and Alec
answers, a very unique partnership begins.

Kiera's first desire is to get "home." But until she
figures out a way to do that, she must survive in our
time period and use all the resources available to her to
track and capture the terrorists before they alter
```

```
def main():
    tr = TvRage()
    #--------------------
    # Find Series by name
    #--------------------
    nam = raw_input("Enter Series Name -> ")
    if nam != None:
        sl = tr.FindIdByName(nam)
        which = tr.DisplayShowResult(sl)
        if which == 0:
            sys.exit()
        else:
            option = int(which)-1
            id = sl[option]['ID']
            print "ShowID selected was %s" % id
    #------------------------------
    # Get Show Info
    #------------------------------
    showinfo = tr.GetShowInfo(id)
    #------------------------------
    # Display Show Info
```

```
    def GetEpisodeList(self,showid,debug=0):
        showidstr = str(showid)
        strng = self.GetEpisodeListString + self.ApiKey
+ "&sid=" + showidstr
        urllib.socket.setdefaulttimeout(8)
        usock = urllib.urlopen(strng)
        tree = ET.parse(usock).getroot()
        usock.close()
        for child in tree:
```

```
                if child.tag == 'name':
                    ShowName = child.text
                elif child.tag == 'totalseasons':
                    TotalSeasons = child.text
                elif child.tag == 'Episodelist':
                    for c in child:
                        if c.tag == 'Season':
                            dict = {}
                            seasonnum = c.attrib['no']
                            for el in c:
```

right.

The information for each episode is in the “episode” tag – which is a child of “Season” – which is a child of “Episodelist” – which is a child of “Show”. We have to be careful how we parse this. As with most of our “worker” routines this time, the first few lines (below) are fairly easy to understand by now.

Now we need to look for the “name” and “totalseasons” tags below the “root” tag “Show”. Once we’ve dealt with them, we look for the

```
      if el.tag == 'episode':
          dict={}
          dict['Season'] = seasonnum
          for ep in el:
              if ep.tag == 'epnum':
                  dict['EpisodeNumber'] = ep.text
              elif ep.tag == 'seasonnum':
                  dict['SeasonEpisodeNumber'] = ep.text
              elif ep.tag == 'prodnum':
                  dict['ProductionNumber'] = ep.text
              elif ep.tag == 'airdate':
                  dict['AirDate'] = ep.text
              elif ep.tag == 'link':
                  dict['Link'] = ep.text
              elif ep.tag == 'title':
                  dict['Title'] = ep.text
              elif ep.tag == 'summary':
                  dict['Summary'] = ep.text
              elif ep.tag == 'rating':
                  dict['Rating'] = ep.text
```

```
<Show>
<name>Continuum</name>
<totalseasons>2</totalseasons>
<Episodelist>
<Season no="1">
<episode>
<epnum>1</epnum>
<seasonnum>01</seasonnum>
<prodnum/>
<airdate>2012-05-27</airdate>
<link>
http://www.tvrage.com/Continuum/episodes/1065162187
</link>
<title>A Stitch in Time</title>
<summary>
Inspector Kiera Cameron loses everything she has and finds
herself on a new mission when she and eight dangerous
terrorists are transported from their time in 2077 back to
2012 during the terrorist's attempt to escape execution.
She takes on a new identity and joins the VPD in order to
stop the terrorists' reign of violence. Along the way, she
befriends Alec Sadler, the 17 year old who will one day
grow up to create the technology her world is built upon.
</summary>
<rating>8.8</rating>
<screencap>
http://images.tvrage.com/screencaps/154/30789/1065162187.p
```

“Episodelist”, “Season” tags. Notice above that the “Season” tag has an attribute. You might notice (in the code above) that we aren’t including the “Showname” or “Totalseasons” data in the dictionary. We are assigning them to a variable that will be returned at the end of the routine to the calling code.

Now that we have that portion of the data, we deal with the episode specific information (shown below).

```
 self.EpisodeItem.append(dict)
        return ShowName,TotalSeasons,self.EpisodeItem
```

All that's left now (bottom right) is to append the episode specific information (that we've put into the dictionary) to our list, and keep going. Once we are done with all the episodes, we return to the calling routine and, as I stated earlier, return three items of data, "ShowName", "TotalSeasons" and the list of dictionaries.

Next, we need to create our display routine. Again, it's fairly straightforward. The only thing that you might not recognize is the "if e.has_key('keynamehere')" lines. This is a check to make sure that there is actually data in the "Rating" and "Summary" variables. Some shows don't have this information, so we include the check to make our print-to-screen data a little prettier (shown above right).

All that's left is to update our "main" routine (next page, shown top right). Once again, I'm going to provide the full "main" routine with the newest code **in black bold**.

Now, if you save and run the program, the output of the "GetEpisodeList" and "DisplayEpisodeList" will work. Shown bottom right is a snippet of the Episode information.

That's it for this month. As always, you can find the full source code on pastebin at http://pastebin.com/kWSEfs2E.

I hope you enjoy playing with the library. There is additional data available from the API that you can include. Please remember, TVRage provides

```
    def DisplayEpisodeList(self,SeriesName,SeasonCount,EpisodeList):
        print "--------------------------------------"
        print "Series Name: %s" % SeriesName
        print "Total number of seasons: %s" % SeasonCount
        print "Total number of episodes: %d" % len(EpisodeList)
        print "--------------------------------------"
        for e in EpisodeList:
            print "Season: %s" % e['Season']
            print "   Season Episode Number: %s - Series Episode Number: %s" %
(e['SeasonEpisodeNumber'],e['EpisodeNumber'])
            print "   Title: %s" % e['Title']
            if e.has_key('Rating'):
                print "   Airdate: %s   Rating: %s" % (e['AirDate'],e['Rating'])
            else:
                print "   Airdate: %s   Rating: NONE" % e['AirDate']
            if e.has_key('Summary'):
                print "   Summary: \n%s" % e['Summary']
            else:
                print "   Summary: NA"
            print "==========================="
```

```
--------------------------------------
Series Name: Continuum
Total number of seasons: 2
Total number of episodes: 10
--------------------------------------
Season: 1
   Season Episode Number: 01 - Series Episode Number: 1
   Title: A Stitch in Time
   Airdate: 2012-05-27   Rating: 8.8
   Summary:
Inspector Kiera Cameron loses everything she has and finds herself on a new mission when
she and eight dangerous terrorists are transported from their time in 2077 back to 2012
during the terrorist's attempt to escape execution. She takes on a new identity and
joins the VPD in order to stop the terrorists' reign of violence. Along the way, she
befriends Alec Sadler, the 17 year old who will one day grow up to create the technology
her world is built upon.
```

```
def main():
    tr = TvRage()
    #--------------------
    # Find Series by name
    #--------------------
    nam = raw_input("Enter Series Name -> ")
    if nam != None:
        sl = tr.FindIdByName(nam)
        which = tr.DisplayShowResult(sl)
        if which == 0:
            sys.exit()
        else:
            option = int(which)-1
            id = sl[option]['ID']
            print "ShowID selected was %s" % id
    #------------------------------
    # Get Show Info
    #------------------------------
    showinfo = tr.GetShowInfo(id)
    #------------------------------
    # Display Show Info
    #------------------------------
    tr.DisplayShowInfo(showinfo)
    #-----------------------------
    # Get Episode List
    #-----------------------------
    SeriesName,TotalSeasons,episodelist = tr.GetEpisodeList(id)
    #-----------------------------
    # Display Episode List
    #-----------------------------
```

this information for free, so consider donating to them to help their efforts at updating the API and for all their hard work.

I'll see you next time. Enjoy.

Greg Walters is owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his

Programming In Python: Pt 42

Let's assume that you have decided to create a multimedia center for your family room. You have a dedicated computer for the wonderful program called XBMC. You've spent days ripping your DVD movies and TV series onto the computer. You have done the research and named the files the correct way. But let's say that one of your favorite shows is "NCIS," and you have every episode that you can get on DVD. You found a place that provides the current episodes as well. You want to find out what the next episode is and when it will be broadcast. Plus, you want to create a list of all the TV episodes that you have to impress your friends.

This is the project we will be starting this month. Our first task is to dig through the folder containing your TV shows, grabbing the series name, and each episode – including the name and season number, and the episode number. All this information will go into a database for easy storage.

According to XBMC, you should name each of your tv episode files like this:

```
Tv.Show.Name.SxxExx.Episode
name here if you
care.extension
```

So, let's use the very first episode of NCIS as an example. The filename for an AVI file would be:

```
NCIS.S01E01.Yankee White.avi
```

and the very latest episode would be:

```
NCIS.S10E17.Prime Suspect.avi
```

If you have a show name that has more than one word, it could look like this:

```
Doctor.Who.2005.S07E04.The
Power of Three.mp4
```

The directory structure should be as follows:

```
TVShows
    2 Broke Girls
       Season 1
          Episode 1
          Episode 2
             ...
          Season 2
            ...
     Doctor Who 2005
          Season 1
            ...
          Season 2
            ...
```

and so on. Now that we know what we will be looking for and where it will be, let's move on.

A very long time ago, we created a program to make a database of our MP3 files. That was back in issue #35 I believe, which was part number 9 of this series. We used a routine called WalkThePath to recursively dig through all the folders from a starting path, and pull out the filenames that had a ".mp3" extension. We will reuse most of that routine and modify it for our purposes. In this version, we will be looking for video files that have one of the following extensions:

```
.avi
.mkv
.m4v
.mp4
```

Which are very common extensions for video files in the media PC world.

Now we will get started with the first part of our project. Create a file called "tvfilesearch.py". Be sure to save it when we are done this month, because we will be building on it next month.

Let's start with our imports:

```
import os
from os.path import join,
getsize, exists
import sys
import apsw
import re
```

As you can see, we are importing the os, sys and apsw libraries. We've used them all before. We are also importing the re library to support Regular Expressions. We'll touch on that quickly this time, but more in the next article.

Now, let's do our last two routines next (next page). All our other code will go in between the imports and these last two routines.

This (next page, bottom right) is our main worker routine. In it, we create a connection to the SQLite database provided by apsw. Next we create a cursor to interact with it. Then we call the MakeDatabase routine which will create the database if it doesn't exist.

My TV files are located on two hard drives. So I created a list to hold the path names. If you have only one location, you can change the three lines to be as follows:

```
    startfolder =
"/filepath/folder/"

    WalkThePath(startfolder)
```

Next, we create our "standard" if __name__ routine.

```
#=============================
if __name__ == '__main__':
    main()
```

Now all the dull stuff is done, so we can move on the the meat and potatoes of our project. We'll start with the MakeDataBase routine (middle right). Put it right after the imports.

We discussed this routine before when we dealt with the MP3 scanner, so I'll just remind you that, in this routine, we check to see if the table exists, and if not, we create it.

Now we'll create the WalkThePath routine (right, second from bottom).

When we enter the routine (as we talked about way back when), we give the filepath that we are going to search through. We clear the showname variable, which we will use later, and open an error log file. Then we let the routine do its thing. We get back from the call (os.walk) a 3-tuple (directory path, directory names, filenames). The directory path is a string which is the path to the directory, directory names is a list of the names of subdirectories in the path, and the filenames is a list of non-directory names. We then parse through the list of filenames, checking to see if the filename ends with one of our target extensions.

```
#==========================================
def main():
    global connection
    global cursor
    # Create the connection and cursor.
    connection = apsw.Connection("TvShows.db3")
    cursor = connection.cursor()
```

```
#==========================================
def MakeDataBase():
    # IF the table does not exist, this will create the table.
    # Otherwise, this will be ignored due to the 'IF NOT EXISTS' clause
    sql = 'CREATE TABLE IF NOT EXISTS TvShows (pkID INTEGER PRIMARY KEY, Series TEXT,
RootPath TEXT, Filename TEXT, Season TEXT, EPISODE TEXT);'
    cursor.execute(sql)
```

```
#==========================================
def WalkThePath(filepath):
    showname = ""
    # Open the error log file
    efile = open('errors.log',"w")
    for root, dirs, files in
os.walk(filepath,topdown=True):
```

```
    #==========================================
    # Set your video media paths
    #==========================================
    startfolder = ["/extramedia/tv_files/","/media/freeagnt/tv_files_2/"]
    for cntr in range(0,2):
        WalkThePath(startfolder[cntr])
        # Close the cursor and the database
    cursor.close()
    connection.close()
```

```
for file in [f for f in files if f.endswith(('.avi','mkv','mp4','m4v'))]:
```

Now, we split the filename into the extension and the filename (without the extension). Next, we call the GetSeasonEpisode routine to pull out the Season/Episode information that is embedded in the filename, assuming it is correctly formatted.

```
OriginalFilename,ext = os.path.splitext(file)

fl = file

isok,data = GetSeasonEpisode(fl)
```

GetSeasonEpisode returns a boolean and a list (in this case "data") which holds the name of the series, the season, and the episode numbers. If a filename doesn't have the correct format, the "isok" boolean variable (top right) will be false.

Next (middle right), we will check to see if the file is in the database. If so, we don't want to duplicate it. We simply check for the filename. We could go deeper and make sure the path is the same as well, but for this time, this is enough.

```
                if isok:
            showname = data[0]
            season = data[1]
            episode = data[2]
            print("Season {0} Episode {1}".format(season,episode))
        else:
            print("No Season/EPisode")
            efile.writelines('---------------------------\n')
            efile.writelines('{0} has no series/episode information\n'.format(file))
```

```
            sqlquery = 'SELECT count(pkid) as rowcount from TvShows where Filename = "%s";' % fl
            try:
                for x in cursor.execute(sqlquery):
                    rcntr = x[0]
                if rcntr == 0:  # It's not there, so add it
```

```
                    try:
                        sql = 'INSERT INTO TvShows (Series,RootPath,Filename,Season,Episode) VALUES (?,?,?,?,?)'
                        cursor.execute(sql,(showname,root,fl,season,episode))
                    except:
                        print("Error")
                        efile.writelines('---------------------------\n')
                        efile.writelines('Error writing to database...\n')
                        efile.writelines('Filename = {0}\n'.format(file))
                        efile.writelines('---------------------------\n\n')
            except:
                print("Error")
```

If everything works as it should, the response from the query should only be a 1 or a 0. If it's a 0, then it's not there, and we will write the information to the database. If it is, we just move past. Notice the Try Except commands above and below. If something goes wrong, like some character that the database doesn't like, it will keep the program from aborting. We will, however, log the error so we can check it out later on.

We are simply inserting a new record into the database or writing to the error file.

```
            # Close the log file
            efile.close
        # End of WalkThePath
```

Now, let's look at the GetSeasonEpisode routine.

```
#===========================
```

```
=============
def GetSeasonEpisode(filename):
    filename = filename.upper()
    resp = re.search(r'(.*).S\d\dE\d\d(\.*)', filename, re.M|re.I)
```

The re.search portion of the code is part of the re library. It uses a pattern string, and, in this case, the filename that we want to parse. The re.M|re.I are parameters that say that we want to use a multiline type search (re.M) combined with an ignore-case (re.I). As I said earlier, we'll deal with the regular expressions more next month, since our routine will match only one type of series|episode string. As for the search pattern we are looking for: ".S", followed by two decimal numbers, followed by an uppercase "E", then two more numbers, then a period. If our filename looked like "tvshow.S01E03.avi", this would match. However, some people encode their shows like this "tvshow.s01e03.avi", or "tvshow.103.avi", which makes it harder to deal with. We'll modify this routine next month to cover the majority of the instances. The "r'" allows for a raw string to be used within the search.

Continuing on, the search returns a match object that we can look at. "resp" is a response that is empty if there is no match, and, in this case, two groups of returned information. The first one will give us the characters up to the match, and the second including the match. So, in the case above, group(1) would be "tvshow", and the second group would be "tvshow.S01E03.". This is specified by the parens in the search "(.*)" and "(\.*)".

```
    if resp:
        showname = resp.group(1)
```

We take the show name from group number one. Then we get the length of that so we can grab the series and episode string with a substring command.

```
        shownamelength = len(showname) + 1
        se = filename[shownamelength:shownamelength+6]
        season = se[1:3]
        episode = se[4:6]
```

Next, we replace any periods in the showname with a space – to be more "Human Readable".

```
        showname = showname.replace("."," ")
```

We create a list to include the show name, season and episode, and return it along with the True boolean to say things went well.

```
        ret = [showname,season,episode]
        return True,ret
```

Otherwise, if we didn't find a match, we create our list containing no show name and two "-1" numbers, and this gets returned with a boolean False.

```
    else:
        ret = ["",-1,-1]
        return False,ret
```

That's all the code. Now let's see what the output would look like. Assuming your file structures are exactly like mine, some of the output on the screen would look like this...

```
Season 02 Episode 04
SELECT count(pkid) as rowcount from TvShows where Filename = "InSecurity.S02E04.avi";
Series - INSECURITY File - InSecurity.S02E04.avi
Season 01 Episode 08
SELECT count(pkid) as rowcount from TvShows where Filename = "Prime.Suspect.US.S01E08.Underwater.avi";
Series - PRIME SUSPECT US File - Prime.Suspect.US.S01E08.Underwater.avi
```

and so on. You can shorten the output to keep the screen from driving you crazy if you would like. As we said earlier, each entry we find gets put to the database. Something like this:

```
pkID | Series | Root Path | Filename | Season | Episode
2526 | NCIS   | /extramedia/tv_files/NCIS/Season 7|NCIS.S07E04.Good.Cop.Bad.Cop.avi | 7 | 4
```

As always, the full code listing is available on PasteBin.com at http://pastebin.com/txmmagkL

Next time, we will deal with more Season|Episode formats, and do some other things to flesh out our program.

See you soon.

Programming In Python: Pt 43

Last time, we started a project that would eventually use the TvRage module that we created the month before that. Now we will continue the project. This time we will be adding functionality to our program: tweaking the filename parse routine and adding two fields (TvRageId and Status) to the database. So, let's jump right in.

First, we will make the changes to our import lines. For those who are just joining us, I'll include the ones from last time (shown top right).

The lines after 'import re' are the new ones for this time.

The next thing we will do is rewrite the GetSeasonEpisode routine. We are going to throw out pretty much everything we did last month, and make it more flexible across the possible season/episode schemes. In this iteration, we will be able to support the following schemes...

```
Series.S00E00

Series.s00e00

Series.S00E00.S00E01

Series.00x00

Series.S0000

Series.0x00
```

We will also fix any 'missing leading zero' issues before we write to the database.

Our first pattern tries to catch multi-episode files. There are various naming schemes, but the one we will support is similar to 'S01E03.S01E04'. We use the pattern string "(.*)\.s(\d{1,2})e(\d{1,2})\.s(\d{1,2})e(\d{1,2})". This returns (hopefully) five groups which consist of: the series name (S[1]), season(S[2]), episode number 1 (S[3]), season (S[4]), and episode number 2 (S[5]). Remember that the parens create each group for returns. In the case above, we group anything from the first character up to the ".s", then two numbers, skip the "e", then two numbers, and repeat. So the filename "Monk.S01E05.S01E06.avi" returns the following groups...

```
import os
from os.path import join, getsize, exists
import sys
import apsw
import re
#------------------------------
#   NEW LINES START HERE
#------------------------------
from xml.etree import ElementTree as ET
import urllib
import string
from TvRage import TvRage
```

```
S[1] = Monk

S[2] = 01

S[3] = 05

S[4] = 01

S[5] = 06
```

We are using only groups S[1], S[2] and S[3] in this code, but you can see where we are going with this. If we find a match, we set a variable named "GoOn" to true. This allows us to know what we should do after we've fallen through the various If lines.

So, next page (top right) is the code for the GetSeasonEpisode routine.

When we get to this point, (next page, bottom left) we prepare the show name by removing any periods in the show name, and then pull the season and episode information from the various groups, and return them. For the season information, if we have a pattern like "S00E00", the season number will have a leading zero. However if the pattern is like “xxx”, then the season is assumed to be the first character, and the trailing two are the episode. In order to be forward thinking, we want to make the season a two-digit number with a leading zero if needed.

Next, in our MakeDatabase routine, we will change the create SQL statement to add the two new fields (next page, top).

Again, the only thing that has changed from last time is the last two field definitions.

In our WalkThePath routine, the only changes are the lines that actually insert into the database. This is to support the new structure. If you remember

```
    if GoOn:
        shownamelength = len(showname) + 1
        showname = showname.replace("."," ")
        season = resp.group(2)
        if len(season) == 1:
            season = "0" + season
        episode = resp.group(3)
        ret = [showname,season,episode]
        return True,ret
    else:
        ret = ["",-1,-1]
        return False,ret
```

```
def GetSeasonEpisode(filename):
    GoOn = False
    filename = filename.upper()
```

This is our first pattern check.

```
    #Should catch multi episode .S01E01.S01E02 type filenames
    resp = re.search(r'(.*)\.s(\d{1,2})e(\d{1,2})\.s(\d{1,2})e(\d{1,2})',filename,
re.I)
    if resp:
        showname = resp.group(1)
        GoOn = True
    else:
```

Our second pattern check looks for SddEdd or sddedd...

```
    # Should catch SddEdd or sddedd
        resp = re.search(r'(.*).S(\d\d?)E(\d\d?)(\.*)', filename, re.I)
        if resp:
            showname = resp.group(1)
            GoOn = True
        else:
```

The next pattern looks for ddxdd.

```
       #check for ddxdd
       resp = re.search(r'(.*)\.(\d{1,2})x(\d{1,2})(.*)', filename, re.I)
       if resp:
           showname = resp.group(1)
           GoOn = True
       else:
```

This pattern checks for Sdddd.

```
                   #check for Sdddd
                   resp = re.search(r'(.*).S(\d\d)(.\d\d?)' , filename, re.I)
    if resp:
        showname = resp.group(1)
        GoOn = True
    else:
```

And finally we try for ddd

```
        # Should catch xxx
        resp = re.search(r'(.*)(\d)(.\d\d?)',filename,re.I)
        if resp:
            showname = resp.group(1)
```

```
def MakeDataBase():
    # IF the table does not exist, this will create the table.
    # Otherwise, this will be ignored due to the 'IF NOT EXISTS' clause
    sql = 'CREATE TABLE IF NOT EXISTS TvShows (pkID INTEGER PRIMARY KEY, Series TEXT, RootPath TEXT, Filename TEXT, 
Season TEXT, Episode TEXT, tvrageid TEXT,status TEXT);'
    cursor.execute(sql)
```

from last time, we pass the folder that holds our TV files to this routine. In my case, there are two folders, so it's set into a list and we use a for loop to pass each into the routine. As we go through the routine, we walk through each directory looking for files with extensions of .avi, .mkv, .mp4 and .m4v. When we find a file that matches, we send it to the GetSeasonEpisode routine. We then check to see if we already have it entered into the database, and, if not, we add it. I'm going to give you (top right) only part of the routine from last month.

```
            sqlquery = 'SELECT count(pkid) as rowcount from TvShows where Filename = 
"%s";' % fl
            try:
                for x in cursor.execute(sqlquery):
                    rcntr = x[0]
                if rcntr == 0:  # It's not there, so add it
                    try:
                        sql = 'INSERT INTO TvShows 
(Series,RootPath,Filename,Season,Episode,tvrageid) VALUES (?,?,?,?,?,?)'
                        cursor.execute(sql,(showname,root,fl,season,episode,-1))
                    except:
```

The two lines in black are the ones that are new this time.

We are already over halfway done. Next are some support routines that work with our TvRage routine to fill in the database fields. Our first routine runs after the WalkThePath routine, and runs through the database, getting the series name and querying the TvRage server for the id number. Once we have that, we update the database, then use that id number to once again query TvRage to get the current status of the series. This status can be "New Series", "Returning Series", "Canceled", "Ended" and "On Haitus". The reason we want this information is that, when we go to check for new episodes, we don't want to bother with series that won't have any new episodes because they are cancelled. So, now we have the status and can write that to the database (above).

```
def WalkTheDatabase():
    tr = TvRage()
    SeriesCursor = connection.cursor()
    sqlstring = "SELECT DISTINCT series FROM TvShows WHERE tvrageid = -1"
```

We will pause here in our code and look at the SQL query we are using. It's a bit different from anything we've done before. The string is:

```
SELECT DISTINCT series FROM
TvShows WHERE tvrageid = -1
```

Which says, give me just one instance of the series name, no matter how many of them I have, where the field tvrageid is equal to "-1". If, for example, we have 103 episodes of Doctor Who 2005. By using the Distinct, I will get back only one record, assuming that we haven't gotten a TvRageID yet.

