

# The Python Programming Language



## About Python

Guido van Rossum is the creator of the Python programming language, first released in the early 1990s. Its name comes from a 1970s British comedy sketch television show called Monty Python's Flying Circus. (Check them out on YouTube!) The development environment IDLE provided with Python comes from the name of a member of the comic group.

Python has a simple syntax. Python programs are clear and easy to read. At the same time, Python provides powerful programming features, and is widely used. Companies and organizations that use

Python include YouTube, Google, Yahoo, and NASA. Python is well supported and freely available at [www.python.org](http://www.python.org).

**IDLE** is an **integrated development environment (IDE)**. An IDE is a bundled set of software tools for program development. This typically includes an editor for creating and modifying programs, a translator for executing programs, and a program debugger. A debugger provides a means of taking control of the execution of a program to aid in finding program errors. Python is most commonly translated by use of an interpreter. Thus, Python provides the very useful ability to execute in interactive mode. The window that provides this interaction is referred to as the Python shell. Interacting with the shell is much like using a calculator, except that, instead of being limited to the operations built into a calculator (addition, subtraction, etc.), it allows the entry and creation of any Python code. Example use of the Python shell is shown below.

A screenshot of the Python Shell window. The window title is "Python Shell". The menu bar includes "File", "Edit", "Shell", "Debug", "Options", "Windows", and "Help". The main text area shows the following text:

```
Python 3.1.3 (r313:86834, Nov 27 2010, 18:30:53) [MSC v.1500 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>> 2 + 3
5
>>> |
```

Here, the expression  $2 + 3$  is entered at the shell prompt (`>>>`), which immediately responds with the result 5. Open your Python shell and try your own calculation. The indented “code” is your assigned task:

```
58763 + 19753          Enter this in your Python shell and record results
```

Although working in the Python shell is convenient, the entered code is not saved. Thus, for program development, a means of entering, editing, and saving Python programs is provided by the program editor in IDLE. Details are given below.

One of the most fundamental concepts in programming is that of a **variable**. A simple description of a variable is “a name that is assigned to a value,” as shown below,

```
n = 5          variable n is assigned the value 5
n + 20.        Observe the result of this calculation: 5 + 20
```

If variable  $n$  is assigned a new value, then the same expression,  $n + 20$ , will produce a different result,

```
n = 10        reassign the variable n.
n + 20.        Observe the result of this calculation: 10 + 20
```

## Part II - Basic Arithmetic Operators

The common arithmetic operators in Python are  $+$  (addition),  $-$  (subtraction),  $*$  (multiplication),  $/$  (division), and  $**$  (exponentiation). Addition, subtraction, and division use the same symbols as standard mathematical notation. Please enter these simple calculations:

```
13 * 17
29 - 83
780 / 10
2 ** 3
```

Multiplication is *never* denoted by the use of parentheses as in mathematics, as depicted below,

```
10 * (20 + 5)    CORRECT
10 (20 + 5)      INCORRECT
```

Note that parentheses may be used to denote subexpressions. Next, you will see how to input information from the user, and display program results.

## Basic Input and Output

The programs that you write request will often require information from the user. In Python, the `input` function is used for this purpose,

```
name = input ('What is your name?: ')
```

Characters within quotes are called **strings**. This particular use of a string, for requesting input from the user, is called a **prompt**. The input function displays the string on the screen to prompt the user for input,

```
What is your name?: Charles
```

Note: the underline is used here to indicate the user's input. You should use your own name here.

The `print` function is used to display information on the screen in Python. This may be used to display a message, like the following:

```
>>> print('Welcome to My First Program!')
Welcome to My First Program!
```

or used to **output** the value of a variable,

```
>>> n = 10
>>> print(n)
10
```

or to display a combination of both strings and variables,

```
>>> name = input ('What is your name?: ')
What is your name?: Charles
>>> print('Hello', name) Hello Charles
```