```
def UpdateDatabase(seriesname,id):
    idcursor = connection.cursor()
    sqlstring = 'UPDATE tvshows SET tvrageid = ' + id + ' WHERE series = "' + seriesname + '"'
    try:
        idcursor.execute(sqlstring)
    except:
        print "error"
```

```
def GetShowStatus(seriesname,id):
    tr = TvRage()
    idcursor = connection.cursor()
    dict = tr.GetShowInfo(id)
    status = dict['Status']
    sqlstring = 'UPDATE tvshows SET status = "' + status + '" WHERE series = "' + seriesname + '"'
    try:
        idcursor.execute(sqlstring)
    except:
```

```
    for x in
SeriesCursor.execute(sqlstrin
g):

        seriesname = x[0]

        searchname =
string.capwords(x[0]," ")
```

We are using the capwords routine from the string library to change the series name (x[0]) to a "proper case" from the all-uppercase we currently store the show name in. We do this because TvRage expects something other that all-uppercase entries, and we won't get the results we are looking for. So the series name "THE MAN FROM UNCLE" will be converted to "The Man From Uncle". We use that in the call to our TvRage Library FindIdByName. This gets the list of matching shows, and displays them for us to pick the best one. Once we pick one, we update the database with the id number and then call the GetShowStatus routine to get the current show status from TvRage (bottom right).

```
        print("Requesting information on " + searchname)
        sl = tr.FindIdByName(searchname)
        which = tr.DisplayShowResult(sl)
        if which == 0:
            print("Nothing found for %s" % seriesname)
        else:
            option = int(which)-1
            id = sl[option]['ID']
            UpdateDatabase(seriesname,id)
            GetShowStatus(seriesname,id)
```

The UpdateDatabase routine (top) simply uses the series name as the key to update all the records with the proper TvRage ID.

```
startfolder = ["/extramedia/tv_files","/media/freeagnt/tv_files_2"]
#for cntr in range(0,2):
    #WalkThePath(startfolder[cntr])
WalkTheDatabase()
# Close the cursor and the database
cursor.close()
connection.close()
```

GetShowStatus (above) is also very simple. We call the GetShowInfo routine from the TvRage library by passing the id that we just got to TvRage – to get the series information. If you remember, there is a lot of information provided about the series from TvRage, but all we are concerned about at this point is the show status. Since everything is returned in a dictionary, we just look for the ['Status'] key. Once we have it, we update the database with that and move on.

We are almost done with our code. We finally add one line to our main routine from last month (in black, below) to call the "WalkTheDatabase" routine after we are done getting all our filenames. Again, I'm going to give you only part of the Main routine, just so you can find the correct place to put the new line.

That's all our code. Let's mentally go over what happens when we run the program.

First, we create the database if it doesn't exist.

Next, we walk through the predefined paths, looking for files that have any one of the following extensions:

```
.AVI, .MKV, .M4V, .MP4
```

When we find one, we go through and try to parse the filename looking for a series name, Season number, and episode number. We take that information and put it into a database, if it does not already exist there.

Once we are through looking for files, we query the database looking for series names that don't have a TvRage ID associated with them. We then will query the TvRage API and ask for matching files to gather that ID. Each series will go through that step once. The following screenshot shows the options for, in this case, the tv series Midsomer Murders.

```
Requesting information on Midsomer Murders
5 Found
------------------------
1 - Midsomer Murders - 4466
2 - Motives and Murders - 31373
3 - See No Evil: The Moors Murders - 11199
4 - The Atlanta Child Murders - 26402
5 - Motives & Murders: Cracking the Case - 33322
Enter Selection or 0 to exit ->
```

I entered (in this case) 1, which associates that series with the TvRage ID 4466. That's entered into the database, and we then use that ID to request the current status for the series, again from TvRage. In this case, we got back "Returning Series". This is then entered into the database and we move on.

While doing the initial "run" into the database, it will take a while and require your attention, because each and every series needs to ask about the ID number match. The good news is that this has to be done only once. If you are "somewhat normal", you won't have that many to deal with. I had 157 different series to do, so it took a little while. Since I was careful when I set up my filenames (checking TvRage and TheTvDB.com for the proper wording of the series name), the majority of the searches were the #1 option.

Just to let you know, over half of the TV series that I have either ended or have been canceled. That should tell you something about the age group I fall in.

The full code is, as always, available on PasteBin at http://pastebin.com/MeuGyKpX

Next time we will continue with the integration with TvRage. Until then have a great month!

Greg Walters is owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his family. His website is

HOW-TO
Written by Greg Walters

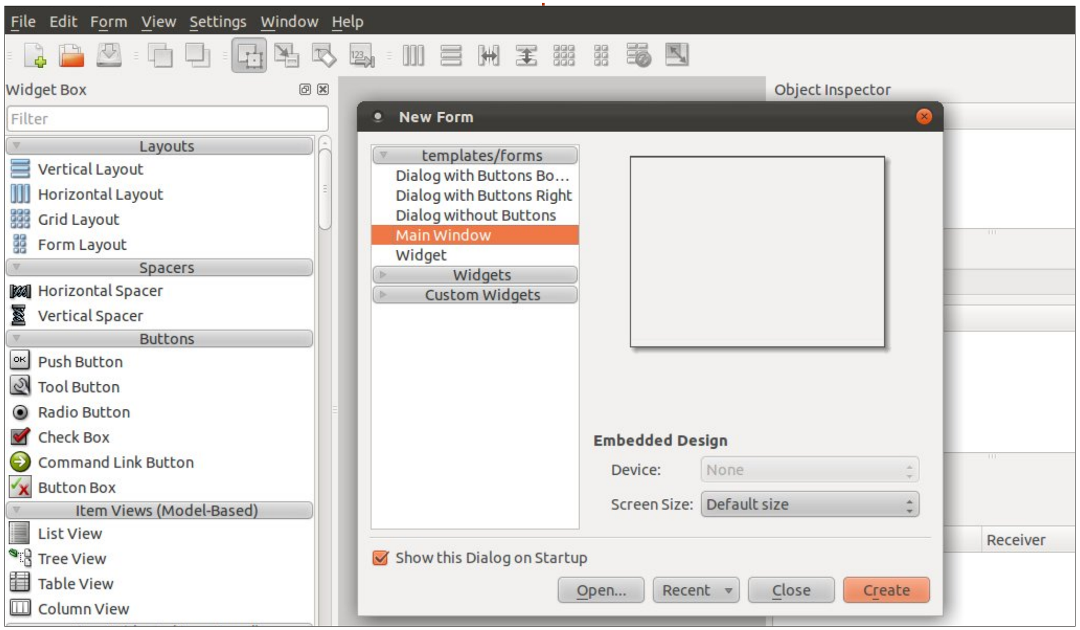
Programming In Python: Pt 44

We are going to take a short detour this month from our TVRage program to partially answer a question from a reader. I was asked to talk about QT Creator, and how to use it to design user interfaces for Python programs.

Unfortunately, from what I can tell, the support for QT Creator isn't ready yet for Python. It IS being worked on, but is not “ready for prime time” quite yet.

So, in an effort to get us ready for that future article, we will work with QT4 Designer. You will need to install (if they aren't already) python-qt4, qt4-dev-tools, python-qt4-dev, pyqt4-dev-tools and libqt4-dev.

Once that is done, you can find QT4 Designer under Applications | Programming. Go ahead and start it up. You should be presented with something like the following:



Make sure that 'Main Window' is selected, and click the 'Create' button. Now you will have a blank form that you can drag and drop controls onto.

The first thing we want to do is resize the main window. Make it about 500x300. You can tell how big it is by looking at the Property Editor under the geometry property on the right side of the designer window. Now, scroll down on the property editor list box until you see 'windowTitle'. Change the text from 'MainWindow' to 'Python Test1'. You should see the title bar of our design window change to 'Python Test1 – untitled*'. Now is a good time to save our project. Name it 'pytest1.ui'. Next, we will put a button on our form. This will be an exit button to end the test program. On the left side of the designer window you will see all of the controls that are available. Find the 'Buttons' section and drag and drop the 'Push Button' control onto the form. Unlike the GUI designers we have used in the past, you don't have to create grids to contain your controls when you use QT4 Designer. Move the button to near center-bottom of the form. If you look at the Property Editor under geometry, you will see something like this:

```
[(200,260), 97x27]
```

In the parentheses are the X and Y positions of the object (push-button in this case) on the form, followed by its width and height. I moved mine to 200,260.

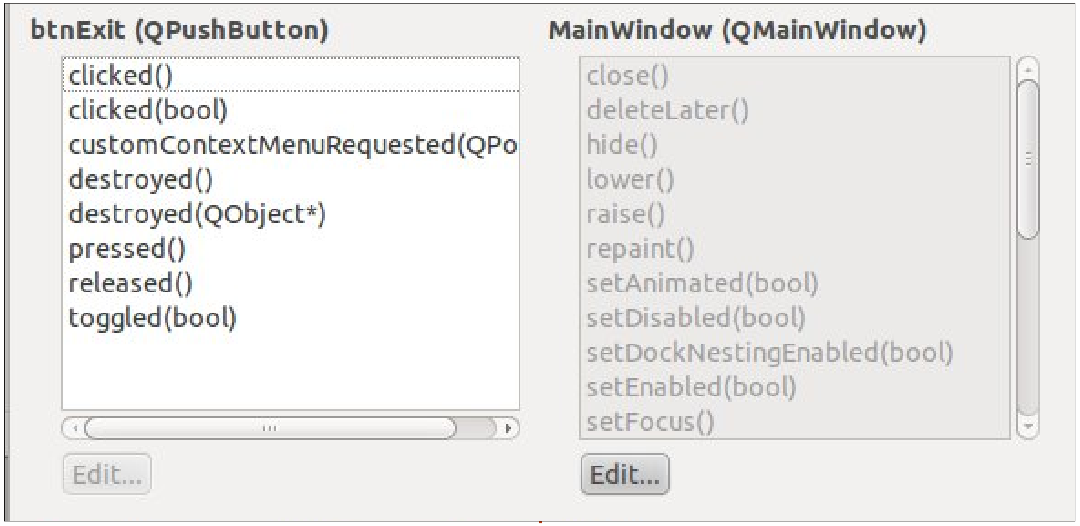
Just above that is the objectName property—which, by default, is set to 'pushButton'. Change that to 'btnExit'. Now scroll down on the Property Editor list to the 'QAbstractButton' section, and set the 'text' property to 'Exit'. You can see on our form that the text on the button has changed.

Now, add another button and position it at 200,200. Change its objectName property to 'btnClickMe,' and set the text to 'Click Me!'.

Next add a label. You will find it in the toolbox on the left under 'DisplayWidgets'. Put it close to the center of the form (I put mine at 210,130), and set its objectName property to lblDisplay. We will want to make it bigger than what it is by default, so set its size to somewhere around 221 x 20. In the property editor, scroll down to the 'Qlabel' section, and set the Horizontal alignment to 'AlignHCenter'. Change the text to blank. We will set the text in code—when the btnClickMe is clicked. Now save the project again.

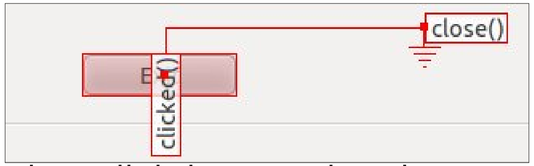
Slots & Signals

This next section might be a bit difficult to wrap your head around, especially if you have been with us for a long time and have dealt with the previous GUI designers. In the other designers, we used events that were raised when



an object was clicked, like a button. In QT4 Designer, events are called Signals, and the function that is called by that signal is called a Slot. So, for our Exit button, we use the Click signal to call the Main Window Close slot. Are you totally confused right now? I was when I first dealt with QT, but it begins to make sense after a while.

Fortunately, there is a very easy way to use predefined slots & signals. If you press the F4 button on the keyboard, you will be in the Edit Signals & Slots mode. (To get out of the Edit Signals & Slots mode, press F3.) Now, left click and hold on the Exit button, and



drag slightly up and to the right, off the button onto the main form, then release the click. You will see a dialog pop up that looks something like that shown above.

This will give us an easy way to connect the clicked signal to the form. Select the first option on the left which should be 'clicked()'. This will enable the right side of the window and select the 'close()' option from the list, then click 'OK'. You will see something that looks like this:

The click signal (event) is linked to the Close routine of the main window.

For the btnClickMe clicked signal, we will do that in code.

Save the file one more time. Exit QT4 Designer and open a terminal. Change to the directory that you saved the file in. Now we will generate a python file by using the command line tool pyuic4. This will read the .ui file. The command will be:

```
pyuic4 -x pytest1.ui -o
pytest1.py
```

The -x parameter says to include the code to run and display the UI. The -o parameter says to create an output file rather than just display the file in stdout. One important thing to note here. Be SURE to have everything done in QT4 Designer before you create the python file. Otherwise, it will be completely rewritten and you'll have to start over from scratch.

Once you've done this, you will have your python file. Open it up in your favorite editor.

The file itself is only about 65 lines long, including comments. We had only a few controls so, it wouldn't be very long. I'm not going to show a great deal of the code. You should be able to follow most all of the code by now. However we will be creating and adding to the code in order to put the functionality in to set the label text.

The first thing we need to do is copy the signal & slot line and modify it. Somewhere around line 47 should be the following code:

```
QtCore.QObject.connect(self.btnExit, QtCore.SIGNAL(_fromUtf8("clicked()")), MainWindow.close)
```

Copy that, and, right below it, paste the copy. Then change it to:

```
QtCore.QObject.connect(self.btnClickMe, QtCore.SIGNAL(_fromUtf8("clicked()")), self.SetLabelText)
```

This will then create the signal/slot connection to our routine that will set the label text. Under the retranslateUi routine add the following code:

```
def SetLabelText(self):

self.lblDisplay.setText(_fromUtf8("That Tickles!!!"))
```

I got the label setText information from the initialization line in the setupUi routine.

Now run your code. Everything should work as expected.

Although this is a VERY simple example, I'm sure you are advanced enough to play with QT4 Designer and get an idea of the power of the tool.

Next month, we will return from our detour and start working on the user interface for our TVRage program.

As always, the code can be found on pastebin at http://pastebin.com/98fSasdb for the .ui code, and http://pastebin.com/yC30B885 for the python code.

MY STORY QUICKIE

By Anthony Venable

This story begins at the beginning of 2010. I was broke at the time so I was trying to find a free operating system. I needed something I could run on my PCs at home. I had searched on the Internet, but found nothing useful for a long time. But one day I was at Barnes and Noble and I saw a magazine for Linux. (While I had heard of Linux before, I never thought of it as something I would ever be able to use.) When I asked people who I knew were computer professionals, I was told it was for people that were experts, and difficult to use. I never heard anything positive about it. I am so amazed that I hadn't came across it sooner.

When I read the magazine I became exposed to Ubuntu 9.10 - Karmic Koala. It sounded so good, as if it was exactly what I was looking for. As a result, I got very excited took it home, and to my surprise had such an easy time installing it to my PC that I decided to run it along with Windows XP as a dual boot system. All I did was put the live CD in the drive and the instructions were step by step you would have to be pretty slow to not get how to set things up.

Since then I have been very satisfied with Ubuntu in general and I have been able to check out later versions of it such as 10.04 (Maverick Meerkat) and 10.10 Lucid Lynx. I looked forward to future versiobs for how they integrate multi-touch even more than 10.04.

This experience just goes to show once again how I manage to find the coolest stuff by accident.

Programming In Python - Part 45

This time, we are going to rework our database program from the previous few articles (parts 41, 42 and 43). Then, over the next few articles, we will use QT to create the user interface.

First, let's look at how the existing application works. Here's a gross overview:
• Create a connection to the database – which creates the database if needed.
• Create a cursor to the database.
• Create the table if it doesn't exist.
• Assign the video folder(s) to a variable.
• Walk through the folder(s) looking for video files.
• Get the filename, seriesname, season number, episode number.
• Check to see if the episode exists in the database.
• If it is not there, add it to the database with a “-1” as the TvRage ID.
• Then walk through the database getting show id and status if needed, and update database.

We will redesign the database to include another table and modify the existing data table. First, we will create our new table called Series. It will hold all the information about the tv series we have on our system. The new table will include the following fields:
• Pkid
• Series Name
• TvRage Series ID
• Number of seasons
• Start Date
• Ended Flag
• Country of origin
• Status of the series (ended, current, etc)
• Classification (scripted, "reality", etc)
• Summary of the series plot
• Genres
• Runtime in minutes
• Network
• Day of the week it airs
• Time of day it airs
• Path to the series

```
sql = 'CREATE TABLE IF NOT EXISTS Series (
        pkid INTEGER PRIMARY KEY AUTOINCREMENT,
        SeriesName TEXT,
        SeriesID TEXT,
        Seasons TEXT,
        StartDate TEXT,
        Ended TEXT,
        OriginCountry TEXT,
        Status TEXT,
        Classification TEXT,
        Summary TEXT,
        Genres TEXT,
        Runtime TEXT,
        Network TEXT,
        AirDay TEXT,
        AirTime TEXT,
```

We can use the existing MakeDataBase routine to create our new table. Before the existing code, add the code shown above right.

The SQL statement (“sql = …”) should be all on one line, but is broken out here for ease of your understanding. We’ll leave the modification of the existing table for later.

Now we have to modify our WalkThePath routine to save the series name and path into the series table.

Replace the line that says

```
sqlquery = 'SELECT
count(pkid) as rowcount from
TvShows where Filename =
"%s";' % fl
```

with

```
sqlquery = 'SELECT
count(pkid) as rowcount from
series where seriesName =
"%s";' % showname
```

This (to refresh your memory) will check to see if we have already put the series into the table. Now find the two lines that say:

```
sql = 'INSERT INTO TvShows
(Series,RootPath,Filename,Sea
son,Episode,tvrageid) VALUES
(?,?,?,?,?,?)'

cursor.execute(sql,(showname,
root,fl,season,episode,-1))
```

and replace them with

```
sql = 'INSERT INTO Series
(SeriesName,Path,SeriesID)
VALUES (?,?,?)'

cursor.execute(sql,(showname,
root,-1))
```

This will insert the series name (showname), path to the series, and a “-1” as the TvRage id. We use the “-1” as a flag to know that we need the series information from TvRage.

Next we will rework the WalkTheDatabase routine to pull those series that we don’t have any information for (SeriesID = -1) and update that record.

Change the query string from

```
sqlstring = "SELECT DISTINCT
series FROM TvShows WHERE
tvrageid = -1"
```

to

```
sqlstring = "SELECT
pkid,SeriesName FROM Series
WHERE SeriesID = -1"
```

This will create a result-set that we can then use to query TvRage for each series. Now find/replace the following two lines

```
seriesname = x[0]

searchname =
string.capwords(x[0]," ")
```

with

```
pkid = x[0]

seriesname = x[1]

searchname =
string.capwords(x[1]," ")
```

We will use the pkID for the update statement. Next we have to modify the call to the UpdateDatabase routine to include the pkid. Change the line

```
UpdateDatabase(seriesname,id)
```

to

```
UpdateDatabase(seriesname,id,
pkid)
```

and change the line

```
GetShowStatus(seriesname,id)
```

to

```
GetShowData(seriesname,id,pki
d)
```

Which will be a new routine we will create in a moment.

Next, change the definition of the UpdateDatabase routine from

```
def
UpdateDatabase(seriesname,id)
:
```

to

```
def
UpdateDatabase(seriesname,id,
pkid):
```

Next, we need to change the query string from

```
sqlstring = 'UPDATE tvshows
SET tvrageid = ' + id + '
WHERE series = "' +
seriesname + '"'
```

to

```
sqlstring = 'UPDATE Series
SET SeriesID = ' + id + '
WHERE pkID = %d' % pkid
```

Now we need to create the GetShowData routine (top). We’ll grab the information from TvRage and insert it into the Series table.

```
def GetShowData(seriesname,id,pkid):
    tr = TvRage()
    idcursor = connection.cursor()
    dict = tr.GetShowInfo(id)
```

```
    seasons = dict['Seasons']
    startdate = dict['StartDate']
    ended = dict['Ended']
    origincountry = dict['Country']
    status = dict['Status']
    classification = dict['Classification']
    summary = dict['Summary']
```

Just as a memory refresher, we are creating an instance of the TvRage routines and creating a dictionary that holds the information on our series. We will then create variables to hold the data for updating the table (above).

Remember that Genres come in as subelements and contain one or many genre listings. Luckily when we coded the TvRage routines, we created a string that holds all the genres, no matter how many are returned, so we can just use the genre string:

```
genres = dict['Genres']
runtime = dict['Runtime']

network = dict['Network']

airday = dict['Airday']

airtime = dict['Airtime']
```

Finally, we create the query string to do the update (bottom). Again, this should all be on one line, but I've broken it up here to make it easy to understand.

The {number} portion (just to remind you) is similar to the "%s" formatting option. This creates our query string replacing the {number} with the actual data we want. Since we've already defined all of these fields as text, we want to use the double quotes to enclose the data being added.

And lastly, we write to the database (below).

That is all for this time. Next time, we'll continue as I laid out at the beginning of the article. Until next time, Enjoy.

```
    try:
        idcursor.execute(sqlstring)
    except:
        print "Error Adding Series Information"
```

```
sqlstring = 'Update Series SET Seasons = "{0}", StartDate = "{1}", Ended = "{2}",
OriginCountry = "{3}", Status = "{4}", Classification = "{5}",
Summary = "{6}", Genres = "{7}", Runtime = "{8}", Network = "{9}",
AirDay = "{10}",AirTime = "{11}"
WHERE pkID ={12}'.format(seasons,startdate,ended,
origincountry,status,classification,summary,
genres,runtime,network,airday,airtime,pkid)
```

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Programming In Python - Part 46

Usually, my articles are fairly long. However, due to some medical issues, this will be a fairly short article (in the grand scheme of things) this month. However, we will push through and continue our series on the media manager program.

One of the things our program will do for us is let us know if we have any missing episodes from any given series in the database. Here's the scenario. We have a series, we'll call it “That 80's Show”, that ran for three seasons. In season 2, there were 15 episodes. However, we have only 13 of them in our library. How do we find which episodes are missing – programmatically?

The simplest way is to use lists and sets. We have already used lists in a number of the articles over the last four years, but Sets are a new data type to this series, so we'll examine them for a while. According to the “official documentation” for Python (docs.python.org), here is the definition of a set:

“A set is an unordered collection with no duplicate elements. Basic uses include membership testing and eliminating duplicate entries. Set objects also support mathematical operations like union, intersection, difference, and symmetric difference.”

I'll continue to use the example from the documentation page to illustrate the process.

```
>>> Basket =
['apple','orange','apple','pear','orange','banana']

>>> fruit = set(basket)

>>> fruit

set(['orange','pear','apple','banana'])
```

Notice that in the original list that was assigned to the basket variable, apple and orange were put in twice, but, when we assigned it to a set, the duplicates were discarded. Now, to use the set that we just created, we can check to see if an item of fruit (or something else) is in the set. We can use the “in” operator.

```
>>> 'orange' in fruit

True

>>> 'kiwi' in fruit

False

>>>
```

That's pretty simple and, hopefully, you are beginning to see where all this is going. Let's say we have a shopping list that has a bunch of fruit in it, and, as we go through the store, we want to check what we are missing – basically the items in the shopping list but not in our basket. We can start like this.

```
>>> shoppinglist =
['orange','apple','pear','banana','kiwi','grapes']

>>> basket =
['apple','kiwi','banana']

>>> sl = set(shoppinglist)

>>> b = set(basket)

>>> sl-b

set(['orange', 'pear',
'grapes'])

>>>
```

We create our two lists, shoppinglist for what we need and basket for what we have. We assign each to a set and then use the set difference operator (the minus sign) to give us the items that are in the shopping list but not in the basket.

Now, using the same logic, we will create a routine (next page, bottom left) that will deal with our missing episodes. We will call our routine “FindMissing” and pass it two variables. The first is an integer that is set to the number of episodes in that season and the second is a list containing the episode numbers that we have for that season.

The routine, when you run it, prints out [5, 8, 15], which is correct. Now let's look at the code. The first line creates a set called EpisodesNeeded using a list of integers created using the range function. We need to give the range function the start value and end value. We add 1 to the range high value to give us the correct list of values from 1 to 15. Remember the range function is actually 0 based, so when we give it 16 (expected (15) + 1), the actual list that range creates is 0 to 15. We tell the range function to start at 1, so even though the range is 0 to 15 which is 16 values, we want 15 starting at 1.

Next we create a set from the list that is passed into our routine, which contains the episode numbers that we actually have.

Now we can create a list using the set difference operator on the two sets. We do this so we can sort it with the list.sort() method. You can certainly return the list if you wish, but in this iteration of the routine, we'll just print it out.

Well, that's all the time in the chair in front of the computer that my body can stand, so I'll leave you for this month, wondering how we are going to use this in our media manager.

Have a good month and see you soon.

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```
def FindMissing(expected,have):
    #====================================
    # 'expected' is the number of episodes we should have
    # 'have' is a list of episodes that we do have
    # returns a sorted list of missing episode numbers
    #====================================
    EpisodesNeeded = set(range(1,expected+1))
    EpisodesHave = set(have)
    StillNeed = list(EpisodesNeeded - EpisodesHave)
    StillNeed.sort()
    print StillNeed
```

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Programming In Python - Part 47

Last month, we discussed using sets to show us missing episode numbers. Now's the time to put the rough code we presented into practice.

We'll modify one routine and write one routine. We'll do the modification first. In the working file that you've been using the last few months, find the WalkThePath(filepath) routine. The fourth and fifth lines should be:

```
efile =
open('errors.log',"w")

for root, dirs, files in
os.walk(filepath,topdown=True
):
```

In between these two lines, we will insert the following code:

```
lastroot = ''

elist = []

currentshow = ''

currentseason = ''
```

By now, you should recognize that all we're doing here is initializing variables. There are three string variables and one list. We will use the list to hold the episode numbers (hence the elist name).

Let's take a quick look and freshen our memory (above) about what we're doing in the existing routine before we modify any further.

```
for root, dirs, files in os.walk(filepath,topdown=True):
    for file in [f for f in files if f.endswith (('.avi','mkv','mp4','m4v'))]:
```

The first two lines here set things up for the walk-the-path routine where we start at a given folder in the file system and recursively visit each folder below, and check for files that have the file extension of .avi, .mkv, .mp4 or .m4v. If there are any, we then iterate through the list of those filenames.

In the line above right, we call the GetSeasonEpisode routine to pull the series name, season number and episode number from the filename. If everything parses correctly, the variable isok is set to true, and the data we are looking for is placed into a list and then returned to us.

```
# Combine path and filename to create a single variable.
fn = join(root,file)
OriginalFilename,ext = os.path.splitext(file)
fl = file
isok,data = GetSeasonEpisode(fl)
```

Here (below) we are simply assigning the data passed back from GetSeasonEpisode and putting them into separate variables that we can play with. Now that we know where we were, let's talk about where we are going.

```
if isok:
    showname = data[0]
    season = data[1]
    episode = data[2]
    print("Season {0} Episode {1}".format(season,episode))
```

We want to get the episode number of each file and put it into the elist list. Once we are done with all the files within the folder we are currently in, we can then make the assumption that we have been pretty much keeping up with the files and the highest numbered episode is the latest one available. As we discussed last month, we can then create a set that is numbered from 1 to the last episode, and convert the list to a set and pull a difference. While that is great in theory, there is a bit of a "hitch in our git-a-long" when it comes down to actual practice. We don't actually get a nice and neat indication as to when we are done with any particular folder. What we do have though, is the knowledge that when we get done with each file, the code right after the "for file in [...]" gets run. If we know the name of the last folder visited, and the current folder name, we can compare the two and, if they are different, we have finished a folder and our episode list should be complete. That's what the 'lastroot' variable is for.

Just after the 'for file in[' line is where we'll put the majority of our new code. It's only seven lines. Here are the seven lines. (The black lines are the existing lines for your convenience.)

Line by line of the new code, here is the logic:

First, we check to see if the variable lastroot has the same value as root (the current folder name). If so, we are in the same folder, so we don't run any of the code. If not, we then assign the current folder name to the lastroot variable. Next, we check to see if the episode

```
    for file in [f for f in files if f.endswith (('.avi','mkv','mp4','m4v'))]:
        # Combine path and filename to create a single variable.
        if lastroot != root:
            lastroot = root
            if len(elist) > 0:
                Missing(elist,max(elist),currentseason,currentshow)
            elist = []
            currentshow = ''
            currentseason = ''
```

list (elist) has any entries (len(elist) > 0). This is to make sure we weren't in an empty directory. If we have items in the list, then we call the Missing routine. We pass the episode list, the highest episode number, the current season number, and the name of the season, so we can print that out later on. The last three lines clear the list, the current show name, and the current season, and we move on as we did before.

Next we have to change two lines and add one line of code into the if isok: code, a few lines down. Again, right, the black lines are the existing code:

```
        isok,data = GetSeasonEpisode(fl)
        if isok:
            currentshow = showname = data[0]
            currentseason = season = data[1]
            episode = data[2]
            elist.append(int(episode))
```

Here, we have just come back from the GetSeasonEpisode routine. If we had a parsable file name, we want to get the show name and season number, and add the current episode into the list. Notice, we are converting the episode number to an integer before we add it to the list.

We are done with this portion of the code. Now, all we have to do is add the Missing routine. Just after the WalkThePath routine, we'll add the following code.

Again, it is a very simple set of code and we pretty much went over it last month, but we'll walk through it just in case you missed it.

We define the function and set up four parameters. We will be passing the episode list (eplist), the number of episodes we should expect (shouldhave) which is the highest episode

```
#----------------------------------
def Missing(eplist,shouldhave,season,showname):
    temp = set(range(1,shouldhave+1))
    ret = list(temp-set(eplist))
    if len(ret) > 0:
        print('Missing Episodes for {0} Season {1} - {2}'.format(showname,season,ret))
```

number in the episode list, the season number (season), and the show name (showname).

Next, we create a set that contains a list of numbers using the range built-in function, starting with 1 and going to the value in shouldhave + 1. We then call the difference function – on this set and a converted set from the episode list (tempset(eplist)) – and convert it back to a list. We then check to see if there is anything in the list – so we don't print a line with an empty list, and if there's anything there, we print it out.

That's it. The one flaw in this logic is that by doing things this way, we don't know if there are any new episodes that we don't have.

I've put the two routines up on pastebin for you if you just want to do a quick replace into your working code. You can find it at http://pastebin.com/XHTRv2dQ.

Have a good month and we'll see you soon.

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Programming In Python - Part 48

Welcome back. It's hard to imagine that it's been 4 years since I began this series. I thought that I'd shelve the media manager project for a bit and return to some basics of Python programming.

This month, I'll revisit the print command. It's one of the most used (at least in my programming) function that never seems to get the detail it deserves. There is a lot of things you can do with it outside of the standard '%s %d'.

Since the print function syntax is different between Python 2.x and 3.x, we'll look at them separately. Remember, however, you can use the 3.x syntax in Python 2.7. Most everything I present this month will be done from the interactive shell. You can follow along as we go. The code will look like this:

```
>>> a = "Hello Python"
>>> print("String a is %s" % a)
```

and the output will be in bold, like this:

```
String a is Hello Python
```

Python 2.x

Of course you remember the simple syntax for the print function in 2.x uses the variable substitution of %s or %d for simple strings or decimals. But many other formatting options are available. For example, if you need to format a number with leading zeros, you can do it this way:

```
>>> print("Your value is %03d" % 4)
Your value is 004
```

In this case, we use the '%03d' formatting command to say, "Display the number to a width of 3 characters and if needed, left pad with zeros".

```
>>> pi = 3.14159
>>> print('PI = %5.3f.' % pi)
PI = 3.142.
```

Here we use the float formatting option. The '%5.3f' says to produce an output with a total width of five and three decimal places. Notice that the decimal point takes up one of the places of the total width.

One other thing that you might not realize is that you can use the keys of a dictionary as part of the format command.

```
>>> info = {"FName":"Fred","LName":"Farkel","City":"Denver"}
>>> print('Greetings %(FName)s %(LName)s of %(City)s!' % info)
Greetings Fred Farkel of Denver!
```

The following table shows the various possible substitution keys and their meanings.

Conversion	Meaning
'd'	Signed integer decimal
'i'	Signed integer decimal
'u'	Obsolete - identical to 'd'
'o'	Signed octal value
'x'	Signed hexadecimal - lowercase
'X'	Signed hexadecimal - uppercase
'f'	Floating point decimal
'e'	Floating point exponential - lowercase
'E'	Floating point exponential - uppercase
'g'	Floating point format - uses lowercase exponential format if exponent is less than -4 or not less than precision, decimal format otherwise
'G'	Floating point format - uses uppercase exponential format if exponent is less than -4 or not less than precision, decimal format otherwise
'c'	Single character
'r'	String (converts valid Python object using repr())
's'	String (converts valid Python object using str())
'%'	No argument is converted, results in a '%' character

PYTHON 3.X

With Python 3.x, we have many more options (remember we can use these in Python 2.7) when it comes to the print function.

To refresh your memory, here's a simple example of the 3.x print function.

```
>>> print('{0}
{1}'.format("Hello","Python")
)
Hello Python
```

```
>>> print("Python is {0}
cool!".format("WAY"))
Python is WAY cool!
```

The replacement fields are enclosed within curly brackets "{" "}". Anything outside of these are considered a literal and will be printed as is. In the first example, we have numbered the replacement fields 0 and 1. That tells Python to take the first (0) value and put it into the field {0} and so on. However, you don't have to use any numbers at all. Using this option causes the first value to be places in the first set of brackets and so on.

```
>>> print("This version of {}
is
{}".format("Python","3.3.2"))
This version of Python is
3.3.2
```

As they say on the TV ads, "BUT WAIT... THERE'S MORE". If we wanted to do some inline formatting, we have the following options.

```
:<x Left align with a width
of x
:>x Right align with a width
of x
:^x Center align with a width
of x
```

Here is an example:

```
>>>
print("|{:<20}|".format("Left
"))
|Left                |
>>>
print("|{:>20}|".format("Righ
t"))
|               Right|
>>>
print("|{:^20}|".format("Cent
er"))
|       Center       |
```

You can even specify a fill character along with the justification/width.

```
>>>
print("{:*>10}".format(321.40
))
*****321.4
```

If you need to format a date/time output, you can do something like this:

```
>>> d =
datetime.datetime(2013,10,9,1
0,45,1)
>>>
print("{:%m/%d/%y}".format(d)
)
10/09/13
>>>
print("{:%H:%M:%S}".format(d)
)
10:45:01
```

Printing thousands separator using a comma (or any other character) is simple.

```
>>> print("This is a big
number
{:,}".format(7219219281))
This is a big number
7,219,219,281
```

Well, that should give you enough food for thought for this month. I'll see you at the start of the 5th year.

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Programming In Python - Part 49

While I was working this week, a very wise person by the name of Michael W. suggested that I should consider what happens with floating-point numbers and equality.

Take for example a simple calculation: 1.1 + 2.2

The answer, you say, is 3.3! Any school-kid who has dealt with fractions knows that. Well, tell your computer. If you start up the Python Interactive Shell and at the prompt type

```
(1.1+2.2) == 3.3,
```

you might be surprised that the shell responds “False”.

WHAT?!!?!?

Now, confused, you type at the prompt:

```
>>>1.1+2.2
```

And the shell responds back:

```
3.3000000000000003
```

You stare at the screen in disbelief and first think “I must have typed something wrong”. Then you realize that you didn’t. So you type:

```
>>>2.2+3.3
5.5
```

Now you are even more confused and you think to yourself “Ok. This is either a bug or some kind of sick Easter egg.” No, it’s neither a bug nor an Easter egg. It’s real. While I knew about this a very long time ago, it had slipped into the cobwebs hidden in the dark recesses of my old mind, so I had to bring it up here. What we are seeing is the joy of binary floating-point numbers.

We all know that ⅓ equates to .3333333333333333... for ever and a day, but take, for example, the fraction 1/10. Everyone knows that 1/10 is equal to .1, right? If you use the interactive shell you can see that:

```
>>>1/10
0
```

Oh, right. We have to have at least one of the values a floating-point value to show any decimal points since an integer/integer returns an integer. So we try again.

```
>>>1/10.0
0.1
```

Ok. Reality is back. No, not really. Python is simply showing you a rounded version of the answer. So, how do we see the “real” answer? We can use the decimal library to see what’s really happening.

```
>>> from decimal import *
>>> Decimal(1/10.0)
Decimal('0.1000000000000000055511151231257827021181583404541015625')
```

WOW. So let’s try our original formula and see what that would show:

```
>>> Decimal(1.1+2.2)
Decimal('3.3000000000000002664535259100375697016716003417968750')
```

It seems to just be getting worse and worse. So what is really happening?

This is called Representation Error, and exists in almost every modern programming language (Python, C, C++, Java, and even Fortran and more), and on almost every modern computer. This is because these machines use IEEE-754 floating-point arithmetic which (on most machines and OS platforms) maps to an IEEE-754 double-precision number. This double-precision number has a precision of 53 bits. So, our 0.1, when represented in this 53-bit double-precision, turns into:

```
0.00011001100110011001100110011001100110011001100110011010
```

That’s close to .1, but not close enough to avoid issues.

So what do we do about it? Well, the quick answer is that you probably can live with it for 90% of the things we have to do out there in the real world – by using the round() method. While you have to decide on the number of decimal points that you must have in your world to carry the precision that you need, for the most part, this will be an acceptable workaround.

I honestly don't remember if we have gone over the round method, so I'll briefly go over it. The syntax is very simple:

```
round(v,d)
```

where v is the value you want to round and d is the number of decimals (maximum) you want after the decimal point. According to the Python documentation, "Values are rounded to the closest multiple of 10 to the power of minus n digits; if two multiples are equally close, rounding is done away from 0". All that being said, if the number is 1.4144, and we round it to 3 decimal places, the returned value will be 1.414. If the number is 1.4145 it would be returned as 1.415.

For example, let's use the value of pi that comes from the math library. (You must import the math library before you can do this, by the way.)

```
>>> math.pi
3.141592653589793
```

Now, if we wanted to round that value down to 5 decimal places, we would use:

```
>>> round(math.pi,5)
3.14159
```

That is the "standard" value of pi that most everyone knows off the top of their head. That's great. However, if we set the number of decimal places to be returned to 4, look what happens.

```
>>> round(math.pi,4)
3.1416
```

All that sounds good until you run into a value like 2.675 and try to round it to 2 decimal places. The assumption (since it is exactly halfway between 2.67 and 2.68) is that the returned value will be 2.68. Try it.

```
>>> round(2.675,2)
2.67
```

That might cause a problem. It goes back to the initial issue we have been talking about. The actual conversion to a binary floating-point number that is 53 bits long, the number becomes:

```
2.67499999999999982236431605997495353221893310546875
```

which then rounds down to 2.67.

The bottom line here is when trying to compare floating-point numbers, be aware that some things just don't translate well.

See you next time!

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Programming In Python - Part 50

This month, I thought I'd talk about a couple of lesser known functions, maketrans and translate.

We'll start with the translate method. The translate method returns a copy of a string – with all characters in the translate table replaced, or has the characters in the optional parameter deletechars removed from the string. Here's the syntax.

```
s =
str.translate(table[,deletech
aracters])
```

Before we get to the table portion of the method, let's look at the delete portion. Let's say that you have the string "The time has come". And you want to delete all the vowels (for some weird reason) from that string. You can code it like this:

```
astr = "The time has come"
astr.translate(None,'aeiou')
```

will return:

```
"Th tm hs cm"
```

Notice that we included None as the translate table. While this part is cool, it gets better. There is a function called maketrans. It takes an input string and an output string as parameters and returns a table that is used as the first parameter into the translate method. Here (top right) is a very simple example.

```
intable = 'aeiou'
outtable = '12345'
trantable = maketrans(intable,outtable)
astr = "The time has come"
astr.translate(trantable)
```

It returns:

```
"Th2 t3m2 h1s c4m2"
```

Let's look at what this does. We assign intable to a string of vowels as before. outtable is assigned the numbers 1,2,3,4,5 as a string. When we make the call to maketrans, our actual trantable is as follows (shown below. The "\x" means that it is hexadecimal char):

```
'\x00\x01\x02\x03\x04\x05\x06\x07\x08\t\n\x0b\x0c\r\x0e\x0f\x10\x11\x12\x13\x14\
x15\x16\x17\x18\x19\x1a\x1b\x1c\x1d\x1e\x1f !"#$%&\'()*+,-./0123456789:;<=>?@ABC
DEFGHIJKLMNOPQRSTUVWXYZ[\\]^_`1bcd2fgh3jklmn4pqrst5vwxyz{|}~\x7f\x80\x81\x82\x83
\x84\x85\x86\x87\x88\x89\x8a\x8b\x8c\x8d\x8e\x8f\x90\x91\x92\x93\x94\x95\x96\x97
\x98\x99\x9a\x9b\x9c\x9d\x9e\x9f\xa0\xa1\xa2\xa3\xa4\xa5\xa6\xa7\xa8\xa9\xaa\xab
\xac\xad\xae\xaf\xb0\xb1\xb2\xb3\xb4\xb5\xb6\xb7\xb8\xb9\xba\xbb\xbc\xbd\xbe\xbf
\xc0\xc1\xc2\xc3\xc4\xc5\xc6\xc7\xc8\xc9\xca\xcb\xcc\xcd\xce\xcf\xd0\xd1\xd2\xd3
\xd4\xd5\xd6\xd7\xd8\xd9\xda\xdb\xdc\xdd\xde\xdf\xe0\xe1\xe2\xe3\xe4\xe5\xe6\xe7
\xe8\xe9\xea\xeb\xec\xed\xee\xef\xf0\xf1\xf2\xf3\xf4\xf5\xf6\xf7\xf8\xf9\xfa\xfb
```

If you look at it carefully, you'll see that the lowercase vowel letters are replaced with the numbers we specified:

```
1bcd2fgh3jklmn4pqrst5vwxyz
```

If you look even closer, you'll see that there actually 256 entries starting with "\x00" and ending with "\xff". So the table contains the entire 256 possible ascii character set. So, when the translate method gets the table, it iterates (or walks through) each character, getting that characters value in Hex, and then finds that value in the translate table and substitutes it in the output string. The Hex representation of our original astr string ('The time has come') is shown below.

```
\x54\x68\x65\x20\x74\x69\x6d\x65\x20\x68\x61\x73\x20\x63\x6f\x6d\x65
  T   h   e       t   i   m   e       h   a   s       c   o   m   e
```

So now it should be making sense.

Now the purpose of this whole thing. Think back to your schooling where you learned about Julius Ceasar. Whenever he wanted to send a message of a confidential matter, he would use a cipher that would shift all the letters of the alphabet three characters to the right. So, using todays english alphabet:

```
ABCDEFGHIJKLMNOPQRSTUVWXYZabc
defghijklmnopqrstuvwxyz
```

becomes:

```
DEFGHIJKLMNOPQRSTUVWXYZabcdef
ghijklmnopqrstuvwxyzABC
```

While this seems very simple by today's standards, when I was a school kid, we used this all the time to send messages to each other. We used a different index into the string to start the encryption string, the logic behind it was the same.

No one knows how effective this actually was for good old Julius. One would think that if someone intercepted the message, they would have thought that it was in some foreign language. We can only speculate.

We can easily use the translate method and the maketrans helper function to allow us to have fun with this. Let's say we want to make a simple program that allows us to enter a string of "plain text" and get back an encrypted string using the same side right method that Caesar used. For simplicity sake, let's only use uppercase characters (shown top right).

Everything in the above code is pretty much what we've covered above or in earlier Python articles, but I'll go over it quickly.

The first two lines are the in and out strings. We've just shifted the characters and wrapped around to create the out string. The next two lines create a table for encoding and one for decoding. Line 5 prompts the user to enter a string to encode. We then encode that string (EncString) in the next line. To decode it, we simply use the translate method on the encoded string to get the plain text back. Finally we print both strings out. Here's the output of the program.

```
Enter the plaintext string ->
THE TIME HAS COME
Encoded string is -
WKH WLPH KDV FRPH
Decoded string is -
THE TIME HAS COME
```

Just like back in school. But let's flesh it out just a bit to make it a bit more usable. The code is almost the same with a few exceptions. First, we have added a space to the end of the intab string and in between the "Z" and the "A" in the outtab string. This helps keep the actual words from being too obvious in the encrypted string. The next change is where we ask if the user wants to encode or decode the string. Finally we added an if statement to control what we print (shown bottom right).

```
from string import maketrans
#-----------------------
intab  = "ABCDEFGHIJKLMNOPQRSTUVWXYZ"
outtab = "DEFGHIJKLMNOPQRSTUVWXYZABC"
EncTrantab = maketrans(intab,outtab) #Encode
DecTrantab = maketrans(outtab,intab) #Decode
instring = raw_input("Enter the plaintext string -> ")
EncString = instring.translate(EncTrantab)
DecString = EncString.translate(DecTrantab)
print("Encoded string is - %s" % EncString)
```

The output from the program is:

```
Encode or Decode (E or D) -> E
Enter the string -> THE TIME HAS
COME
Encoded string is -
WKHCWLPHCKDVCFRPH
```

And to test the decode side of things:

```
Encode or Decode (E or D) -> D
Enter the string ->
WKHCWLPHCKDVCFRPH
Decoded string is - THE TIME HAS
COME
```

Well, hopefully you are starting to get ideas about how to use this new information in your own code. See you next time!

```
from string import maketrans

#Be sure to include the space character in the strings
intab  = "ABCDEFGHIJKLMNOPQRSTUVWXYZ "
outtab = "DEFGHIJKLMNOPQRSTUVWXYZ ABC"
EncTrantab = maketrans(intab,outtab) #Encode
DecTrantab = maketrans(outtab,intab) #Decode

which = raw_input("Encode or Decode (E or D) -> ")
instring = raw_input("Enter the string -> ")
EncString = instring.translate(EncTrantab)
DecString = instring.translate(DecTrantab)

if which == "E":
    print("Encoded string is - %s" % EncString)
else:
```

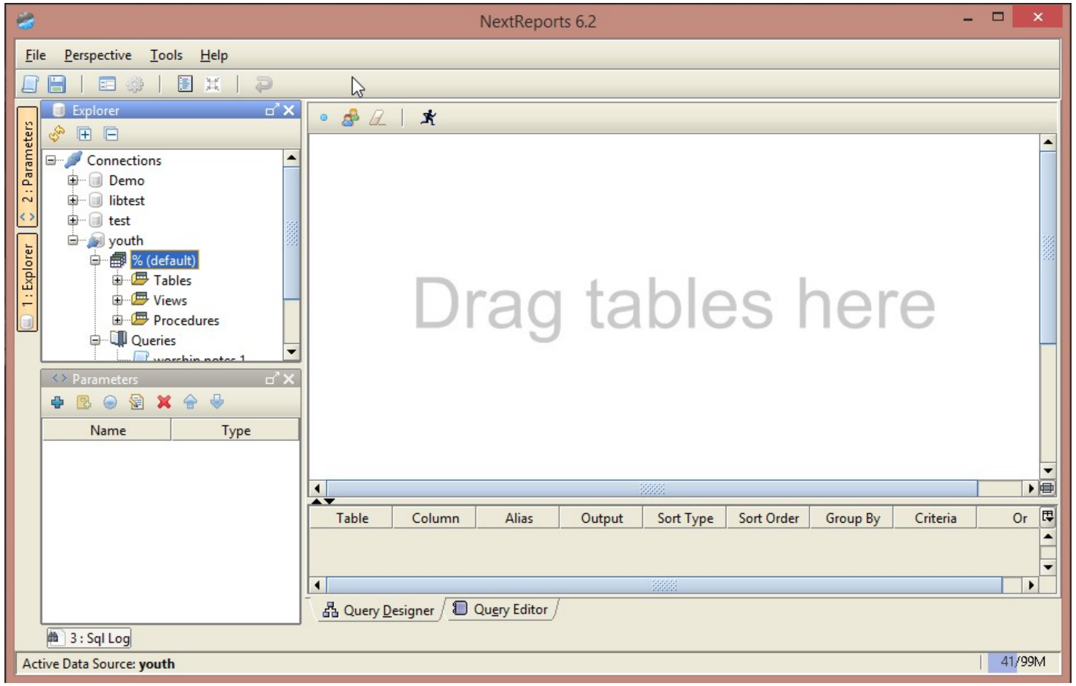
Programming In Python - Part 51

This month, I'm going to discuss a product that is new to me, but has apparently been around for a number of years. It's called NextReports from Advantage Software Factory, and you can get it free from http://www.next-reports.com/ . Not only that, but it's open source and it runs under Windows and Linux!