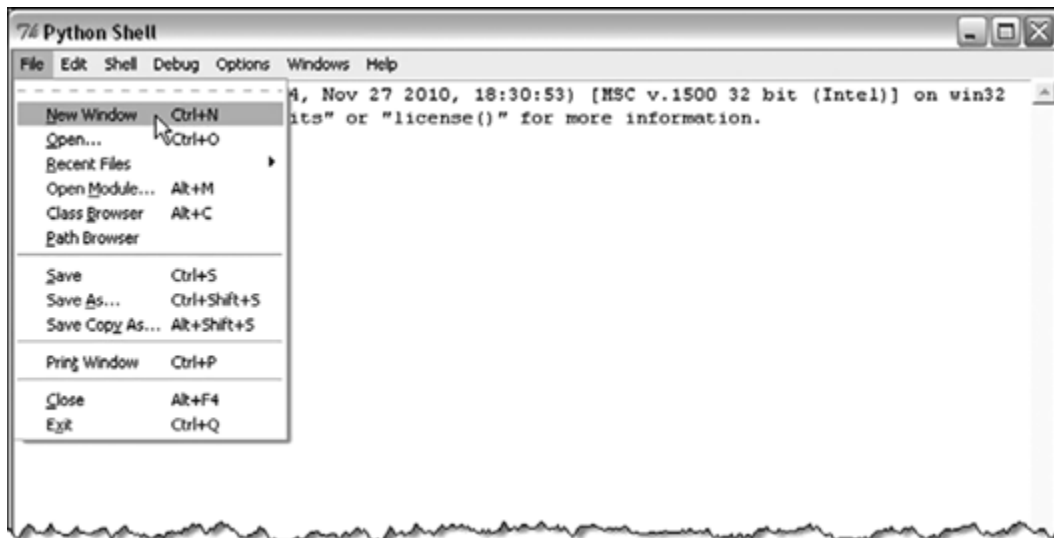
Please note that a comma is used to separate the individual items being printed, causing a space to appear between each when displayed. Thus, the output of the print function in this case is `Hello Charles`, and not `HelloCharles`.

## Part III - Learning How To Use IDLE

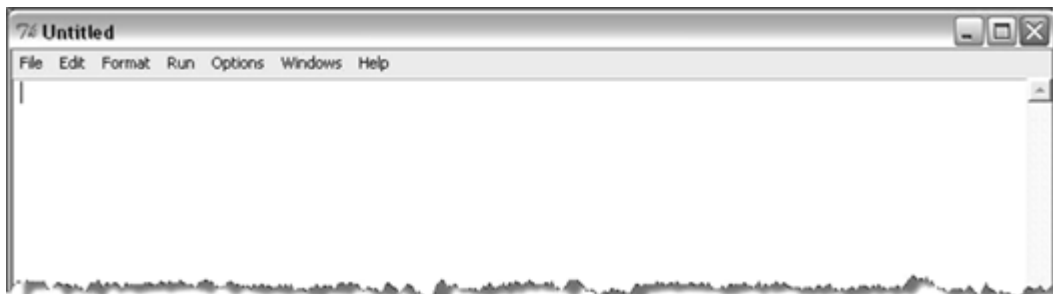
In order to become familiar with writing your own Python programs using IDLE, you will create a simple program that asks the user for their name and responds with a greeting. This program utilizes the following concepts:

- creating and executing Python programs
- input and print

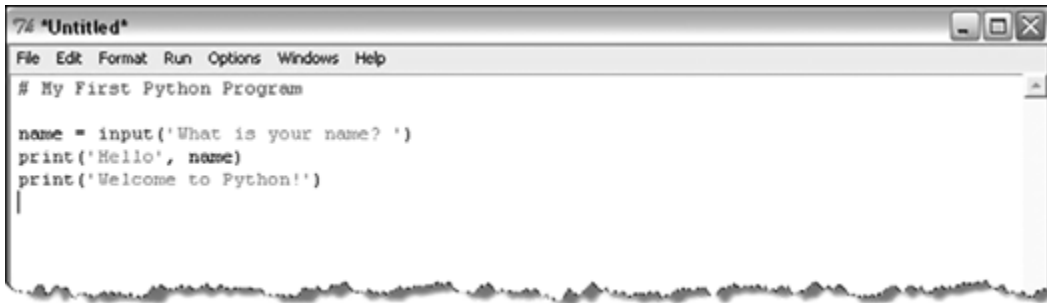
First, to create a Python program file, select New Window from the File menu in the Python shell as shown below:



A new, untitled program window will appear:



Type the following in the program window exactly as shown.



```
Python Shell
File Edit Format Run Options Windows Help
# My First Python Program

name = input('What is your name? ')
print('Hello', name)
print('Welcome to Python!')
```

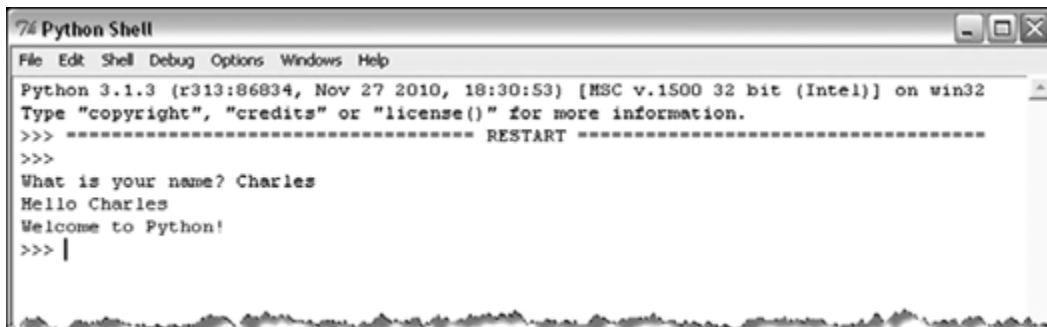
When finished, save the program file by selecting **Save As** under the File menu, and save in the appropriate folder with the name `MyFirstProgram_yourLastName.py`.