Before I start telling you about the product, let me get on my soapbox and vent for a moment or two. For a long time, I've been working with databases and reports. One of the things that I've had issues with is that while there are free database solutions out there, like SQLite and MySql, there was precious little available that was free for report designer tools. More times than not, any reports either had to be done with very expensive software tools, or the developer had to roll his own. Some tools were available, but were lacking. When it came to charting, well, you pretty much had no choice but to use the expensive stuff. Believe me, I've looked for years for really good free reporting tools, and I'm not sure how I have missed this package for so many years (version 2.1 was released in March of 2009 and they are currently up to version 6.3). But now that I've found it, I'm absolutely pumped about it.

Now that I've stepped down from my soap box, I can begin to sing its praises. It is a suite of three parts, a reports designer, a report engine and a report server. All I have had a chance to play with is the reports designer, but if the designer is any indication of the power, ease and flexibility of the rest of the suite, this thing is a winner.

This month, we are going to concentrate on the designer. Because of some constraints on my time, I'm working on a Windows machine, but everything that I show can be done in Linux (so please forgive me in advance).

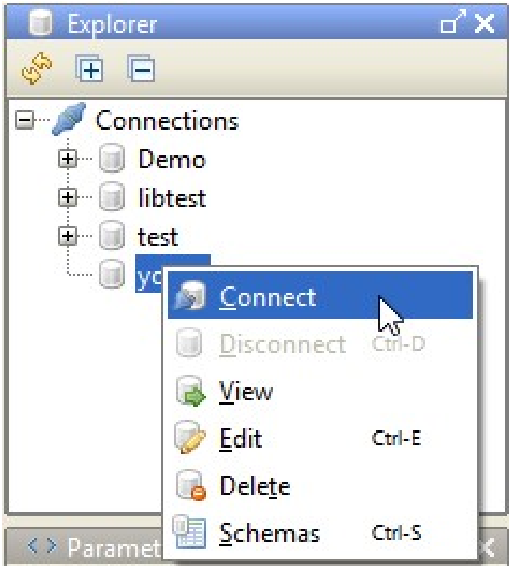


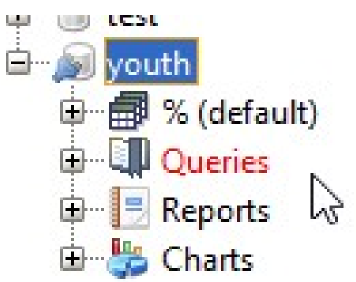
One of the first things you should know is that it supports databases like Oracle, MySql, SQLite, MSSQL and more. Everything is based on queries and a really good thing is that only SELECT type queries are allowed. This means that nothing in the source database can be changed by accident. You can enter your own queries or use a visual designer.

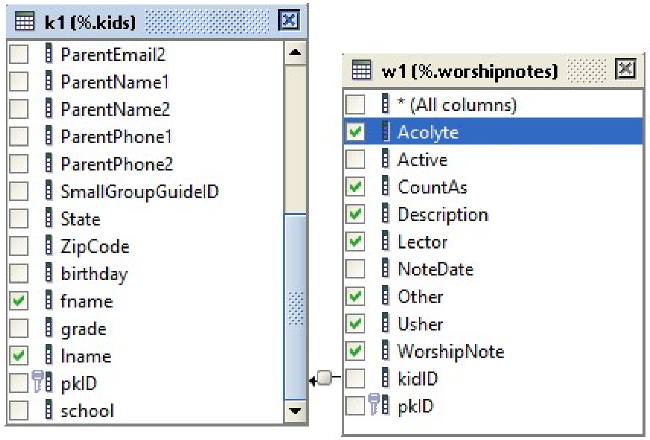
The screenshot shows how nice a UI it is. Things are pretty intuitive and it won't take you long to be productive at this. Let's take a look at the steps to get going.

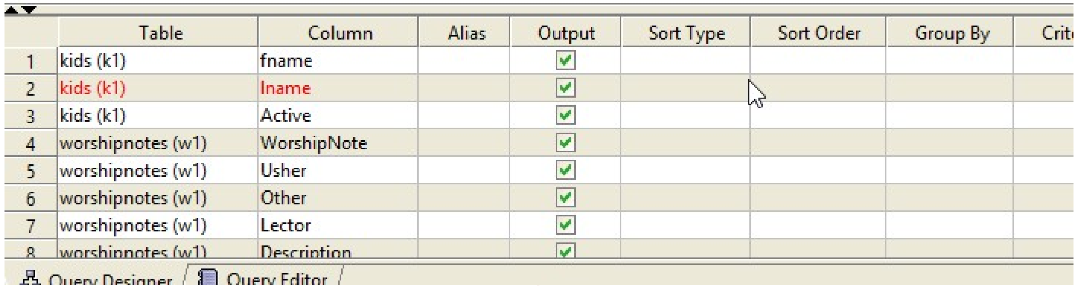
Start with File | New | Data Source. Next, name your source whatever you want to call it.

Now tell NextReports what kind of database it is in the dropdown called "Type:". You can skip over the Driver section and go to the URL: section. This is where you put the path to the database. If you are using, for example, a SQLite database, this will be filled in for you: “jdbc:sqlite:<dbfile-path>”. Replace the <dbfile-path> with the path to your database. Other types of databases have similar types of information already populated to help you. Next, click the “Test” button to make sure you can connect. If everything goes correctly, then click “Save” and







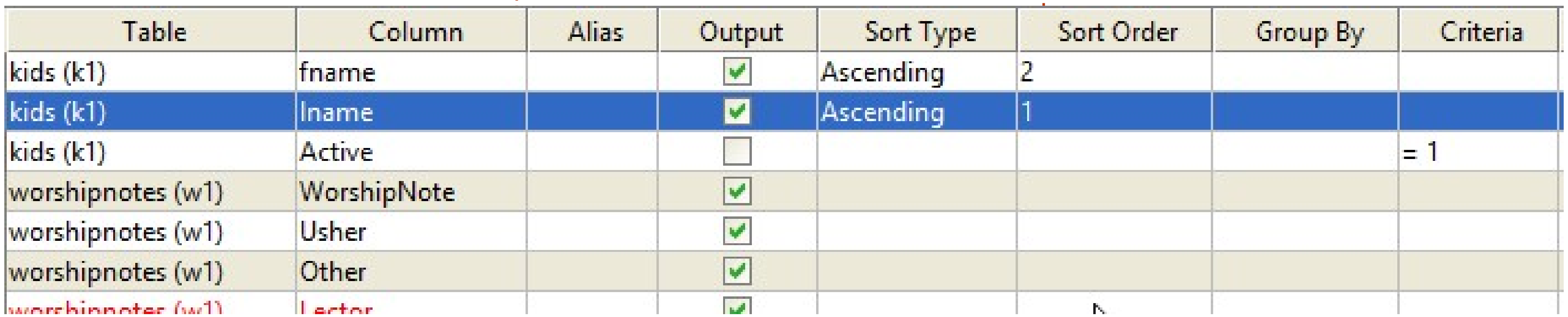


you’ll see it added to the Connetions tree. The next thing you need to do is make a connection to your database that you have just added. Now, right click on the database and then click on Connect.

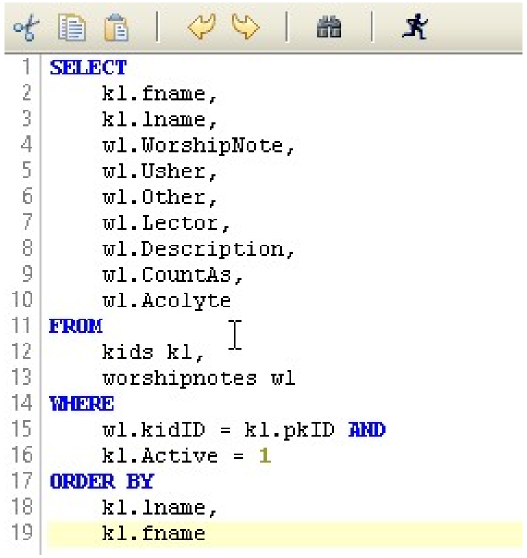
Once you are connected, you’ll see that you have four possible things to choose from. The “%” is the database tables. The next three are so you can create new queries, reports and charts. Simple enough. Now click on the “+” sign to the left of “%” which will open up your database table display. Now you will have Tables, Views and Procedures in the tree. Once again, click on the “+” sign next to “Tables”. This will show all your tables. Now if you want to use the visual query designer, just drag the table(s) you want to deal with onto the designer canvas to the right.

Once you have all your tables there, you can start making connections between the tables.

In the example here, I have two tables, one with information about kids in a confirmation class and the other with entries for worship notes taken. The worship note table doesn’t have the kid’s name in it, just an id that points to the kid information table. I did a drag and drop to make



that link between the kidID field and the pkID of the kid table. Then I selected each field I wanted to have in the result set. In this case, the kid's first and last name and an active (or not-deleted) flag in the kids table and multiple fields from



```
SELECT
    k1.fname,
    k1.lname,
    wl.WorshipNote,
    wl.Usher,
    wl.Other,
    wl.Lector,
    wl.Description,
    wl.CountAs,
    wl.Acolyte
FROM
    kids k1,
    worshipnotes wl
WHERE
    wl.kidID = k1.pkID AND
    k1.Active = 1
ORDER BY
    k1.lname,
    k1.fname
```

the notes table. The grid below shows each of the fields, which table it comes from, and other information.

As you can see, we can set criteria like "Active = 1", choose to display a field or not, and set sort type and sort order. Once you are satisfied with this, you can click on the tab below and see your actual SQL query.

To test your query, simply click on the "running man" and you will (hopefully if you did it correctly) get the query results in a grid below the editor. If you want to add manual lines you can. For example, I want to combine the kids first and last names (fname and lname) into a full name. We can do that by putting a line after the "k1.lname," line like this:

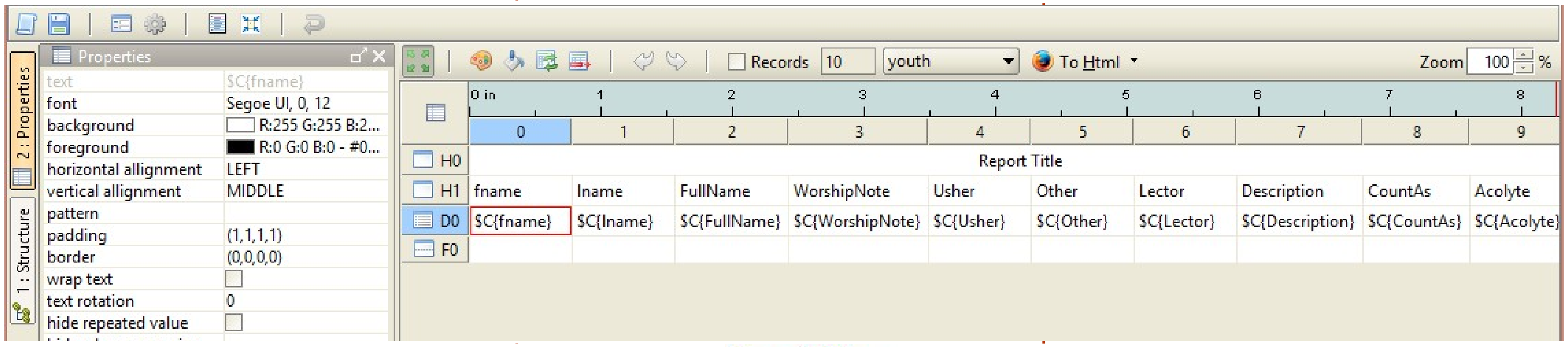
```
k1.fname || " " || k1.lname
as FullName,
```

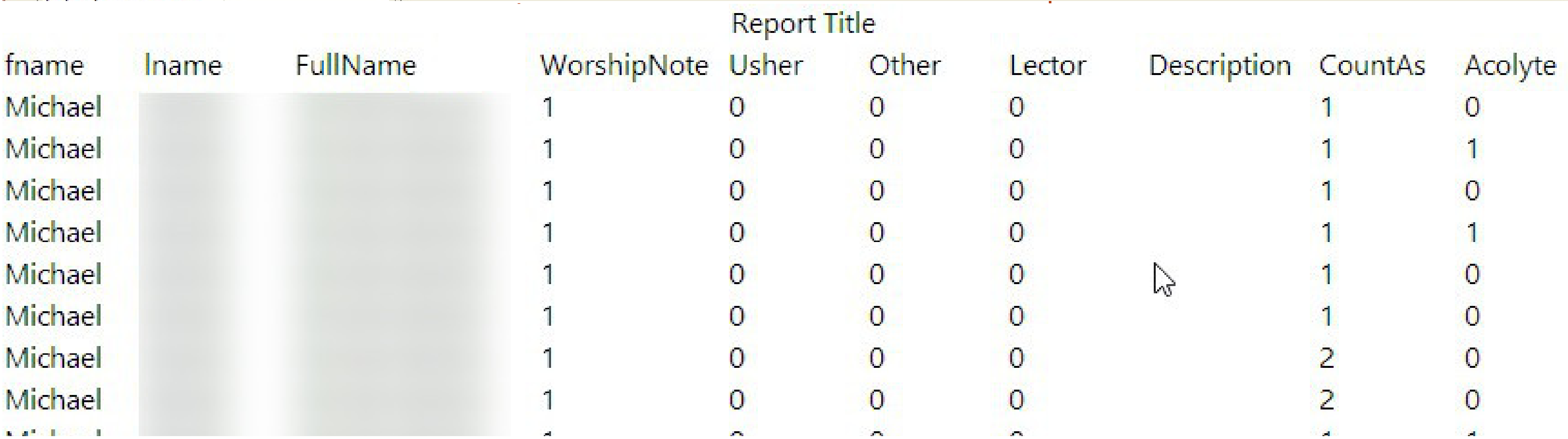
The "||" characters are concatenation characters so we will have the two fields with a space between in a field named "FullName". Don't forget the comma at the end. Once you have your query the way you want it, click on the save button to save the query. You will be asked what you want to call it.

Next, click on the Query item in the tree and right click on the query you just created.

Select "New Report from Query". The query designer canvas goes away and is replaced by the report designer.

On the left is the properties window for any given field or the entire report. On the right is the report designer itself. Notice that it looks like a spreadsheet. Each row is considered a "band" and holds information for that report row. In the case of this example, we



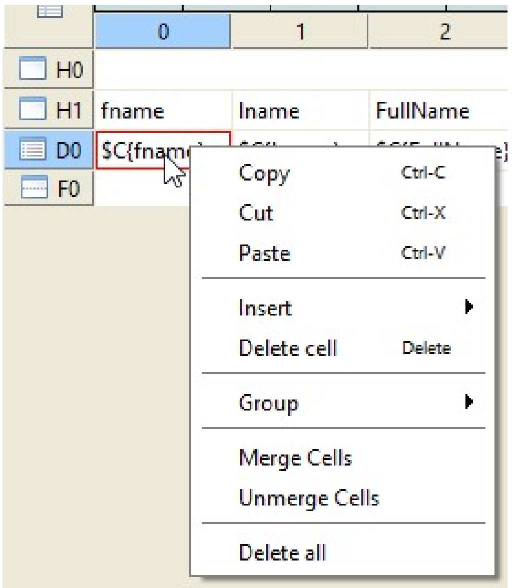


Report Title

fname	lname	FullName	WorshipNote	Usher	Other	Lector	Description	CountAs	Acolyte
Michael			1	0	0	0		1	0
Michael			1	0	0	0		1	1
Michael			1	0	0	0		1	0
Michael			1	0	0	0		1	1
Michael			1	0	0	0		1	0
Michael			1	0	0	0		1	0
Michael			1	0	0	0		2	0
Michael			1	0	0	0		2	0

have four rows, two header rows, one detail row and a footer row. You can add or delete rows as needed. This method is not quite as free-form as some other report designers, but makes for a very nice and clean report.

The two header rows hold our report title and column headers. The detail row has each field we will be reporting on and the footer row is the



report footer. Let's take a look at how the report looks as a default. Click on the button at the top of the bar marked "To Html" to see the report. (I blurred the kids last names, that's not an issue in the generator.)

For a report with almost no work, that's really nice. But let's pretty it up a bit. Let's create a group that puts all of the data for any given kid under the kid's name.

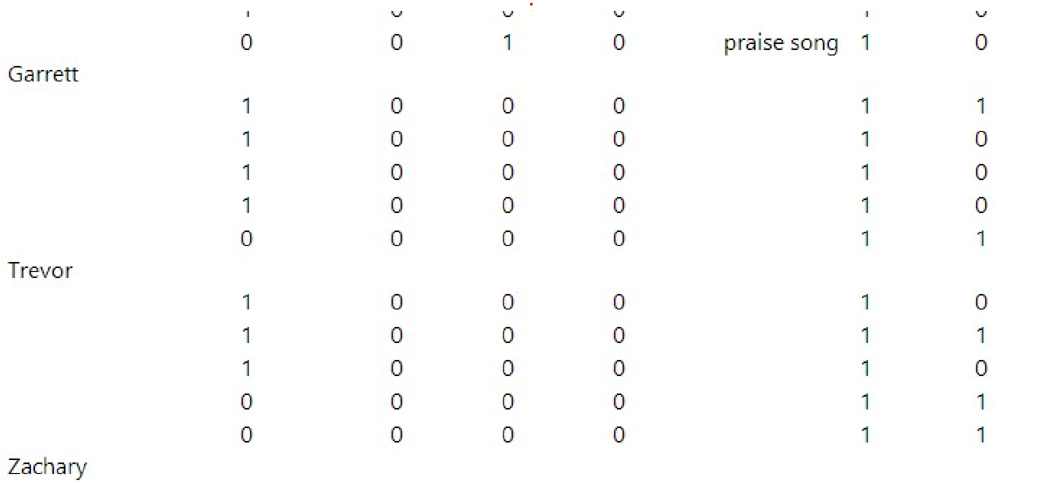
Right click on the first column of the data row. Select Group and then Add.

You will be presented with a new window asking which of the fields you want to create the group upon. In this case, I select FullName and then click the Ok button. Now we have a grouping break. We can also get rid of the three fields (fname, lname and FullName) in the detail section, since we'll be displaying the name in the group band. SImply right-click on them and select "Delete Cell". Now you can resize the three empty cells on the left to make the gap less obvious.

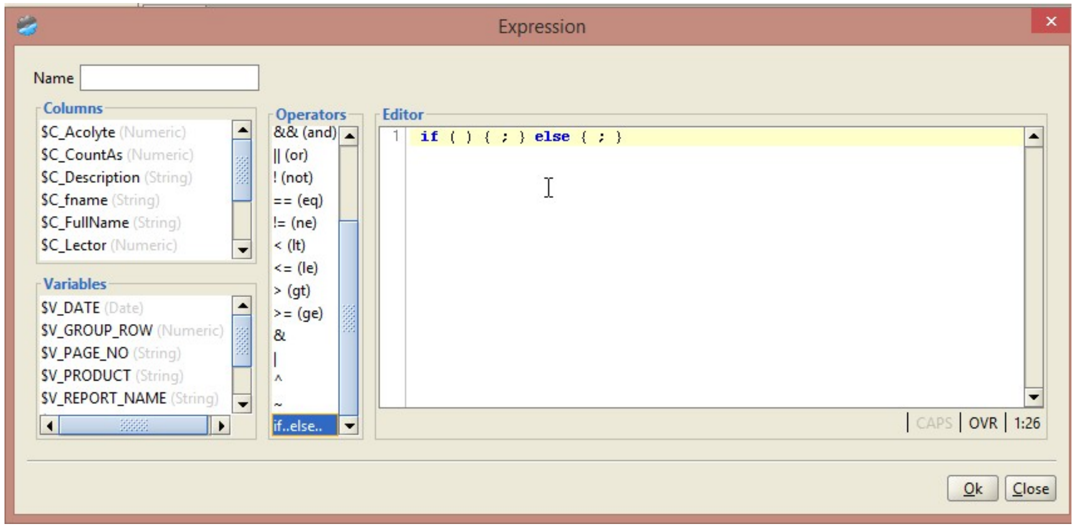
Taking a quick peek at what the report looks like now will show you that the information for each kid is all nicely grouped together.

That's nicer, but now let's do something kind of fun. All the 1s and 0s obviously stand for yes and no. That's rather boring for a report, so let's add an advanced conditional statement for each of those fields that will show a box with a check for Yes (or 1) and an empty box for No (or 0). It's really easy to do, but makes your report look like you spent days on it. By using the Wingdings font from Windows, the two characters we want are 0x6F(0168) for an empty box and 0xFE (0254) for a checked box.

Before I go on, the one thing that Windows does better than Linux (that I have found) is the use of the Alt+NumPad entry of special characters. Linux doesn't allow that. There was a work around that used Ctrl+Shift+U then the unicode value for the character you wanted. However, that doesn't work on all machines. The easiest way I've found to do this on Linux, is to open Character Map, use the search function to find the unicode character you want, double-click the character to copy it to the "Text to copy:" box, then click the "Copy" and then paste it into your document. The unicode characters for them are 2610 (empty box) and 2611 (checked box) using the WingDings 2 font. I'm sure there are many other easier ways to deal with this, but I'm shy on time. (Be sure you have



	0	0	1	0	praise song	1	0
Garrett							
	1	0	0	0		1	1
	1	0	0	0		1	0
	1	0	0	0		1	0
	1	0	0	0		1	0
	0	0	0	0		1	1
Trevor							
	1	0	0	0		1	0
	1	0	0	0		1	1
	1	0	0	0		1	0
	0	0	0	0		1	1
	0	0	0	0		1	1
Zachary							



Common selected in the Script list.)

We'll start with the WorshipNotes field. On the detail row, right click on the field you want to do. In this case it's marked $C{WorshipNote}. Choose Insert, then Expression. Yet another wonderful thing that NextReports gives us it the ability to do pretty much everything with as little typing as possible. Look in the center of window where it says Operators. Double click on the "if..else.." selection, and it will fill that into the editor for you as a template so you don't make a mistake.

Now, we want to put the WorshipNotes field in the parentheses of the editor. Simply click in between the two parentheses to place the cursor and then double-click on the field you want to go in there. BAM! It's filled in for you. Now click after the field name in the editor and then double-click on the "== (eq)" operator. Then add a "1", so the editor line reads

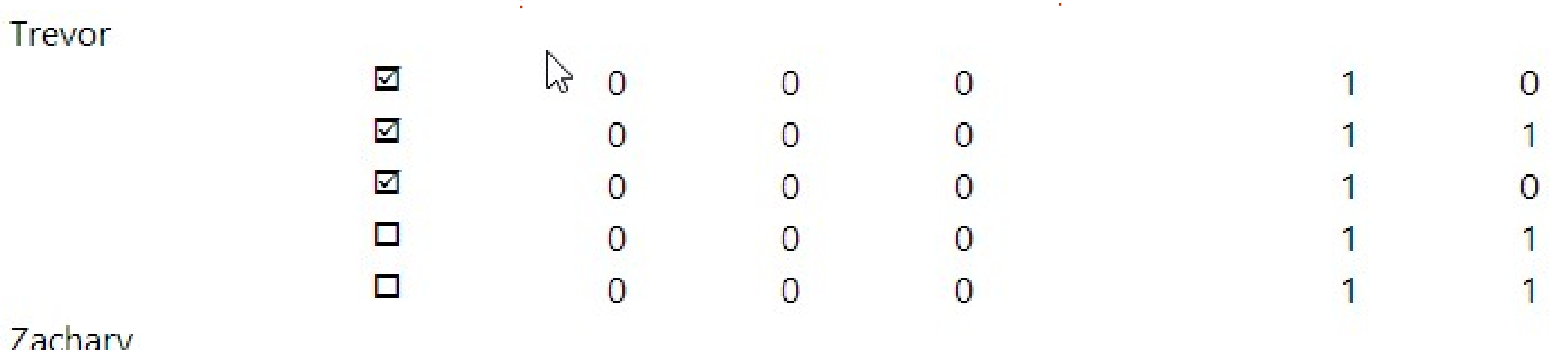
```
if ( $C_WorshipNote == 1 ) { ; } else { ; }
```

We are almost finished with our expression The first set of curly brackets define what to do if the expression is True and the second is what to do if it's false. In this case, we'll use the CharMap (in windows, Linux has one as well, for example gucharmap if you are using Gnome) to copy the characters into our editor string. Or, under windows, you can hold the {Alt} key and press 0168 for the empty box and 0254 for the checked box. So now our expression is (at least in Windows):

```
if ( $C_WorshipNote == 1 ) { "þ"; } else { "o"; }
```

Name the expression (I used WNotes) and save it.

Under properties for that field, select the font (WingDings is what I used here) and this is what it will look like.

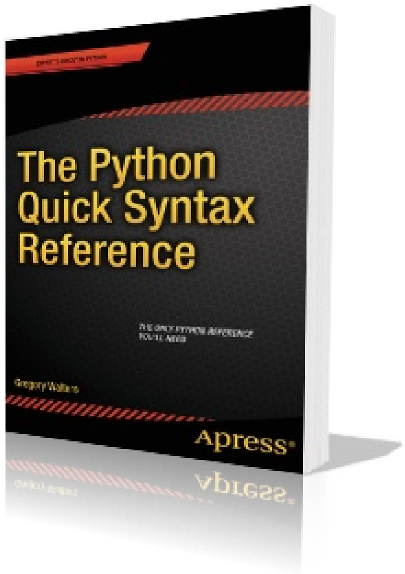


There's our pretty little boxes. Doing this to the other fields is just as simple.

It only took me about 3 hours of playing with the package to get to this point and a whole lot further. I can truly say that I have a great amount more to learn but that's for another day. You can use templates to color your report, you can add images, and much more.

Next time, I'll talk about how we might go about embedding these reports into a Python program. Until then, have fun playing with this wonder FREE software.

Programming In Python - Part 52



Before we get started on this month's actual python subject, let me toot my own horn for just a minute. In late December and early January, my first book on Python was published by Apress. It is named "The Python Quick Syntax Reference", and is available from a number of places. You can find it on the Apress site (http://www.apress.com/9781430264781), Springer.com (http://www.springer.com/computer/book/978-1-4302-6478-1) and Amazon (http://www.amazon.com/The-Python-Quick-Syntax-Reference/dp/1430264780) as well as others. It is, as the title suggests, a syntax reference that will help those of us who program in other languages as well as Python, to remember how a certain command works and the requirements for that command. Please help a poor old programmer make a living by buying the book, if you can.

Now on to bigger and better things.

While I was working on my latest book for Apress, I rediscovered a SQL command that I didn't discuss when we were working with SQL databases a long time ago, so I thought I'd share the information with you. It is the CREATE TABLE AS SELECT command, which allows us to pull a query from one table (or joined tables) and create another table on the fly. The general syntax is:

```
CREATE TABLE [IF NOT EXISTS]
{New Table Name} AS SELECT
{query}
```

The part in square brackets (IF NOT EXISTS) is totally optional, which will create the table only if it doesn't exist already. The part in curly brackets, however, is not. The first is the new table name and the second is the query that you want to use to pull data and create the new table.

Assume we have a database that has multiple tables in it. One of the tables is named "study" that holds data from a receiving operation. There are six fields which are shown below.

```
pkID - Integer, Primary Key, AutoIncrement
DOM -  Integer - Day of the month (1-31)
DOW -  Integer - Day of week (1-7 (Sunday = 1, Monday = 2, etc))
pkgs - Integer - Number of packages received that day
DayName - TEXT - "Sunday","Monday", etc
Holiday - Integer 0 or 1 (Is this day considered a holiday or not) 1 means yes
```

One of the datasets that we will need to produce from this raw data is a grouping of package count and the number of days within the study that quantity of packages came in on, assuming that the days are weekdays (Monday thru Friday) and that the day is not a holiday, since holidays have less than normal number of

```
SELECT pkgs, Count(DOW) as CountOfDOW FROM study
   WHERE (Holiday <> 1)
      AND DayName in ("Monday","Tuesday","Wednesday","Thursday","Friday")
   GROUP BY pkgs
```

packages. Our query is shown above.

This then provides us with data that would look something like this:

```
pkgs          CountOfDow
31                  1
32                  2
33                  1
...
48                  3
```

So the data is showing that during the study of 65 days, only one weekday had 31 packages but 3 weekdays had 48 packages and so on. Similar queries could be created that would cover holidays and weekends.

While having the data simply as a returned dataset from the query, we might want to do further analysis on the data, so we want to put the resulting data from the query into a table. That's why we would create a table from the query. So in the following example, shown above right, we create a table named "weekdays" using the same query we just showed above.

```
CREATE TABLE IF NOT EXISTS weekdays AS
   SELECT pkgs, Count(DOW) as CountOfDOW FROM study
   WHERE (Holiday <> 1)
      AND DayName in ("Monday","Tuesday","Wednesday","Thursday","Friday")
   GROUP BY pkgs
```

Now anytime we need the data for that weekday result set, we can just run a query on the weekdays table.

Once we know what we need, and have tested the query, then we can begin our code. Assuming we already have the study table created and populated, we can use Python to then create our new table in the main database. Just as an FYI, I am using the APSW SQLite library to do the database work.

We, of course, have to open a connection (right) and create a cursor to the SQLite database. We have covered this in a number of past articles.

```
def OpenDB():
    global connection
    global cursor
    connection = apsw.Connection("labpackagestudy.db3")
    cursor = connection.cursor()
```

Now we need to create the routine that will actually create the table with the returned dataset from the query, shown below, then alter it and run some calculations.

As you can see, we want to create a second cursor, so that we don't run any risk of the first cursor having data we need to maintain. We will be using it in the final part of the code. We then drop the table if it exists and run our query on the "study" table.

Now we create three more columns (shown below) within the weekdays table named

```
addcolquery = 'ALTER TABLE weekdays ADD COLUMN probability REAL'
cursor.execute(addcolquery)
addcolquery = 'ALTER TABLE weekdays ADD COLUMN lower REAL'
cursor.execute(addcolquery)
addcolquery = 'ALTER TABLE weekdays ADD COLUMN upper REAL'
cursor.execute(addcolquery)
```

```
def DoWeekDays():
    # Create a second cursor for updating the new table
     cursor2 = connection.cursor()
     q1 = "DROP TABLE IF EXISTS weekdays"
     cursor.execute(q1)
     query = '''CREATE TABLE IF NOT EXISTS weekdays AS SELECT pkgs,
               Count(DOW) as CountOfDOW FROM study WHERE (Holiday <> 1)
               AND DayName in
               ("Monday","Tuesday","Wednesday","Thursday","Friday")
               GROUP BY pkgs'''
```

"probability", "lower" and "upper". We do this by using the "ALTER TABLE" SQL command.

The next step (top right) will be to sum the data in the CountOfDOW field.

There is only one record returned, but we do the for loop thing anyway. Remember from the above discussion that the "CountOfDow" field holds the number of days during the study that a particular number of packages came in. This gives us a value that contains the sum of all of the "CountOfDow" entries. Just so you have a reference as we go forward, the number I got from all my dummy data is 44.

```
upquery = "SELECT * FROM
weekdays"

c1 = cursor.execute(upquery)
```

Here we have done a 'SELECT all' query so every record in the datatable is in the 'c1' cursor. We'll walk through each row of the dataset, pulling the pkgs (row[0]) and CountOfDow (row[1]) data into variables.

```
LastUpper = .0
for row in c1:
   cod = row[1]
   pkg = row[0]
```

Now we will create a probability of each daily package count in the database and calculate an upper and lower value that will be used in another process later on. Notice that we check to see if the LastUpper variable contains '.0'. If it does, we set it to the probability value, otherwise we set it to the lower plus the probability value.

Finally we use an update SQL statement to put the new computed values into the database.

What we end up with is a package count (pkgs), a count of the number of days that package count came in, a probability of that occurring within the whole of the study (31 packages on 1 day out of a total of 44 (weekdays in that 60+ day study), will have a probability of 0.02.).

If we add up all the probability values in the table it should add up to 1.0 .

```
    sumquery = "SELECT Sum(CountOfDOW) as Sm FROM weekdays"
    tmp = cursor.execute(sumquery)
    for t in tmp:
        DaySum = t[0]

        prob = cod / float(DaySum)
        if LastUpper != .0:
            lower = LastUpper
            LastUpper = (lower + prob)
        else:
            lower = .0
            LastUpper = prob

          nquery = 'UPDATE weekdays SET probability = %f, \
                    lower = %f, upper = %f WHERE pkgs = %d' \
                    % (prob,lower,LastUpper,pkg)
        u = cursor2.execute(nquery)
#=====================================
#     End of DoWeekDays
#=====================================
```

The upper and lower values then reflect a number between floating point number 0 and 1 that will mirror the possibility of any random number within that range that will give us a randomized number of packages. This number can then be used for a statistics analysis of this data. A "normal real-world" example would be to predict the number of cars that arrive at a carwash based on observational data done in the field. If you want to understand more, you could look at http://www.algebra.com/algebra/homework/Probability-and-statistics/Probability-and-statistics.faq.question.309110.html to see an example of this. All we did is generate (the hard part) easily with Python.

The code for the two routines that we presented this time is at: http://pastebin.com/kMc9EXes

Until next time.

Program In Python - Part 53

This month, I thought I would create a routine that makes a license key from an email. We all know the reason for having a license key, and if you ever need to have a quick and dirty set of routines to do it, you can use this. Remember, Python is a scripting language, so the source is always readable. There are ways around this; we'll discuss them in another article. Let's take a look at the "gross" logic behind the code, before we actually dive into the code.

First, we will ask for an email address and then break it into two parts, the local part (the part before the "@" character) and the domain part (the part after the "@" character). There are very specific rules for email address validity, and it can get very complicated. For our purposes, we will only use some of the rules and only on the local part. You can do a web search on the actual rule set. In our code, we will only look at:

- lowercase characters
- upper case characters
- numbers between 0 and 9
- special characters (!#$%&'*+-/=?^_`{|}~.)
- period characters are allowed, but may not be repeated next to each other (..., etc)

Once we have validated the email, we then will create a "checksum character" which is based on the ascii value of each character in the entire email address, and then divide it by the number of characters in the email address. For example, let's use a mythical email address of fredjones@someplace.com. If we walk through the email address, we can get the ascii value of each character by using the ord() function. When we add up each of the ascii values, we get a sum of 1670, then we divide that by the length of the email address (23); we get 72. Remember we are using integer division here, so our result will be an integer.

```
localvalid1 = "abcdefghijklmnopqrstuvwxyz"
localvalid2 = "ABCDEFGHIJKLMNOPQRSTUVWXYZ1234567890"
localvalid3 = "!#$%&'*+-/=?^_`{|}~."
Offset = 0
```

Now that we have our checksum value, we subtract 68 from that (ascii 'D') to create an offset. We use this offset when we encode each character in the email. Just to make things a bit harder to decode, we put the length (with offset) as character position 2 and the checksum as character position 4.

So for the email fredjones@someplace.com we get a license key of:

```
j[vHihnsriwDwsqitpegi2gsq
```

Lets get started with the code. Since this is the 53rd article in the series, I won't be quite as verbose from here on out.

First our imports.

```
import sys
```

Now (as shown above right) we will create a string that will include all of our "legal" characters for the IsValidEmail function. I've split it into 3 strings so it fits nicely for the magazine. We combine them in the IsValidEmail routine. We also set a global variable 'Offset' to 0. This will be the value that we add (later on) to each character when we create the encoded string.

```
def IsValidEmail(s,debug=0):
    email = s
    pos = email.rfind("@")
    local = email[:pos]
    domain = email[pos+1:]
    if debug == 1:
        print local
        print domain
    isgood = False
    localvalid = localvalid1 + localvalid2 + localvalid3
```

Now for our first function. This (below) is the IsValidEmail routine. Basically we pass the email in the variable s, and an optional debug flag. We use the debug flag, as we have done in the past, to provide some print statements to see how things are going. Usually we would simply pass a 1 as the second parameter if we want to see the progress verbosely.

First we assign the passed in email address to the variable ‘email’ and find the ‘@’ character that separates the local from the domain portions of the email. We then assign the local portion of the email to (I think it’s appropriate) ‘local’, and the domain portion to ‘domain’. We then set the boolean isgood flag to False and finally create the ‘localvalid’ string from the 3 shorter strings we set up earlier.

Next (top right) we simply walk through each character in the local portion of the email against the list of valid characters using the in keyword. If any character in the local portion of the email fails the test, we break out of the for loop, setting the ‘isgood’ flag to False.

Finally, we look for any set of period characters that are contiguous. We use the string.find routine that will match anything that is like ‘..’ or ‘...’ and so on. Being a lazy programmer, I used only a single “double dot” check that works for anything more.

```
r = email.find("..")
if r > -1:
    isgood = False
```

The last thing we do in the routine is return the value of the ‘isgood’ flag.

```
return isgood
```

The next routine (bottom right) is the CheckSum routine which is fairly short. We walk each character in the email and create a running sum of the ascii value of each using the built-in ‘ord’ type conversion. As I stated earlier, we take that sum and divide it by the length of the email address. We return the checksum value and the character represented by that checksum.

```
    # Check Local Part
    for cntr in range(0,len(local)):
        if local[cntr] in localvalid:
            if debug == 1:
                print local[cntr],ord(local[cntr]),"True"
            isgood = True
        else:
            if debug == 1:
                print local[cntr],ord(local[cntr]),"False"
            isgood = False
            break
```

```
def CheckSum(s,debug = 0):
    sum = 0
    email = s.upper()
    for cntr in range(0,len(email)):
        if debug == 1:
            print email[cntr],ord(email[cntr])
        sum += ord(email[cntr])
    cs = sum/len(email)
    if debug == 1:
        print('Sum = %d' % sum)
        print('ChkSum = %d' % cs)
        print('ChkSum = %s' % chr(cs))
```

Now for the EncodeKey routine. While it looks simple, it requires some concentration so pay attention! We assign the Offset variable to global status so we can change it within the function and so it can be used in other functions. We then set the Offset variable to the checksum minus 68. As in the example presented at the beginning of the article, it would be 72-68 which equals 4. We then step through each character of the email address adding the offset to the ascii value of that character. For the ‘f’ in ‘fredjones’, it would be 102 + 4 or 106 which equates to ‘i’. Using the counter variable ‘cntr’, we then determine what we add to the ‘NewEmail’ string we build up character by character. Notice in the code that we go from 0 to the length of the email, so character 0 is ‘f’, character 1 is ‘r’ and so on. Now comes the part that might confuse some of you. If cntr is a value of 1 ('r'), we insert the character for the length of the email + 68 and then the offset character, which using our example would be iYt. The next time we go through the loop, cntr will equal 2, but we already have 3 characters in the email. That's where we want to insert the checksum character ('F') and then the third character offset. From there, we simply add each offset character to the string, and when the loop is done, we return the key (top right).

The DecodeKey routine (bottom right) basically reverses the process we used in the EncodeKey routine. One thing you might notice here is that in the first 'if debug' statement of this function, I used '!= 0' rather than '== 1', simply to remind you that the two can be interchangeable.

The DoIt function (below) asks for an email address using 'raw_input', then calls the functions in order to create the license key.

Lastly, we call the DoIt routine.

```
if __name__ == "__main__":
    DoIt()
```

Now, obviously the output is not super-encrypted, and if someone were to put in a fair amount of time, they could figure out what we used to create the key fairly easily. However, it should give you enough of a starting point that you could simply modify the code to make it much harder to break. You could, for example, use a random number rather than the 'D' (68). If you do that, set a seed in the code so that it will always generate the same random number. You could also go a bit deeper and put the offset value somewhere into the license key, maybe the last character so you could use that as the decryption offset.

As always, the full source is available at http://pastebin.com/MH9nVTNK. Until next time, enjoy.

```
def DoIt():
    email = raw_input("Please enter email address -> ")
    isok = IsValidEmail(email,0)
    if isok == True:
        csum,csumchr = CheckSum(email)
        ke = EncodeKey(email,csum,0)
        print("License Key    = %s" % ke)
        print("Original email = %s" % DecodeKey(ke,0))
```

```
def EncodeKey(s, csum, debug = 0):
    global Offset
    email = s
    Offset = csum - 68
    if debug == 1:
        print("Offset is %d" % Offset)
    NewEmail = ""
    for cntr in range(0,len(email)):
        ch = ord(email[cntr]) + Offset
        if cntr == 1:
            NewEmail = NewEmail + (chr(len(email)+68)) +
chr(ch)
        elif cntr == 2:
            NewEmail = NewEmail + chr(csum) + chr(ch)
        else:
            NewEmail = NewEmail + chr(ch)
    if debug == 1:
        print cntr, NewEmail
```

```
def DecodeKey(s,debug = 0):
    global Offset
    eml = ""
    for cntr in range(0,len(s)):
        if debug != 0:
            print cntr,s[cntr],ord(s[cntr])-
Offset,chr(ord(s[cntr])-Offset)
        if cntr == 0:
            eml = eml + chr(ord(s[cntr])-Offset)
        elif cntr == 1:
            emllen = ord(s[cntr])-Offset
        elif cntr == 3:
            csumchr=s[cntr]
        else:
            eml = eml + chr(ord(s[cntr])-Offset)
    if debug == 1:
```

Program In Python - Part 54

Many years ago, I was dealing with high blood pressure issues. My doctor suggested that I do something that allowed me to concentrate on something fairly useful, but rather trivial. I dealt with it by trying to do counted cross stitch. It's creative, focused, and keeps your mind occupied on what you are doing, not what is bothering you. I find myself in that position again, so I broke out the hoop and needles and started again.

In case you aren't familiar with counted cross stitch, I'll give you a gross overview of what it is. Cross stitch is a type of needlework that uses tiny 'x' patterns of thread that eventually make up a picture. The thread is called "floss" and the fabric that you use is called "aida". According to Wikipedia, aida is a special fabric that has tiny squares that have small holes at regular intervals that form the squares. This facilitates the placement of the "x" patterns that make the image. There are two types of cross stitch. One has an image printed on the aida (sort of like paint by numbers), and the other uses totally blank aida that you count stitches from the pattern. The second is much harder than the first. Go to your favorite fabric store or craft section of your local mega-mart and you'll get the idea.

Also a while back, I started playing with creating a program that would take an image and convert it into a cross stitch pattern. One thing lead to another, and I had to shelve the program for other things. I've now dusted off the idea and started anew.

We will spend the next few articles dealing with this project. It will take a while, since some things are fairly complex and have many parts to them. Here is the "game plan":

- Create a database for the pixel colors to floss colors.
- Create a GUI using Tkinter for the application.
- Flesh out the application to do the manipulation of the image files.
- Create a PDF file that will be the ultimate pattern for the project.

What you will learn

- Revisitation of database and XML manipulation.
- Revisitation of Tkinter GUI programming. If you missed the previous articles on this, please refer to FCM issues 51 thru 54.
- Image manipulation using PIL (http://pillow.readthedocs.org/en/latest/).
- PDF creation using pyFPDF (https://code.google.com/p/pyfpdf).

Getting Started

The first thing in our list of tasks is to create the database that will hold the DMC(™) floss colors and reference them to the closest approximation to the RGB (Red, Green, Blue) values that are used in images on the computer. At the same time, the database will hold the hex value and the HSV (Hue, Saturation, Value) representations for each floss color. It seems that HSV is the easiest way to find the "closest" representation of a color that will match the floss colors. Of course, the human eye is the ultimate decision maker. If you are not familiar with HSV color representations, there is a rather complex writeup on Wikipedia at http://en.wikipedia.org/wiki/HSL_and_HSV. It might help, but it might make things less clear.

The first thing we need is an XML file that has the DMC floss

```
# makedb.py
# DMC.xml to SQLite database
# For Full Circle Magazine #85

import apsw
from xml.etree import ElementTree as ET
tablename = "DMC"
```

colors with a RGB conversion. The best one I found is at http://sourceforge.net/p/kxstitch/feature-requests/9/. The file you want is dmc.xml. Download it and put it in a folder that you will use to hold the Python code.

Now we will be using apsw (below) to do our database manipulation, which you should already have and ElementTree to do the XML parsing (which is included in Python version 2.7+).

As always, we start with our imports. In this program, we have only the two. We also set the name of the table.

The next portion should be familiar if you have been reading the articles for a while. We create a function that will read the XML file, and parse it for us. We then can use the information to load the database. A snippet of the XML file is shown top right.

We are looking for the <floss> tag for each line of information. To do this, we use the .findall('floss') command. Once we have the information line, we break each tag (name, description, etc.) into separate variables to place into the database. When it comes to the <color> tag, we use the .floss.findall('color') command to get each value of Red, Green and Blue.

We start by telling the function that we will be using the global variables connection and cursor. We then set the filename of the XML file, parse the XML file, and get started. We also use a counter variable to show that something is happening while the parsing and database inserts are going on.

Now that we have all our data, we need to create the SQL insert statement and execute it. Notice the "\" after the word VALUES in the SQL statement. That is a line-continuation character to make it easier for printing here in the magazine. We will be creating the database and table in a few moments.

```
    SQL = "INSERT INTO DMC (DMC,Description,Red,Green,Blue) VALUES \
('%s','%s',%s,%s,%s)" % (name,desc,red,green,blue)

 cursor.execute(SQL)
```

Now, we print to the terminal window that something is going on:

```
   print "Working record {0}".format(cntr)

    cntr += 1
```

Now we create and/or open the database in the OpenDB routine (bottom right). If you've

```
<floss>
    <name>150</name>
    <description>Dusty Rose Ultra VDK</description>
    <color>
         <red>171</red>
         <green>2</green>
        <blue>73</blue>
    </color>
```

```
def ReadXML():
    global connection
    global cursor
    fn = 'dmc.xml'
    tree = ET.parse(fn)
    root = tree.getroot()
    cntr = 0
    for floss in root.findall('floss'):
        name = floss.find('name').text
        desc = floss.find('description').text
        for colour in floss.findall('color'):
            red = colour.find('red').text
            green = colour.find('green').text
```

```
def OpenDB():
    global connection
    global cursor
    global ucursor
    global dbname
    connection = apsw.Connection("floss.db3")
    cursor = connection.cursor()
```

been with us when we have done database work before, you will notice that we are using two cursors this time. The cursor variable is used for the "normal" inserts, and later on in the select statement for the update to set the hex and HSV values. We have to use two cursors, since if you modify a cursor in the middle of a logic statement, you lose everything with the new command. By using 'ucursor', we can use that for the update statements. Other than that, it is our normal OpenDB routine.

Now that the database is created and/or opened, we can set up our table (top right). Notice that the SQL statement below uses the triple quote to allow for the line to break neatly for viewing.

The EmptyTables routine (middle right) is there just to make sure that if we want to or need to run the application more than once, we start with a clean and empty table if it exists.

IF we were to stop here, we would have a reasonable working database with the DMC color, color name and the RGB values associated with each. However, as I alluded to before, it is easier to pick the closest floss color by using the HSV data.

We next create the hex value from the RGB values (middle left).

The next function creates the HSV values from the RGB values. I found the algorithm on the internet. You can research it there.

Finally, we create the UpdateDB function (next page, top left). We use the SELECT * FROM DMC command and use the "standard" cursor variable to hold the data. We then step through the returned data, and read the RGB values, and pass them to the rgb2hex function as a tuple and to the rgb2hsv function as three separate values. Once we get the return values, we use the update SQL command to match the proper record by using the primary key (pkID). As I stated before, we have to use a separate cursor for the update statement.

The last thing we do is call each of the functions in order to create the database, and, at the end, we print "Finished" so the user knows everything is done.

```
def MakeTables():
    sql = '''CREATE TABLE IF NOT EXISTS DMC
          (pkID INTEGER PRIMARY KEY, DMC INTEGER,
           Description TEXT, Red INTEGER, Green INTEGER, Blue INTEGER,
           HEX TEXT,H INTEGER,S INTEGER,V INTEGER)'''
    cursor.execute(sql)
```

```
def rgb2hex(rgb):
    return '%02x%02x%02x' % rgb
```

```
def EmptyTables():
    sql="DELETE FROM %s" % tablename
    cursor.execute(sql)
```

```
def rgb2hsv(r, g, b):
    r, g, b = r/255.0, g/255.0, b/255.0
    mx = max(r, g, b)
    mn = min(r, g, b)
    df = mx-mn
    if mx == mn:
        h = 0
    elif mx == r:
        h = (60 * ((g-b)/df) + 360) % 360
    elif mx == g:
        h = (60 * ((b-r)/df) + 120) % 360
    elif mx == b:
        h = (60 * ((r-g)/df) + 240) % 360
    if mx == 0:
        s = 0
    else:
        s = df/mx
        v = mx
```

```
OpenDB()
MakeTables()
EmptyTables() # Just to be
safe
ReadXML()
UpdateDB()
```

```
print "Finished"
```

I named this program "MakeDB". The database should be created in the same folder where the code and XML file are located. As always, the full code can be found at http://pastebin.com/Zegqw3pi.

Next time, we will work on the GUI. We use Tkinter for the GUI, so, in the meantime, you might want to refresh your memory by looking at FCM issues 51 thru 54 where I take you through Tkinter.

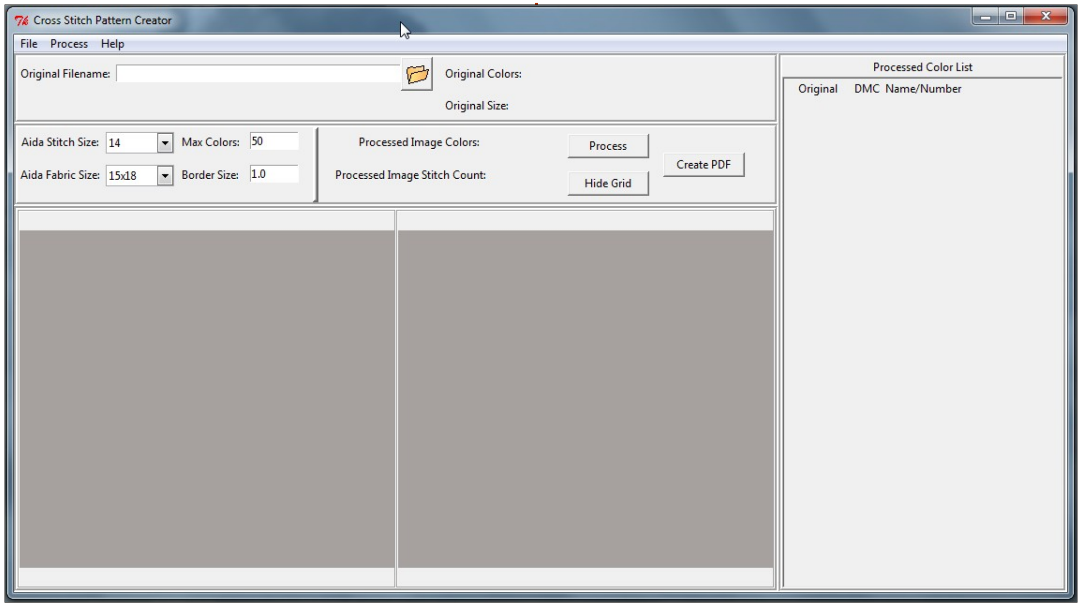
Until next time, have a good month.

Program In Python - Part 55

This is the second in a multi-part tutorial on creating a Cross Stitch pattern generator. In the first part (FCM85), we created a database containing the DMC™ floss colors with their closest RGB values. In this part, we will create the GUI using Tkinter. We will also use PIL (Python Imaging Library) and PMW (Python Mega Widgets). You'll need to download those libraries and install them before we go too far. For PIL, go to the Pillow fork at https://github.com/python-imaging/Pillow and download the latest version. For PMW, go to http://pmw.sourceforge.net/ and download from there.

You will also need two image files. One is a simple grey rectangle 500x400 pixels. You can use GIMP or some other image manipulating program to create it. Name it default.jpg, and place it into your source code directory along with the database. The other is an image of a folder for the open image button. I got one from open clipart and searched for the word "folder". I found a reasonable one at https://openclipart.org/detail/177890/file-folder-by-thebyteman-177890. Open it in GIMP, resize it to 30x30 and save it in the same directory as the other two files as "open.gif".

Above is a screenshot of what the finished GUI will look like. There are four main frames in the GUI. Three on the left side and one on the right. When we go through the build widget process, I refer to them as Top Frame, Middle Frame, Bottom Frame and Side Frame. The top frame deals with the original image. The middle frame deals with the processing of the image. The bottom frame shows the original image on the left and the processed image on the right, and the side frame displays the colors and floss required. It seems from first glance there is a lot of wasted space here, but when you see the program run, it doesn't really have that much empty space, once we get through the



processing portion.

Now we are ready to start working on the code. Here is our long list of imports...

```
from Tkinter import *

import tkFileDialog

import tkCommonDialog

import tkMessageBox

import ttk

from PIL import
Image,ImageTk,ImageOps

import Pmw

import apsw  # Database
Access

import math  # Math library

import sys
```

From the sheer number of imports, you can tell this is going to be a long program. In fact, the UI portion of the code will be over 300 lines, including comments. The "good" news is that about 200 of the lines of code deal with the Tkinter portion of the program, the actual GUI itself. The majority of the remaining lines of code in this portion are stubs for functions needed for the next article.

We'll create a class to hold all of our UI processing code (next page, top right).

First, we have the class definition and next we have the __init__ function which we pass the TopLevel "root" window into. We create the TopLevel window in the last four lines of the program. Within the __init__ function we are defining all the global variables and doing some initial assignments before we start the other functions. The first thing we do is create a list of Tuples that hold the picture file formats that we need when we call the OpenFile dialog. The next two lines below, define and ready the two image files we just created (open folder GIF file, and the grey rectangle – which will be used as placeholders for our images used to create the pattern.

```
self.openimage =
PhotoImage(file='open.gif')

self.DefaultImage
=ImageTk.PhotoImage(self.Thum
bnail("default.jpg",450,450))
```

Now we get into the global definitions (middle right). If you remember, when you use Tkinter, if you have a widget like a text entry box or combo box that you want to retrieve the information selected or entered, you define a global variable and then assign it to a Variable Class (BooleanVar, DoubleVar, IntVar or StringVar). This will then "track" changes to the values within the widget values so you can access them with the .get() or .set() methods. In the next lines of code, we create the global variable name, then assign it to the proper wrapper class. I put some comments into the code to try to help you keep track of what we are doing.

As you can see, we are setting a variable called OriginalFilename, which holds the image that we want to create the pattern from, OriginalColorCount which holds the number of colors in the original image file, and OriginalSize which holds the size in pixels of the original image. As they say on tv... "***BUT WAIT! THERE'S MORE!***" (bottom right):

```
class XStitch:
    def __init__(self, master):
        self.picFormats = [
        ('JPEG / JFIF','*.jpg'),
        ('Portable Network Graphics','*.png'),
        ('CompuServer GIF','*.gif'),
        ('Windows Bitmap','*.bmp'),
        ('All File Types *.*','*.*'),
        ]
```

```
        #-------------------------------------------
        #              Global Definitions
        #-------------------------------------------
        #                  UI Required
        global OriginalFilename
        OriginalFilename = StringVar()
        global OriginalColorCount
        OriginalColorCount = StringVar()
        global OriginalSize
```

```
        global ComboStitch
        ComboStitch = IntVar()
        global ComboSize
        ComboSize = StringVar()
        global FabricWidth
        FabricWidth = DoubleVar()
        global FabricHeight
        FabricHeight = DoubleVar()
        global MaxColors
        MaxColors = IntVar()
        global BorderSize
```

The ComboStitch variable is set by a combobox, and handles the stitch size of the aida that you wish to use for your project. The ComboSize variable is also set by a combo box and holds the size of the aida fabric. FabricHeight and FabricWidth are the breakdowns from the aida size. MaxColors is a value from an entry box to set the number of colors, and BorderSize is a floating point value that specifies the amount of unused aida for framing.

```
global ProcessedColors

ProcessedColors = StringVar()

global ProcessedSize

ProcessedSize = StringVar()

global DmcColor

DmcColor = StringVar()
```

The final ‘variable class’ variables are used for information once we have processed the original image to the desired parameters.

The next set of globals is (top right) used for easy access throughout the program. For the most part, they are either obvious by their name, or will become obvious once we use them. There are three not-so-obvious variables here. backgroundColor1 and backgroundColor2 are tuples that are used in the gridding process, and the ReadyToProcess variable is used to designate that the original image is loaded and everything is ready to go – just in case the user presses the Process button too early.

Finally we have assigned all our globals, and now have the code that actually creates the GUI. We open the database, create the menu, set up the widgets, and finally place the widgets into the proper places. Just to give you a heads-up, we will be using the Grid geometry placement manager. More on that later.

```
#-----------------------
-

self.OpenDB()

self.MakeMenu(master)

frm =
self.BuildWidgets(master)

self.PlaceWidgets(frm)
```

The next portion of our code (middle right) will set up the menu bar. I’ve tried to lay it out logically so it will be easy to understand.

We define a function called MakeMenu, and pass in the TopLevel window. We then define the three menu sets we will be creating. One for File, one for Process, and one for Help.

```
menu.add_cascade(label="File"
, menu=filemenu)

menu.add_cascade(label="Proce
ss",menu=process)

menu.add
```

```
        #-------------------------------------------
        global ShowGrid
        ShowGrid = True
        global ProcessedImage
        ProcessedImage = ""
        global GridImage
        GridImage = ""
        global backgroundColor1
        backgroundColor1 = (120,)*3
        global backgroundColor2
        backgroundColor2 = (0,)*3
        global ReadyToProcess
```

```
#=======================================================
#                    BEGIN UI DEFINITION
#=======================================================
    def MakeMenu(self,master):
            menu = Menu(master)
            root.config(menu=menu)
            filemenu = Menu(menu, tearoff=0)
            process = Menu(menu,tearoff=0)
```

```
#--------------------------------------------
   #                  File Menu
   #--------------------------------------------
   filemenu.add_command(label="New")
   filemenu.add_command(label="Open", command=self.GetFileName)
   filemenu.add_command(label="Save", command=self.FileSave)
   filemenu.add_separator()
   filemenu.add_command(label="Exit", command=self.DoExit)
```

```
_cascade(label="Help",menu=help)
```

Now we set up the File menu options (bottom right). Open will open our image and uses a function called “GetFileName”. Save will create the output PDF file and uses the FileSave function. We add a separator and finally an Exit function.

Now we have the Process option and the Help functions (next page, top right).

All of the options in the menu bar are also available from various buttons within the program.

Now we will make our BuildWidgets function. This is where we create all the widgets that will be used on the GUI.

```
def BuildWidgets(self,master):

        self.frame = Frame(master,width=900,height=850)
```

We start with the function (bottom right) definition, passing in the TopLevel window (master) and placing a frame that holds all of our other widgets. I’ve added comments to help realize which part of code deals with which frame. We’ll deal with the top frame first.

Assuming you remember or refreshed your memory on Tkinter, it should be fairly straight-forward. Let’s look at the first label as a discussion item.

```
self.label1 = Label(self.frm1,text = "Original Filename: ")
```

First, we define the name of the widget (self.label1 =). Next we set that variable to which widget type we want to use; in this case Label. Finally we set the parameters we want to apply to that widget starting with the parent widget (self.frm1), and in this case, the text that will show up in the label. Now let’s take a moment to look at the button self.btnGetFN.

```
self.btnGetFN = Button(self.frm1, width=28, image=self.openimage,
```

```
#------------------------------------------
#                  Process Menu
#------------------------------------------
process.add_command(label="All",command=self.Process)
#------------------------------------------
#                   Help Menu
#------------------------------------------
help.add_command(label="Help",command=self.ShowHelp)
help.add_separator()
help.add_command(label="About",command=self.ShowAbout)
```

```
# ---------------Middle Frame --------------------
self.frm2 = Frame(self.frame,width=900,height=160,bd=4,relief=GROOVE)
self.lbl4 = Label(self.frm2,text="Aida Stitch Size: ")
self.lbl5 = Label(self.frm2,text="Aida Fabric Size: ")
self.TCombobox1 = ttk.Combobox(self.frm2,textvariable=ComboStitch,width=8)
self.TCombobox1.bind('<<ComboboxSelected>>', self.StitchSizeSelect)
self.TCombobox1['values'] = (7,10,11,12,14,16,18,22)
self.TCombobox2 = ttk.Combobox(self.frm2,textvariable=ComboSize,width = 8)
self.TCombobox2.bind('<<ComboboxSelected>>',self.AidaSizeSelect)
self.TCombobox2['values'] = ("12x18","15x18","30")
```

```
# ---------------- TOP FRAME ---------------------
self.frm1 = Frame(self.frame,width=900,height=100,bd=4,relief=GROOVE)
self.label1 = Label(self.frm1,text = "Original Filename: ")
self.entFileName = Entry(self.frm1,width=50,textvariable=OriginalFilename)
self.btnGetFN = Button(self.frm1, width=28, image=self.openimage,
     command=self.GetFileName)
self.label2 = Label(self.frm1,text = "Original Colors: ")
self.lblOriginalColorCount = Label(self.frm1,text="",width=10,
     textvariable=OriginalColorCount)
self.label3 = Label(self.frm1,text = "Original Size: ")
self.lblOriginalSize = Label(self.frm1,text="",width=10,
```

```
command=self.GetFileName)
```

First thing to notice is that this is broken into two lines. You can safely place everything on one line...it is just too long to fit into a 72-character line. We'll really pay attention to the parameters we use here. First the parent (frm1), next the width which is set at 28. When we use a widget that has the option of text or an image, we have to be careful setting the width. If it will contain text, the width parameter is the number of characters it will hold. If it is to display an image, it will be set at the number of pixels. Finally, we set the command parameter, which tells the system what function to call when the button is clicked.

One more thing to look at is the textvariable parameter. This tells us what variable will hold the information that will be displayed in the widget. We set these in the __init__ function earlier. One other thing to mention is that the frame itself has two parameters you might not remember. The Relief parameter sets the border type of the frame, which in this case is GROOVE, and the bd parameter sets the border width. Border width defaults at 0 so if you want to see the effect, you have to set the border width (bd is a shortcut).

Now we'll deal with the middle frame widgets.

The last 6 lines of this section (previous page, middle right) deal with the two combo boxes in the UI. Each combo box uses three lines (the way I programmed it to make it easy to understand). In the first line, we set the basic parameters. The next line, we bind the combobox selection-changed event to the function

```
self.lbl6 = Label(self.frm2,text="Max Colors: ")
self.entMaxColors = Entry(self.frm2,textvariable=MaxColors,width=3)
self.lbl7 = Label(self.frm2,text="Border Size: ")
self.entBorderSize = Entry(self.frm2,textvariable=BorderSize,width = 8)
self.frmLine = Frame(self.frm2,width=6,height=80,bd=3,relief="raised")
    self.lbl8 = Label(self.frm2,text="          Processed Image Colors: ")
self.lbl9 = Label(self.frm2,text="Processed Image Stitch Count: ")
self.lblProcessedColors = Label(self.frm2, width=10,textvariable=ProcessedColors,
     justify=LEFT)
self.lblProcessedSize = Label(self.frm2, width=10, textvariable=ProcessedSize,
     justify=LEFT)
self.btnDoIt = Button(self.frm2,text="Process",width=11,command = self.Process)
self.btnShowGrid = Button(self.frm2,text="Hide Grid", width=11,
     command=self.ShowHideGrid)
self.btnCreatePDF = Button(self.frm2, text="Create PDF", width=11,
```

```
# --------------- Bottom Frame ------------------
self.frm3 = Frame(self.frame,width=450,height=450,bd=4,relief=GROOVE)
self.lblImageL = Label(self.frm3, image=self.DefaultImage,
     height=400, width=400, borderwidth=2, relief=GROOVE)
self.lblImageR = Label(self.frm3, image=self.DefaultImage, height=400,
     width=400,borderwidth=2, relief=GROOVE)
```

```
#---------------- Side Frame -------------------
self.frm4 = Frame(self.frame,width = 300,height=580,bd=4,relief=GROOVE)
# Create the ScrolledFrame.
self.sf = Pmw.ScrolledFrame(self.frm4,
    labelpos = 'n', label_text = 'Processed Color List',
    usehullsize = 1,
    hull_width = 300,
    hull_height = 567,)
return self.frame
```

StitchSizeSelect, and the last line has a list of the values that will be available for the pulldown.

```
ROW | Col 0  | Col 1 - Col 6          |Col 7   | Col 9 | Col 10              |
    ---------------------------------------------------------------------------
 0  | Label1 | entFileName            |btnGenFN| Label2|lblOriginalColorCount  |
 1  |                                          | Label3|lblOriginalSize       |
```

Everything else above is pretty “normal” stuff. Now we set our defaults for the widgets that need them. Again, we are using the global variables that we set up in the __init__ function and wrapped to the widget variable class.

```
ComboStitch.set(14)

ComboSize.set("15x18")

FabricWidth.set(15)

FabricHeight.set(18)

MaxColors.set(50)

BorderSize.set(1.0)
```

```
    def PlaceWidgets(self,frame):
        frame.grid(column = 0, row = 0)
        # ---------------- TOP FRAME ---------------------
        self.frm1.grid(column=0,row=0,rowspan=2,sticky="new")
        self.label1.grid(column=0,row=0,sticky='w')
        self.entFileName.grid(column=1,row=0,sticky='w',columnspan = 5)
        self.btnGetFN.grid(column=7,row = 0,sticky='w')
        self.label2.grid(column=9,row=0,sticky='w',padx=10)
        self.lblOriginalColorCount.grid(column=10,row=0,sticky='w')
        self.label3.grid(column=9,row=1,sticky='w',padx=10,pady=5)
```

Now we deal with the bottom frame. This is really simple, since we have to set up only the frame and two labels which we will use to hold our images.

```
        # ---------------- MIDDLE FRAME ---------------------
        self.frm2.grid(column=0,row=2,rowspan=2,sticky="new")
        self.lbl4.grid(column=0,row=0,sticky="new",pady=5)
        self.lbl5.grid(column=0,row=1,sticky="new")
        self.TCombobox1.grid(column=1,row=0,sticky="new",pady=5)
        self.TCombobox2.grid(column=1,row=1,sticky="new")
        self.lbl6.grid(column=2,row = 0,sticky="new",padx=5,pady=5)
        self.entMaxColors.grid(column=3,row=0,sticky="new",pady=5)
        self.lbl7.grid(column=2,row=1,sticky='new',padx=5)
        self.entBorderSize.grid(column=3,row=1,sticky='new')
        self.frmLine.grid(column=4,row=0,rowspan=2,sticky='new',padx=15)
        self.lbl8.grid(column=5,row=0,sticky='new',pady=5)
        self.lbl9.grid(column=5,row=1,sticky='new')
        self.lblProcessedColors.grid(column=6,row=0,sticky='w')
        self.lblProcessedSize.grid(column=6,row=1,sticky='new')
        self.btnDoIt.grid(column=7,row=0,sticky='e',padx=5,pady = 5)
        self.btnShowGrid.grid(column=7,row=1,sticky='e',padx=5,pady = 5)
```

Finally we deal with the side frame. The side frame will hold a ScrolledFrame from the PMW library. It’s really easy to use and provides a nice interface to the information about the floss that should be used. You can research the ScrolledFrame on your own, since we still have a lot to cover here.

```
        # ---------------- BOTTOM FRAME ---------------------
        self.frm3.grid(column=0,row=4,sticky="nsew")
        self.lblImageL.grid(column=0,row=0,sticky="w")
        self.lblImageR.grid(column=1,row=0,sticky="e")
```

That's all for the widgets. Now we have to place them. As I said earlier, we will be using the Grid geometry manager, rather than the absolute or pack managers.

The Grid method places the widgets in (you guessed it) a grid, referenced by row and column designations. I'll use the top frame as an example (shown top right).

First we place the frame.

You can see that we place the widget by using the {widgetname}.grid command, then the row and column positions. Notice that we are telling the entry widget to span 5 columns. Padx and pady values will place some extra space on both the right and left sides (padx) or the top and bottom (pady). The sticky parameter is similar to a justify command for text.

The middle frame is a bit more complicated, but basically the same as the top frame. You might notice an extra frame in the middle of the code (self.frmLine). This gives us a nice divider between the options section and the display section. Since there is no horizontal or vertical line widget, I cheated and used a frame with a width of 6 pixels and border width of 3, making it just look like a fat line.

The bottom frame is simple since we have only the frame and the two labels to hold the images.

The side frame is pretty much the same thing, except the ScrolledFrame allows for a frame to be set to the interior of the scrolled frame widget. We then create three widgets here and place them in their grids as column headers. We do this since we assigned the interior frame for the scroll frame here and we have to assign the parent (self.sfFrame) after we have created it.

```
# ---------------- SIDE FRAME ---------------------
self.frm4.grid(column=2,row=0,rowspan=12,sticky="new")
self.sf.grid(column=0,row=1)
self.sfFrame = self.sf.interior()
self.lblch1 = Label(self.sfFrame,text="        Original")
self.lblch2 = Label(self.sfFrame,text="        DMC")
self.lblch3 = Label(self.sfFrame,text="Name/Number")
self.lblch1.grid(column=0,row=0,sticky='w')
self.lblch2.grid(column=1,row=0,sticky='w')
self.lblch3.grid(column=2,row=0,sticky="w")
```

```
    def Thumbnail(self,file,hsize,wsize):
        size = hsize,wsize
        extpos = file.rfind(".")
        outfile = file[:extpos] + ".thumbnail"
        im = Image.open(file)
        im.thumbnail(size)
        im.save(outfile,"JPEG")
```

That's all the hard work for now. At this point, we will create all of the functions that we need to get the GUI to run, stubbing most of them until next month. There are a few we will go ahead and complete, but they are fairly short.

The first function will be the Exit option from the menu bar. It's under the File menu option.

```
    def DoExit(self):
        sys.exit()
```

The only other one is the Thumbnail function. We need this to fill the grey rectangles into the labels in the bottom frame. We pass the filename and the width and height that we want the thumbnail image to be.

```
def ShowHelp(self):, def ShowAbout(self):, def OpenDB(self):, def ShowHideGrid(self):
def StitchSizeSelect(self,p):, def AidaSizeSelect(self,p):, def Process(self):
def CreatePDF(self):, def OriginalInfo(self,file):, def GetColorCount(self,file):
def GetHW(self,file):, def GetHW2(self,file):, def GetColors(self,image):
def Pixelate(self,im,pixelSize):, def ReduceColours(self,ImageName):
def MakeLines(self,im,pixelSize):, def MakeLines2(self,im,pixelSize):
def Rgb2Hex(self,rgb):, def FillScrolledList(self,filename):
def GetBestDistance(self,r1,g1,b1):
```

Since this article is so long, I'm going to give you a list of function names and all you have to do is stub it out by using the pass command. We'll fill them in next month. I'll give you the first one as an example, but you should already know how to do it.

```
    def GetFileName(self):
        pass
```

For the rest of the functions, I'll just give you the def lines. Be sure to include them all in your code.

You can see, we have a large amount of work to do next month. We still have four more lines to write to finish up for this month. This is out of our class code.

```
root = Tk()

root.title("Cross Stitch
Pattern Creator")

test = XStitch(root)

root.mainloop()
```

The first line sets up the root TopLevel window. The next line sets the title on the top line. The third line instantiates our XStitch class, and the last line starts the main loop that shows the UI and gives control over to it.

Well that's a lot for this month, but we are finally done. You can actually run the program to see the GUI.

As always, the code is available on Pastebin at http://pastebin.com/XtBawJps.

Next month we will flesh out the code. See you then.

Program In Python - Part 56

We've been working on a Cross Stitch pattern generator. Last month we did the UI portion, and now it's time to do the code that does the most of the work. Next month we will start working on the PDF file output portion.

We'll work on the menu items first. The code is shown below.

The global ReadyToProcess variable is used to make sure that if the user presses the Process button, the system doesn't try to process things without anything to process. We use the tkFileDialog askopenfilename built-in dialog routine to get the filename of the original image. We then get the number of colors in the original image as well as the width and height. We save those values and display them in the GUI. We then open the image and create a thumbnail image to display in the left image in the bottom frame. See the text box to the right.

Next we do the ShowHideGrid function. This simply exchanges two images in the right image label based on the global variable ShowGrid. If False, we change the text on the show/hide button, then set the ShowGrid variable to true and set the image to the one with the grid. Otherwise we change the text on the show/hide button to "Show Grid", set the ShowGrid variable to False and put up the ungridded image. Code is on the next page, top left.

The StitchSizeSelect function is fired whenever the stitch size combobox is changed. We get

```
    def GetFileName(self):
        global ReadyToProcess
        #---------------------------------
        fileName = tkFileDialog.askopenfilename(parent=root,filetypes=self.picFormats ,title="Select File to open...")
```

```
            OriginalFilename.set(fileName)
            OriginalColorCount.set(self.GetColorCount(fileName))
            OriginalSize.set(self.GetHW(fileName))
            masterimage=Image.open(fileName)
            masterimage.thumbnail((400,400))
            self.img = ImageTk.PhotoImage(masterimage)
            self.lblImageL['image'] = self.img
            ReadyToProcess = True
```

The FileSave menu option will simply call the CreatePDF routine, once it's finished.

```
    def FileSave(self):
        self.CreatePDF()
```

We'll stub out the ShowHelp and ShowAbout routines with a dialog box saying that those options are not yet available.

```
    def ShowHelp(self):
        tkMessageBox.showinfo(title="Help",message='Sorry, 
but help is not yet available.')

    def ShowAbout(self):
        tkMessageBox.showinfo(title="About",message='Sorry, 
but the About function is not yet available.')
```

We've written the OpenDB routine a dozen times before, so you should know what it does.

```
    def OpenDB(self):
        global connection
        global cursor
        #-------------------------------
```

```
def ShowHideGrid(self):
    global ShowGrid
    #--------------------------------
    if ShowGrid == False:
        self.btnShowGrid['text'] = 'Hide Grid'
        ShowGrid = True
        self.im2=Image.open(self.GridImage)
        self.im2.thumbnail((400,400))
        self.img3 = ImageTk.PhotoImage(self.im2)
        self.lblImageR['image'] = self.img3
    else:
        self.btnShowGrid['text'] = 'Show Grid'
        ShowGrid = False
        self.im2=Image.open(self.ProcessedImage)
        self.im2.thumbnail((400,400))
        self.img3 = ImageTk.PhotoImage(self.im2)
```

```
def AidaSizeSelect(self,p):
    selection = ComboSize.get()
    if selection != "30":
        pos = selection.find("x")
        width = int(selection[:pos])
        height=int(selection[pos+1:])
    else:
        width = 30
        height = 30
    FabricWidth.set(width)
```

the value from the combo box and assign it to a local variable.

```
def StitchSizeSelect(self,p):

selection = ComboStitch.get()
```

The AidaSizeSelect function (top right) is very similar to the StitchSizeSelect function. We set the FabricWidth and FabricHeight globals based on the selection on the combo box. We also default to 30x30 if they select 30.

We have a variable called ReadyToProcess (below) just in case the user tries to run the process function before the image is loaded.

We pixelate the original file to a 5x5 pixel matrix This allows us to group that 5x5 matrix to a single color. We then reduce the colors, get the width and height of the processed image and set the size so the user can see how big the resulting image will be.

```
# Place image

self.im2=Image.open(Reduced)

self.im2.thumbnail((400,400))

self.img3 =
ImageTk.PhotoImage(self.im2)

self.lblImageR['image'] =
self.img3

self.ProcessedImage =
'im1.png'
```

The above set of code places the processed image into the image that will hold the processed image. The next set of code will create a grid so that the user will have the grid to do the cross stitching.

```
self.MakeLines(Reduced,5)

self.MakeLines2('output.png',
50)
```

```
def Process(self):
    global ReadyToProcess
    #--------------------------------
    if ReadyToProcess == False:
        tkMessageBox.showinfo(title="ERROR...",message='You must load an original imaage first.')
    else:
        newimage = self.Pixelate(OriginalFilename.get(),5)
        Reduced = self.ReduceColors(newimage)
        W,H = self.GetHW2(Reduced)
        siz = "{0}x{1}".format(W/5,H/5)
```

```
self.im2 =
Image.open('output2.png')

self.im2.thumbnail((400,400))

self.img3 =
ImageTk.PhotoImage(self.im2)

self.lblImageR['image'] =
self.img3

self.FillScrolledList('output
.png')

self.GridImage =
'output2.png'
```

We stub the CreatePDF function until we finish the PDF function next month.

```
    def CreatePDF(self):

tkMessageBox.showinfo(title="
Create PDF",message='Sorry,
but the Create PDF function
is not yet available.')
```

The OriginalInfo() routine gets and sets variables based on the original image format, size and mode.

```
def OriginalInfo(self,file):
  im = Image.open(file)
  imFormat = im.format
  imSize = im.size
  imMode = im.mode

  self.size = imSize
  self.imformat = imFormat
  self.immode = imMode
```

```
def Pixelate(self,im,pixelSize):
    image = Image.open(im)
    self.GetColors(image)
    image = image.resize((image.size[0]/pixelSize, image.size[1]/pixelSize), Image.NEAREST)
    image = image.resize((image.size[0]*pixelSize, image.size[1]*pixelSize), Image.NEAREST)
    self.GetColors(image)
    #image.show()
    image.save('newimage.png')
```

The GetColorCount function uses the .getcolors method to get the number of colors in the image file. We have to use 1600000 as the maxcolors parameter because if the image contains more than 256 colors (or whatever is in the parameter, the method returns 'None'. This function is similar to the GetColors function except the GetColors works with an already opened image file. If you use GetColorCount, you have to pass an unopened file.

```
def GetColorCount(self,file):
  im = Image.open(file)
  numColors =
im.getcolors(1600000)
  self.colors =
len(numColors)
  return self.colors
```

The next two functions return the height and width of the image file in pixels. The difference between the two is that GetHW returns a string like 1024x768 and GetHW2 returns two integers.

```
def GetHW(self,file):
  im = Image.open(file)
  tmp =
"{0}x{1}".format(im.size[0],i
m.size[1])
  return tmp

def GetHW2(self,file):
  im = Image.open(file)
  return
im.size[0],im.size[1]
```

GetColors will get the number of colors in the passed image file. We use 1.6 million colors as the parameter, because the image.getcolors() routine defaults to 0 over color count over 256.

```
def GetColors(self,image):
  numColors =
image.getcolors(1600000)
  colors = len(numColors)
```

```
def ReduceColors(self,ImageName):
    #Reduce colors
    numcolors=MaxColors.get()
    image = Image.open(ImageName)
    output = image.convert('P', palette=Image.ADAPTIVE, colors=numcolors)
    x = output.convert("RGB")
    self.GetColors(x)
    numcolors = x.getcolors()
    ProcessedColors.set(len(numcolors))
    x.save('im1.png')
```

The Pixelate function (above) takes two parameters, image filename (im) and the size of pixels you want. The work is done by the image.resize method. I found this routine on the web in a number of places. In this instance we will be passing a pixel size of 5, which works well for Cross Stitch projects. We also tell the method to take the color of the nearest neighbor. This returns a new image, which we save as a file and return the filename.

The ReduceColors routine (below) basically uses the Image.ADAPTIVE pallet so we can get a much smaller number of colors.

There are two MakeLines (top right) routines. They create the grid we spoke of earlier.

Rgb2Hex() returns a hex value of the RGB value that is passed in. We will use this to try to compare the colors in the database with the colors in the image.

```
def Rgb2Hex(self,rgb):
  return '#%02x%02x%02x' %
rgb
```

```
    def MakeLines(self,im,pixelSize):
        global backgroundColor1
        #---------------------------------
        image = Image.open(im)
        pixel = image.load()
        for i in range(0,image.size[0],pixelSize):
            for j in range(0,image.size[1],pixelSize):
                for r in range(pixelSize):
                    pixel[i+r,j] = backgroundColor1
                    pixel[i,j+r] = backgroundColor1
        image.save('output.png')

    def MakeLines2(self,im,pixelSize):
        global backgroundColor2
        #---------------------------------
        image = Image.open(im)
        pixel = image.load()
        for i in range(0,image.size[0],pixelSize):
            for j in range(0,image.size[1],pixelSize):
                for r in range(pixelSize):
                    try:
                        pixel[i+r,j] = backgroundColor2
                        pixel[i,j+r] = backgroundColor2
                    except:
```

```
    def FillScrolledList(self,filename):
        im = Image.open(filename)
        numColors = im.getcolors()
        colors = len(numColors)
        cntr = 1
        for c in numColors:
            hexcolor = self.Rgb2Hex(c[1])
            lblColor=Label(self.sfFrame,text="              ",bg=hexcolor,relief=GROOVE)
            lblColor.grid(row = cntr, column = 0, sticky = 'nsew',padx=10,pady=5)
            pkID = self.GetBestDistance(c[1][0],c[1][1],c[1][2])
            sql = "SELECT * FROM DMC WHERE pkID = {0}".format(pkID)
            rset = cursor.execute(sql)
            for r in rset:
                hexcolor2 = r[6]
                dmcnum = r[1]
                colorname = r[2]
            lblColor2=Label(self.sfFrame,text="             ",bg="#" + hexcolor2,relief=GROOVE)
            lblColor2.grid(row = cntr,column = 1,sticky = 'w',padx=5,pady=5)
            lblColor3=Label(self.sfFrame,text = str(dmcnum) + "-" + colorname,justify=LEFT)
            DmcColor.set(dmcnum)
```

The ScrollList (below) on the right side holds the colors that will be used to get the proper floss colors. We simply create labels to hold the colors (visual) and text.

This (next page) is the routine that we use to try to find the closest match between the color in the image and the color in the database. There are many different algorithms on the web that you can look at and try to understand the logic behind it. It gets rather complicated.

Ok. That's all for this month. Next time, we will start creating the PDF output file so the cross stitcher has something to work with.

As always, the code is available on PasteBin at http://pastebin.com/DmQ1GeUx .

We will continue in the next month or so. I'm facing some surgery soon so I'm not sure how soon I will be able to sit for any long periods of time. Until then, enjoy.

```
    def GetBestDistance(self,r1,g1,b1):
        # dist = math.sqrt(((r1-r2)**2) + ((g1-g2)**2) + ((b1-b2)**2))
        sql = "SELECT * FROM DMC"
        rset = cursor.execute(sql)
        BestDist = 10000.0
        for r in rset:
            pkID = r[0]
            r2 = r[3]
            g2 = r[4]
            b2 = r[5]
            dist = math.sqrt(((r1-r2)**2) + ((g1-g2)**2) + ((b1-b2)**2))
            if dist < BestDist:
                BestDist = dist
                BestpkID = pkID
```

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Cross Stitch Pattern Generator - Part 4 - Understanding pyfPDF

Sorry for missing so many months. I still can't sit for long periods of time, so this article might be shorter than what you are used to. My original plan was to jump right into the PDF output portion of the program, but there is so much to understand about this library, I decided to use this installment as a tutorial on pyfPDF and then tackle the PDF output next time. So let's get started.

FPDF stands for Free PDF. A VERY minimal example would be as follows:

```
from fpdf import FPDF

pdf = FPDF()

pdf.add_page()

pdf.set_font('Arial','B',16)

pdf.cell(40,10,'Hello From Python')

pdf.output('example1.pdf','F')
```

The first line imports the library file. The next creates an instance of the FPDF object. We use the default values for this example, which are:

- Portrait
- Measure Unit = Millimeters.
- Format = A4

If you need to use 'US' standards, you could do it this way:

```
pdf=FPDF('P','in','Letter)
```

Notice the parameters are FPDF(orientation, units, format):

- Possible values for orientation are "P" for Portrait and "L" for Landscape.
- Possible values for units are: 'pt' (poiints), 'mm' (millimeter), 'cm' (centimeter), 'in' (inches).
- Possible values for format are: 'A3', 'A4', 'A5', 'Letter', 'Legal' or a tuple containing the width and height expressed in the unit given in the unit parameter.

The third line creates a page to enter data into. Notice a page is not automatically created when we create the instance of the object. The origin of the page is the upper-left corner, and the current position defaults to 1 cm from the margin. The margin can be changed with the SetMargins function.

Before you can actually print any text, you must call pdf.set_font() to define a font. In the line above, we are defining Arial Bold 16 point. Standard valid fonts are Arial, Times, Courier, Symbol and ZapfDingbats.

Now we can print a cell with the pdf.cell() call. A cell is a rectangular area, possibly framed, which contains some text. Output is at the current position which is specified (40,10 cm) in the above example. The parameters are:

```
pdf.cell(Width, Height, text, border, line, align, fill, link)
```

Where:

- Width is length of cell. If 0, width extends to the right margin.
- Height is the height of the cell.
- Text is the string of text you want to print.
- Border is either 0 (no border(default)), 1 is border, or a string of any or all of the following characters: "L","T","B","R"
- Line is where the current position should go after printing the text. Values are 0 (to the right), 1 (to the beginning of the next line, 2 (below). Default is 0, and putting 1 is equivalent to putting 0 and calling ln() immediatly after.
- Align allows to center or align the text within the cell. Values are "L" (left), "C" (center), "R" (right).
- Fill sets the background to be painted (true) or transparent (false). Default is false.

• Link is a url or identifier returned by addlink().

Finally, the document is closed and sent to the file with Output. The parameters are fpdf.output(name,dest). If file is not specified, the output will be sent to the browser. Options for destination are "I" (inline to browser(default)), "F" (local file given by name), "D" (to the browser and force a file download with the name passed), and "S" (return the document as a string).

Since we will be sending our cross stitch images to the pdf file, we will have to understand the image function.

The function is called like this:

```
pdf.image(name,x=None,y=None,
w=0,h=0,type="",link="")
```

This function puts the image. The size it will take on the page can be specified in different ways:
• Explicit width and height or
• One explicit dimension

Supported formats are JPEG, PNG, and GIF. If you wish to use GIF files, you must get the GD extension.

For JPEGs, all flavors are allowed:
• gray scale
• true colours (24 bits)
• CMYK (32 bits)

For PNGs, the following are allowed:
• gray scales on at most 8 bits (256 levels)
• indexed colors
• true colors (24 bits)

Note: interlacing is not allowed, and if you are using a version of FPDF prior to 1.7, Alpha channel is not supported.

I stole this example (shown right) from the pyFPDF tutorial.

You have been around long enough that you should be able to look at the program and understand what is going on. But in this example the line we are REALLY interested in is the fourth line:

```
this.image('img1.png',10,8,33
)
```

```
from fpdf import FPDF

class PDF(FPDF):
    def header(this):
        # Logo - replace with a small png of your own
        this.image('img1.png',10,8,33)
        # Arial bold 15
        this.set_font('Arial','B',15)
        # Move to the right
        this.cell(80)
        # Title
        this.cell(30,10,'Title',1,0,'C')
        # Line break
        this.ln(20)

# Instantiation of inherited class
pdf=PDF()
pdf.alias_nb_pages()
pdf.add_page()
pdf.set_font('Times','',12)
for i in range(1,41):
```

In this instance, we are calling the image function with the filename, the x position of where the picture will go on the page, the y position, and the width of the picture.

Now that you have a gross grasp of the library, we will start our PDF code next time.

Until then, have a good month. See you soon.

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Program in Python - Part 57

First, let me thank all the readers who sent me emails of hope and wishes for a quick recovery. They were very kind and helpful. I also want to thank Ronnie, our wonderful editor, for his support and patience during that painful period. I still have issues with sitting for long periods of time, so this is being done over the course of a number of days, so I hope the continuity that I'm trying for works. Now on with "the show"...

Not too long ago, I was walking to the time clock and the General Manager of my "day job" called me into his office. Hoping it was just a "how's it going" talk, I went in and sat down. He then started the meeting with "I'm having a problem with my spreadsheet program, and was hoping you could help me".

As my vision darkened and the three-note ominous orchestral string hits "Da Da DAAAAAAAAA" that we all know from the horror flicks of the 70's and 80's rang through my mind, rather than running screaming from the room, I innocently asked what was wrong. He responded that there was something wrong with one of the macros and "the thing just quits in the middle of the calculations". As I whipped out my white cowboy hat, I said in my best hero voice "Don't worry citizen. We'll have you up and running in no time." Within a short while, I discovered the reason the spreadsheet was unceremoniously crashing was that one cell in one of 35 workbooks was getting a divide by zero error due to an expected value not being entered in another cell in yet another one of the 35 workbooks. Let me make this perfectly clear, it was not my boss's fault. All he had asked for was a simple way to get the higher-up values from the data. (The previous two sentences have absolutely nothing to do with the fact that my boss may read this article! Or maybe it does.)

As I walked back to my work area, brushing the spurious bits of computer code from my white hat, I realized that this would be an excellent teaching moment. So, here we are. But first, let's revert back to 1979 when Apple introduced Visicalc. That was the first "Free Form Calculation type system" to really make a hit in the marketplace. While there were many bugs in the software, the world loved the idea and clones (bugs and all) began to pop up on other computer systems, like the Commodore Pet and other Apple competitors (including Microsoft in 1981 with a program called Multiplan). Finally, in 1983, a company called Lotus Development Corp. introduced Lotus 1-2-3. While very close to Visicalc in many aspects, including the menu structure, it was written completely in x86 assembly language, which made it very fast, and many of the bugs of Visicalc were fixed. Lotus 1-2-3 was so popular that it became a common benchmark to test a machine for "PC Compatibility".

The advent of the Free Form Calculation systems, allowed the "normal" person to deal with numbers in a way that previously was in the realm of the programmer. Almost anyone could, in a few hours or so, make sense of numbers, create charts and graphs, and share that information with coworkers. Shortly after that, the ability to automate some portions of the spreadsheet through Macros and Basic-like embedded languages gave these non-programmer users even more power over their destiny. They could get the answers themselves, and pretty charts and graphs as well, without having to wait in the queue for I.T. assistance. However, as we all learned from Peter Parker's uncle Ben...

With great power, comes great responsibility.

Soon the spreadsheet was taken into areas that were better suited for databases than spreadsheets. We now had workbooks upon workbooks that relied on other workbooks, and if one little number along the way didn't happen to get updated... well, we had the old "house of cards" effect.

While I don't think that every spreadsheet is evil, there are some (read this to say 'many') that should have been converted to databases many years ago. They just became too large and unwieldy for their own good. If someone had just sat down with the programmers and said, "Please help", the world would be a kinder, gentler place.

Now as I step down from my soapbox, we come to the real reason for this month's article. Every good Python programmer should have a way to deal with spreadsheets in their arsenal of tools. You never know when you will be called upon to pull data from a spreadsheet and manipulate it. While there are many ways to get data from spreadsheets like using CSV files, which has its own drawbacks, sometimes you need to read and write directly from and to a 'live' spreadsheet. After looking around, I settled on a very nice library to access my boss's problematical spreadsheet.

	A	B
1	1	6
2	2	7
3	3	8
4	4	9
5	5	10

We will be adding the library called XLRD, which one might imagine stands for eXceL ReaD. This library allows us to easily read data from Excel files (.xls , .xlsx and .xlsm) from versions 2.0 onward.

Let's create an excel spreadsheet that we can use to examine the functionality of XLRD. Either open excel, or openoffice or libreoffice calc. In the first column (A), enter the numbers 1 to 5 going down. In the next column (B), enter 6 to 10. It should look something like this:

Now save the spreadsheet as "example1.xls" in the folder you will use to save the test code. This way, we won't have to worry about paths.

Now download and install XLRD (https://pypi.python.org/pypi/xlrd). We can use it like is shown below.

```
import xlrd
def OpenFile(path):
      # Open and read excel file
      book = xlrd.open_workbook(path)
      # Get number of active workbooks
      print "Number of workbooks: ",book.nsheets
      # Get the names of those workbooks
      print "Workbook names: ",book.sheet_names()
      first_sheet = book.sheet_by_index(0)
      cell = first_sheet.cell(1,1)
      print "Cell at 1,1: ",cell
      print "Cell Value at 1,1: ",cell.value

if __name__ == "__main__":
      path = "example1.xls"
```

Save the file as example1.py in the same folder as the spreadsheet. Since the code is so short, we will simply discuss it here. Of course, the first line imports the library. Then we create a function called OpenFile and pass the name (and path if needed) of the spreadsheet to the function.

Now we call the open_workbook method and get back a 'book' object. Then we use the nsheets attribute to return the number of ACTIVE workbooks. We can also get the name of the workbooks. In this case, they are the default. We use the sheet_by_index method to get Sheet1 into the first_sheet object. Now we can start getting data. We get the information from the cell at position (1,1) which translates to cell position B2 (it's Zero based, so cell A1 would be (0,0)). We print the data from there, both what the cell contains and the value, so we could use it in a calculation if we wish.

That was really easy, wasn't it? Now, let's do something a bit more useful. Enter the code shown on the next page (top right) and save it as 'example2.py'. This example will print out the contents of the workbook.

Since we already used the first four lines of code in the first example, we'll skip them. By using the 'sheet.nrows' and 'sheet.ncols' attributes, we get the number of rows and columns. This can be helpful, not only so we know what we are dealing with; we can write "generic" routines that use those values in our calculations as you will see. In fact, we use 'rows' in a for loop to obtain each row's information.

Notice the line that has 'first_sheet.row_slice'. This gets a block of cells of a given row. The syntax is as follows:

```
X = first_sheet.row_slice(RowInQuestion, Start_Column, End_Column)
```

So we have used the number of rows and the number of columns in calculations. The output from our program should look something like this...

```
There are 5 rows in this workbook.
There are 2 cols in this workbook.
[number:1.0, number:6.0]
[number:2.0, number:7.0]
[number:3.0, number:8.0]
[number:4.0, number:9.0]
[number:5.0, number:10.0]
Press any key to continue . . .
```

We'll do one more example before we end this month's article. Go to the spreadsheet and in column C put some dates. Here's what my spreadsheet looks like now:

1	6	1/10/2014
2	7	4/15/2015
3	8	6/24/1986
4	9	9/30/1963
5	10	3/3/2000

You can use any dates you like. Now let's re-run our

```
import xlrd
def OpenFile(path):
      book = xlrd.open_workbook(path)
      first_sheet = book.sheet_by_index(0)
# Get the number of rows in this workbook
rows = first_sheet.nrows
      # get the number of columns in this workbook
      cols = first_sheet.ncols
      print "There are %d rows in this workbook." % rows
      print "There are %d cols in this workbook." % cols
      for r in range(0,rows):
      cells = first_sheet.row_slice(rowx=r,start_colx=0,end_colx=cols)
      print cells

if __name__ == "__main__":
      path = "example1.xls"
```

```
     for c in cells:
         if c.ctype == xlrd.XL_CELL_DATE:
         date_value = xlrd.xldate_as_tuple(c.value,book.datemode)
         dt = str(date_value[1]) + "/" + str(date_value[2]) + "/" + str(date_value[0])
         print dt
         else:
```

example2.py program. Here is the output from mine.

```
There are 5 rows in this
workbook.
There are 3 cols in this
workbook.
[number:1.0, number:6.0,
xldate:41649.0]
[number:2.0, number:7.0,
xldate:42109.0]
[number:3.0, number:8.0,
xldate:31587.0]
[number:4.0, number:9.0,
xldate:23284.0]
[number:5.0, number:10.0,
xldate:36588.0]
Press any key to continue ...
```

Well, that's not what we expected. It seems that excel holds dates as a value that is simply formatted for whatever we ask it to. This might be helpful for sorting and calculations, but, for showing the actual data, this won't do. Luckily, the writers of the library already thought of this. Delete the line that says "print cells" and replace it with the code shown below.

Here, we go through each cell in the cells list and check the type of the cell to see if it is considered a XL_CELL_DATE. If it is, then we convert it to a tuple. It is stored as YYYY,MM,DD. We simply pretty it up to print it as MM/DD/YYYY. Here is the output of our new program...

```
There are 5 rows in this
workbook.
There are 3 cols in this
workbook.
1.0
6.0
1/10/2014
2.0
7.0
4/15/2015
3.0
8.0
6/24/1986
4.0
9.0
9/30/1963
5.0
10.0
3/3/2000
Press any key to continue ...
```

Just for your information, there is a library from the same wonderful people called XLWT, which allows you to write to excel files. There is a wonderful tutorial and documentation on these two libraries at http://www.python-excel.org/.

The source code for example3.py is on pastebin at http://pastebin.com/bWz7beBw.

Hopefully, I'll see you next month.

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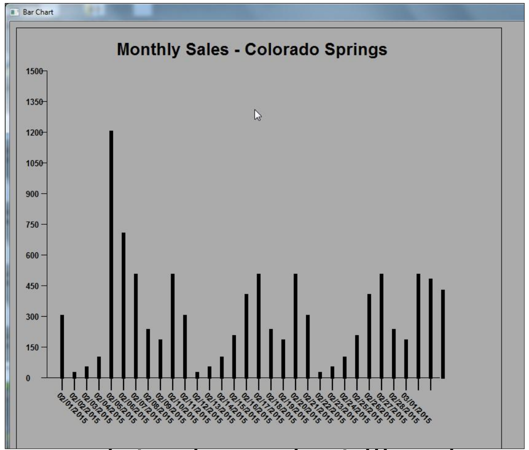
Program in Python - Part 58

Last time, we discussed reading and using data from an Excel file directly. If you remember, my boss (from my “day” job) had a massive spreadsheet that if one calculation failed, it caused the entire process to abort. Well, I created a database from that spreadsheet that was easy to get a report from. However, the original spreadsheet created pretty charts and graphs that his bosses liked to see. So I undertook the task to create charts so everyone would be happy.

After spending about two days digging into the existing charting/graphing packages already available for Python, most free, most of them output directly to a file, like a pdf file or some sort of a graphics (jpg, png, svg) file. What I was looking for was one that would go directly to a wxPython frame or panel so it can be displayed inside a GUI program. I found one solution, but it required so many interdependent libraries that the possibility of just giving the application on a flash drive quickly became nil.



So, being the pig-headed, tenacious, never-say-die kinda guy that I am, I decided to write one on my own. The original goal was that it was to do (at least) bar-charts and maybe in the future line charts and/or other types. It also should eventually be able to do colours, but just plain black bars would suffice for the time being. It should be standalone in general so that it could be called as a library. It wasn’t supposed to be so generic that it gets complicated, just dates along the horizontal (bottom) axis, values along the vertical axis and bars that represent the daily sales for that period. In order to keep the chart somewhat neat, the dates should be angled so that they don’t overwrite each other. So, what I came up with will be presented here. Left, is a sample output of the code.

Again, not fancy, not terribly pretty, but it does the job. If it needs to be prettier later on, then I can work on it down the road.

The first thing I had to do was pull out my wxPython documentation to remember the graphic commands. In able to draw graphics, we use the a “dc” or Device Context. It’s sort of like a blank canvas that we can draw points, lines, and text to. wxPython offers 9 different types of dc objects and I chose the wx.PaintDC which works from the OnPaintEvent. We will use some very basic commands to do our drawing and painting. These are:

```
dc.DrawLine
dc.SetPen
dc.SetFont
dc.DrawText
dc.DrawRectangle
dc.DrawRotatedText
dc.GetFullTextExtent
```

Those are the only wxPython routines we will use, though there are many others that would make our program much prettier. We will combine these commands into our own “logical” routines like, DrawBars, DrawAxis, DrawValues, and so on. While I could have done it in one or two large routines, I wanted to break them out into routines that make sense for the teaching moment. So let’s get started looking into the code. Create a file called mygraph.py. I couldn’t come up with anything pithy, since PyChart, PyGraph and the like are all taken. Maybe if I had a bit more time, I’d come up with something, but that’s not important. Let’s get started. First, we’ll do the imports as we always do.

```
#!/usr/bin/python

# mygraph.py

import wx

from datetime import date,
datetime, time

import time

import math
```

Obviously, we need to import he wxPython library and the math library will help us with some of the calculations. The datetime and time libraries are used to do the date calculations for the horizontal axis labels.

Something to keep in mind as we go from here...When you think about drawing on a context, the upper left corner of the container window (our dc) is X=0, Y=0. X is the horizontal axis and Y is the vertical axis. The closer we get the lower right corner, both numbers go higher. In our program, we will actually start by drawing a box that defines our charting area which starts at upper left X=10, Y=10 and end with lower right at X=800, Y=700. However, before we get to that part, we have to define a class to handle the routines and the __init__ routine. Hopefully you remember these from earlier sessions.

```
class Line(wx.Frame):
    def __init__(self, parent, id, FrameTitle, IncomingData, ChartTitle):
        wx.Frame.__init__(self, parent, id, FrameTitle, size=(1024, 768))
        self.Bind(wx.EVT_PAINT, self.OnPaint)
        self.BoxWidth = 790
        self.BoxHeight = 690
        self.ChartTitle = ChartTitle
        self.data = []
        self.SetData(IncomingData)
        self.Centre()
```

Top right is the class definition and the __init__ routine.

Our class is called Line and we will be creating a wxFrame to do our drawing. This could also be a panel within a frame or any number of other options. My choice was to have a Frame pop up with our chart data on it. When the class is first instantiated, the __init__ routine is called with the name of the parent object, the id of that object, the title of the frame (in the title bar), the data that we want to chart and finally the title of the chart itself. Next we create the wx.Frame object that is 1024x768 pixels in size. Next we bind the paint event (which is called everything the frame is created, moved, covered, uncovered, etc.) to our event routine OnPaint. Remember, since this is inside of a class we use the “self.” to say the routine belongs to the class not somewhere else. We set some variables (BoxWidth, BoxHeight, ChartTitle, data) for use later. After we set self.data to an empty list, we call a routine called SetData to find our data scale, which we will discuss further down. Finally, we set the frame to be centered in the screen and call the Show routine. This will automatically

```
    def DrawBox(self,dc):
        #Horizontal
        dc.DrawLine(10,10,800,10)
        dc.DrawLine(10,700,800,700)
        #Vertical
        dc.DrawLine(10,10,10,700)
        dc.DrawLine(800,10,800,700)
```

This is fairly simple. We pass the dc of the frame, then draw four lines. The DrawLine function parameters are:

```
def DrawAxis(self,dc):
    #Horizontal
    dc.DrawLine(60,580,700,580)
    #Vertical
    dc.DrawLine(60,580,60,80)
```

call the OnPaint routine since we are creating the Frame.

Next (above) we will write a routine that will create a box that shows the area that we want to constrict our graph to. This is not a clipping or constraining box, it is simply to draw the eye to what we want the user to look at.

Not really difficult. We will be using the DrawLine function several times throughout the program. Next we will create a routine that will draw the X (horizontal) and Y (vertical) axis lines on the screen. We again pass the dc of the frame into the routine.

Since we just discussed the DrawLine method, there's nothing very out of the ordinary here. We are drawing a line 580 pixels down the Frame that starts at X=60 and ends at X=700. Then we draw a line that starts at X=60 Y=580 and goes up to X=60 Y=80. This one is drawn from the bottom up, but we could have drawn it from the top down.

Next we will deal with the DrawTitle routine. Once again, we pass the dc of the frame as well as the text we want to draw. During this process, think of drawing text rather than printing text. It's a very minor thing, but it will help.

This routine is longer than most of the others, but part of that is the comments I put in. The first two lines set the font and the pen style that we will be using. In the first line (SetFont), we define the font to be the "default" font, 20 points, not italic and bold. Next we set the colour of the pen to black and the width to be 20. Now we need to figure out the width of the text that we will be drawing so we know how to center it in the box. We get this information by calling the GetFullTextExtent with the text that we will be drawing using the font, font size, pen width and so on that we just defined. The tuple that is returned contains Width, Height, Decent (how far down letters like "g" and "y" will go below the base line) and any leading space. For our purposes, all we are concerned with the width. If you remember, we defined the width of the box back in the __init__ function as 790. To find the center of our text within our box we take the box width minus the width of the text and then divide it by 2. That will be the X value we use to draw our text. Finally, we reset the pen size and colour. Rather than use some default values we pick out of nowhere, we could have called the dc.GetPen function before we started, but when I started the project, I didn't think about it.

```
def DrawTitle(self,dc,txt):

dc.SetFont(wx.Font(20,wx.DEFAULT,wx.NORMAL,wx.BOLD))
        dc.SetPen(wx.Pen(wx.NamedColour('black'),20))
        #Get the length of the text to draw
        vals = dc.GetFullTextExtent(txt)
        # Returned (Width,height,Decent,externalLeading)
        #Get the left position (x) to draw centered text
        txtleft = (self.BoxWidth-vals[0])/2
        dc.DrawText(txt,txtleft,30)
```

```
    def DrawDateTicks(self,dc,dcount):
        for cntr in range(1,dcount+1):
            dc.DrawLine(65+(cntr*20),580,65+(cntr*20),600)
```

Our next routine will draw the tic lines along the horizontal axis at the bottom of the chart. We want them to be equidistant along the line. We pass (as usual) the dc and a value I called dcount which is the number of dates we want to show. Since the number of days in any given month can range from 28 to 31, I wanted to be a bit dynamic. We simply use a for loop to count the number of lines to draw, which one to draw and where. If you have been carefully paying attention, we will start the lines at position 85 and it will be 20 pixels high and they will be 20 pixels apart.

```
def DrawRotText(self,dc,txt,x,y):
     dc.SetFont(wx.Font(10,wx.DEFAULT,wx.NORMAL,wx.BOLD))
     dc.SetPen(wx.Pen(wx.NamedColour('black'),20))
     dc.DrawRotatedText(txt,x,y,-45)
```

When we get around to drawing the dates into the chart, we want to draw the text on an angle. That way, the text doesn't draw over itself and, well let's admit it, looks cool. For this we will use the DrawRotatedText function. The function takes the text that we want to have drawn, the X and Y location as a starting point and the angle we want the text to be drawn. In this case, we want the text to be rotated anti-clockwise by 45 degrees which we enter as "-45". We will set the font and pen parameters each time the text is drawn. We'll deal with the actual draw date function in a little bit.

We will also want to draw the values along the vertical axis showing tics along the way. If we had the same range of data each time, it would be very easy to do. However, reality shows that the data range of our chart could vary from run to run. One time, the highest value could be 300. The next time it could be 3000. How could we create a generic routine that would account for this? I will try to explain my mindset here.

You might have wondered why I chose the value of 500 for the vertical axis when we drew the line from 80 to 580 (or actually 580 to 80). I chose to use a 500 pixel "view port" to contain our values. That way, we can create a scaling value based on an offset of 500.

Let's say that for a given run that our highest value is 395. We can simply draw a bar that is 395 pixels high to represent that value. The next run, our highest value is 2,345. If we try to draw the bar to its full height, it would disappear off the top of the chart. In order to show the value, we can round the value to the nearest 500, which would be 2500 and then set that as the top value of our axis. We then can scale the value by dividing 2500 by 500 which gives us a "scaling factor" of 4. Now if we take our data values and divide each one by our scaling factor, we can then plot the values that they will fit within our graph.

So (shown top right) we need to find the highest value within our data and round that up to the nearest 500. So 375 would be 500, 3750 would be 5000 and so on.

```
    #==================================
    # Round up to the nearest 500
    #==================================
    def roundup(self,x):
        return int(math.ceil(x/500.0))*500
```

```
    def SetData(self,DataToUse):
        if type(DataToUse[1]) is tuple:
            self.DateList=[]
            self.ValList=[]
            for l in DataToUse:
                self.DateList.append(l[0])
                self.ValList.append(l[1])
            self.HiValue = self.roundup(max(self.ValList))
            self.ScaleValue = self.HiValue/500
        else:
            self.ValList=[]
            self.DateList=[]
            for l in DataToUse:
                self.ValList.append(l)
            self.HiValue = self.roundup(max(self.ValList))
```

Next, we need to decide what kind of data we are going to use. You will see further down the program that I provide two different types of data in lists. One assumes that the date range we will use, along the X axis, is data for October, but you can easily follow that code (shown in a

```
def DrawValues(self,dc):
    c2 = 0
    for cntr in range(580,30,-50):
        dc.SetPen(wx.Pen(wx.NamedColour('black'),1))
        dc.DrawLine(60,cntr,50,cntr)
        dc.SetFont(wx.Font(10,wx.DEFAULT,wx.NORMAL,wx.BOLD))
        dc.SetPen(wx.Pen(wx.NamedColour('black'),20))
        dc.DrawText(str(c2),26,cntr-7)
        c2 = c2 + (50 * self.ScaleValue)
```

few moments) and change it to whatever month you wish. The second data list, is more generic and provides both a date and a value as a list of tuples. This allows for data to be passed for any time period. The date is a string and the value is either an integer or a float. The SetData function will look at the first value within the data list and to determine if it is a tuple. If it is, we assume that the data structure of the list is the second option, if not, it is the first.

If it is a tuple, we create two lists, one for the dates and one for the values. We then walk the list splitting the data between the two lists. Once we have that done, we then find the highest value (max(self.ValList)) and send it the roundup function (shown above) so we can get our scaling value. If the data isn't in tuples, then we clear BOTH lists and do the same steps as above.

Now that we have our scale value we can draw our tics and the values that will represent our vertical axis. We again use a for loop, this time from 580 to 30 with a step of -50 to work our way up the line and draw a 10 pixel line. Next we set the font (just in case it gets changed somehow) and draw the value of each of our values.

```
    def DrawBars(self,dc):
        dc.SetPen(wx.Pen(wx.NamedColour('black'),5))
        for cntr in range(0,len(self.ValList)):
            dc.DrawRectangle(84 + (cntr* 20),580,2,self.ValList[cntr]/-self.ScaleValue)

    #==================================
    #  Convert mm/dd/yy to unix timestamp
    #==================================
    def DateToStamp(self,x):
        x = x+" 00:00:00"
        return(time.mktime(time.strptime(x, "%m/%d/%Y %H:%M:%S")))
    #==================================
    #  Convert mm/dd/yy to unix timestamp
    #==================================
    def Timestamp2Date(self,tstmp):
```

```
    #==================================
    #  Draw the dates in rotated text
    #==================================
    def DrawDates(self,dc,startdate,enddate):
        sd = int(self.DateToStamp(startdate))
        ed = int(self.DateToStamp(enddate))
        ed = ed + 86400
        stp = 1
        for cntr in range(sd,ed,86400):
            dt = self.Timestamp2Date(cntr)
            self.DrawRotText(dc,dt,65+(stp*20),600)
```

Now we get into the routines that will create the date tics along the X axis if we choose to have a simple list of data without including the dates. We have two support routines, one called DateToStamp and the other Timestamp2Date (Yes, I got lazy when I wrote this one). Rather than going through a bunch of complicated DateTime routines to determine the number of days in any given month, I'm going to use a start date and an end date, convert both of those to Unix timestamps to get the proper day of month within the sequence. I've shown you the DateToStamp routine before and the Timestamp2Date simply reverses the process.

The next routine takes the start date and end date, as we discussed a moment ago, converts them to Unix timestamps, then adds 86400 (the number of ticks in a 24 hour period) to make sure we get the last date in the sequence, then uses another for loop to draw the rotated text where we want it.

We are now at the OnPaint event handler that calls all the helper routines we dealt with so far. Remember, by using the PaintDC, every time the frame is moved, re-sized, covered or uncovered, the OnPaint event handler is called, thereby assuring our graph will be persistent.

First (shown on the next page, top left) we get an instance of our dc, and then we call the DrawBox, DrawAxis, DrawTitle, and the DrawDateTicks routines. We then determine if the DateList list (created in the SetData routine called from __init__ routine) is empty or if it has dates for us to draw. If so, we call the DrawDates routine with the proper values. We then call the DrawValues routine and finally the DrawBars routine. Now you should understand why I broke everything down into little bitty chunks.

```
#==================================
#  Main routine
#==================================
def OnPaint(self,event):
    dc = wx.PaintDC(self)
    self.DrawBox(dc)
    self.DrawAxis(dc)
    self.DrawTitle(dc,self.ChartTitle)
    ## Date Tics and dates
    self.DrawDateTicks(dc,31)
    leng = len(self.DateList)
    if leng > 0:
        sd = self.DateList[0]
        ed = self.DateList[4]
        self.DrawDates(dc,sd,ed)
    else:
        self.DrawDates(dc,"02/01/2015","03/01/2015")
    # Value Tics - Draw 10 tics
    self.DrawValues(dc)
```

The last thing we have to look at is the runtime routine. You probably remember that the ’if __name__ == “__main__”’ runs if we are calling the program as a standalone rather than as a library. The next two lines are the dummy data that I used to test the program. You could comment out the first one and run it with the second data line which is the one that uses the tuple. The last three lines will instantiate the wxPython routines, then the Line class and finally call the app.MainLoop wxPython routine to get the frame to run.

So there it is. Our own graphing/charting program and library. I’ve put the full code up on pastebin at http://pastebin.com/m2feeh5P.

Until next time, have fun coding.

```
if __name__ == "__main__":
    data =
(300,20,47,96,1200,700,500,230,179,500,300,20,47,96,200,400,500,230,179,500,300,20,47,96,200,400,500,230,179,500,475,423)
    #data = (("02/01/2015",169.63),("02/02/2015",188.81),("02/03/2015",61.85),("02/04/2015",94.53),("02/05/2015",235.85))

    app = wx.App()
    Line(None, -1, 'Bar Chart',data,"Monthly Sales - Colorado Springs")
```

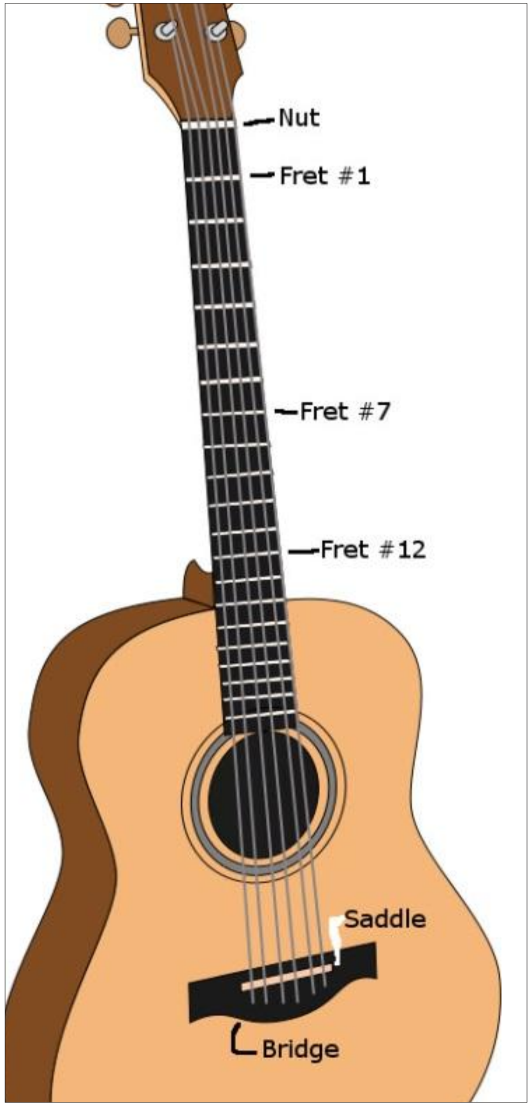
Greg Walters is owner of RainyDay Solutions, LLC, a consulting company in Aurora, Colorado, and has been programming since 1972. He enjoys cooking, hiking, music, and spending time with his

Program in Python Pt. 59

First, let me say Happy 100 to Ronnie and the crew. It's a privilege to be part of this milestone.

This time I thought that I'd share some information on my new obsession. I've started repairing and building stringed musical instruments like guitars and violins. Believe it or not, there is a lot of math involved in musical instruments. Today, we will look at some of the math involved with the length of strings and where the frets should be placed on the fretboard.

Take a look at the picture of the guitar. I annotated various items in the image. The important things to look at are the Nut near the top of the fingerboard, the Frets, the Bridge near the bottom, and the white "line" within the bridge called the Saddle. The purpose of the frets is to create a perfect spot to change the length of the string to create a



note that is in tune. The positions of these frets are not arbitrary, but mathematically determined.

Now, the physics of vibrating strings tells us that if you half the vibrating string length of a theoretically perfect string, you will double the frequency of the vibrations. In the case of a guitar, this string length is between the nut and the saddle. This distance is referred to the Scale Length of the guitar. The half-point that allows for the doubled frequency is fret # 12. If correctly done, just by lightly placing your finger on the string at this location, you get a pleasing tone. There are a few other positions that this will happen, but the 12th fret should be the perfect location for this doubling, making the note go up one octave.

Different scale lengths will create different feel and tones. For example, guitars like the Fender Stratocasters® have a scale length of 25½", which produces a rich and strong bell-like tone. On the other hand, Gibson guitars often use a scale length of 24¾". This creates a lower string tension which makes an easier playing feel and a warmer tone. Other guitar manufacturers decided that a scale length of 25" makes a clearer tone than either of the other two "standard" scale lengths.

So with the ability of a guitar maker to come up with their own scale length, the spacing of the frets will have to be recalculated. This is something that luthiers (guitar makers) have been dealing with for hundreds of years.

In the past, there was a technique called the rule of 18 which involves successively dividing the scale length minus the offset to the previous fret by 18. While this kind of worked, the tones were off, the higher up the fingerboard the player went. These days, we use a different constant. This constant is 17.817. By using this "new" constant, the 12th fret or octave is at the exact position to be half the scale length of the string.

Now, these calculations are easy enough to do by paper and pencil or even a simple calculator, it's just as easy to create a Python program to do the calculations for us in just a second. Once you have the positions, you simply saw a slot for the fret at the correct positions and then hammer in the frets.

So, let's take a look at the program.

We want to create a program that will prompt for the scale length of the guitar (or bass), do the calculations and then print out the distances. The calculations and all returned lengths are all in inches, so all our friends that use metric measurements, please add the proper conversion calculations. After almost 5 years, you should be able to do this with ease.

We don't need to import any libraries for this so we will start off by defining a couple of variables.

```
ScaleLength = 0

CumulativeLength = 0
```

Next we will create a routine (top right) that will be called repeatedly as we "travel down" the fingerboard. We will pass two values into this routine. One is the scale length and the other is the cumulative distance from the nut to the previous fret.

```
def CalcSpacing(Length,NTF):
    BridgeToFret = Length-NTF
    NutToFret = (BridgeToFret/17.817) + NTF
    return NutToFret
```

In this routine, we take the scale length, subtract the cumulative distance and assign that value to BridgeToFret. We then take that value, divide it by our constant (17.817), add back in the cumulative distance and then return that value to our calling routine. Remember, we could simply have returned the calculated value without assigning it to a variable name. However, if we ever want to inspect the calculated values, it's easier to do if we assign the value before we return it.

Now we will make our worker routine. We've done this kind of thing many times in the past. We will pass it the scale length and it will loop for up to 24 frets (range(1,25)). Even if your project has less than 24 frets, you will have the correct positions of all the frets you do have. I chose 24 because that's the maximum of frets for most guitars. When we get into the loop, we check the fret number (x) and if it is 1, we pass the cumulative length as 0, since this is the first calculation. Otherwise, we pass the last cumulative length in and it becomes the result from the calculation routine. Finally, we print each fret number followed by a formatted version of the cumulative length.

Finally, we have the code that does the prompting for the scale length. I'm sure you will remember the format for the raw_input routine, since we have used it so many times before. Something you might not remember: that raw_input always returns a string, so when we pass it off to the DoWork routine, we have to pass it as a floating point number so the routine will work correctly. Of course, we could simply pass it as a string, but we would have to deal with the conversion in the DoWork routine.

```
def DoWork(ScaleLength):
    CumulativeLength = 0
    for x in range(1,25):
        FretNumber = x
        if FretNumber == 1:
            CumulativeLength = CalcSpacing(ScaleLength,0)
        else:
            CumulativeLength = CalcSpacing(ScaleLength,CumulativeLength)
        print("Fret=%d,NutToFret=%.3f" % (FretNumber,CumulativeLength))
```

```
ScaleLength =
raw_input("Please enter Scale
Length of guitar -> ")

DoWork(float(ScaleLength))
```

You might wonder what good this program will do if you aren't going to build a guitar from scratch. It can be valuable when you're looking at buying a used guitar or trying to tweak a guitar with a floating bridge. Also, if you are a guitar player, this might have been something you didn't know about guitars.

Of course, the code is available from pastebin at http://pastebin.com/A2RNECt5.

Python In The REAL World

Welcome fellow pythoners. As the kids here in the central parts of the U.S. say, “What’s Shakin’ Bacon?” I’m not exactly sure what that’s supposed to mean, but I assume it’s a good thing.

You might notice the new header. I decided that I’ve taught you all the basics of Python that I can for “general” programming, so now we are going to delve into using Python to talk to other types of computers and controllers, like the Raspberry Pi and the Arduino micro controller. We’ll look at things like temperature sensors, controlling motors, flashing LEDs and more.

This issue we will be focusing on what we’ll need to do this and focus on a few of the projects we will be looking at in the future. Next issue, we will start the first project.

One of the things we will talk about next time will be the Raspberry Pi. The Pi is a credit-card sized computer that natively runs Linux on an SD card. Its output goes to your TV set via HDMI. It also has an Ethernet connection for Internet access.

You can find out more at the official site https://www.raspberrypi.org. If you want to follow along with the projects, you will need a Pi, SD card, Keyboard, Mouse, a 5volt DC power supply like the ones on modern cell phones, and access to an HDMI monitor or TV. Eventually, you should also consider getting a breadboard and some connecting wires for when we start to interface to the outside world. You can find any number of places that sell the Pi on the Internet. Here in the U.S., we can get them for around $35.

One other thing about the Pi is that it provides access to a series of pins that support GPIO (General Purpose Input/Output). Basically, this means that you can write programs that will send signals to the output pins and read the signals from the input pins. This can be used to interface to things like LEDs, sensors, push buttons, etc. Many people have made home automation systems, multiple processor systems (by linking 40 or so Pi computers together to emulate a supercomputer), weather stations, even drones. So you can imagine that the possibilities are endless. That’s why I decided to start with it for this series of articles.

After a while, we will begin to work with the Arduino, which according to the official website (https://www.arduino.cc): “*Arduino is an open-source electronics platform based on easy-to-use hardware and software. It's intended for anyone making interactive projects*”.

Once again, this is an exciting device to work with. In this part of the series, we will look at talking to the Arduino, first in its native scripting language, and then in Python and eventually interfacing the Pi with the Arduino.

I know this month’s article is fairly short, but I’ve been doing poorly health-wise, so I’m saving my strength for the next article. Until then, grab some electronics and get ready for fun!

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