To run the program, select **Run Module** from the Run menu (or simply hit function key F5).



```
Python Shell
File Edit Format Run Options Windows Help
# My First P
name = input
print('Hello
print('Welco
Python Shell
Check Module Alt+X
Run Module F5
```

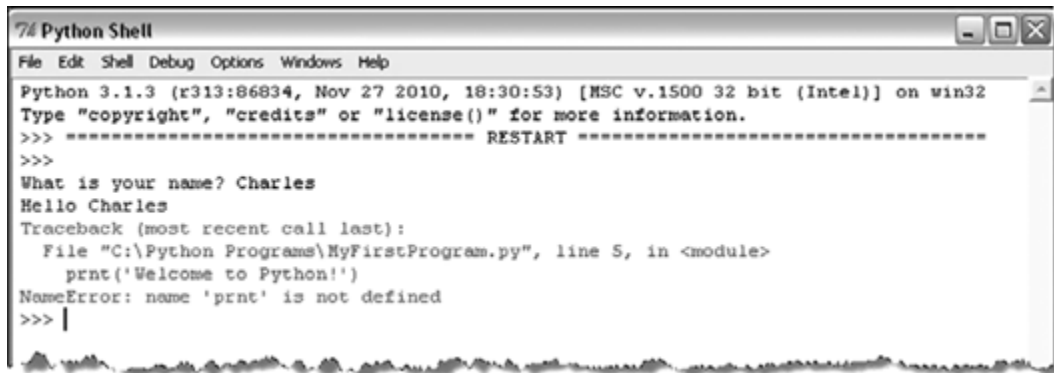
If you have entered the program code correctly, the program should execute as seen here:



```
Python Shell
File Edit Shell Debug Options Windows Help
Python 3.1.3 (r3113:86834, Nov 27 2010, 18:30:53) [MSC v.1500 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>> ----- RESTART -----
>>>
What is your name? Charles
Hello Charles
Welcome to Python!
>>> |
```

If, however, you have mistyped part of the program resulting in a syntax error (such as mistyping

print), you will get an error message similar to the one below:



```
Python Shell
File Edit Shell Debug Options Windows Help
Python 3.1.3 (r313:86834, Nov 27 2010, 18:30:53) [MSC v.1500 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>> ===== RESTART =====
>>>
What is your name? Charles
Hello Charles
Traceback (most recent call last):
  File "C:\Python Programs\MyFirstProgram.py", line 5, in <module>
    print('Welcome to Python!')
NameError: name 'print' is not defined
>>> |
```

In that case, go back to the program window and make the needed corrections, then re-save and re-execute the program. You may need to go through this process a number of times until all the syntax errors have been corrected.

**Task:** Complete and Test `MyFirstProgram_yourLastName.py`. Upload/submit the program.

## Concepts and Procedures

1. Which of the following capabilities does an integrated development environment (IDE) provide?
  - a. Creating and modifying programs
  - b. Executing programs
  - c. Debugging programs
  - d. All of the above
2. The Python shell is a window in which Python instructions are immediately executed. (TRUE/FALSE)
3. Suppose that the `math` module of the Python Standard Library were imported. What would be the proper syntax for calling a function in the `math` module named `sqrt` to calculate the square root of four?
4. What is the value of variable `n` after the following instructions are executed?
  - a. `j = 5`
  - b. `k = 10`

c.  $n = j * k$

5. Which of the following is a proper arithmetic expression in Python?

a.  $10 (15 + 6)$

b.  $(10 * 2)(4 + 8)$

c.  $5 * (6 - 2)$

6. Exactly what is output by the following if the user enters 24 in response to the input prompt.

```
age = input('How old are you?: ')
print('You are', age, 'years old')
```

## Programming Problems

1. Write a simple Python program that displays the following powers of 2, one per line:  $2^1$ ,  $2^2$ ,  $2^3$ ,  $2^4$ ,  $2^5$ ,  $2^6$ ,  $2^7$ ,  $2^8$ .

2. Write a Python program that allows the user to enter any integer value, and displays the value of 2 raised to that power. Your program should function as shown below.

```
What power of two? 10
Two to the power of 10 is 1024
```

3. Write a Python program that allows the user to enter any integer base and integer exponent, and displays the value of the base raised to that exponent. Your program should function as shown below.

```
What base? 10
What power of 10? 4
10 to the power of 4 is 10000
```

4. Write a Python program that allows the user to enter a four-digit binary number and displays its value in base 10. *Each binary digit should be entered one per line, starting with the leftmost digit*, as shown below.

```
Enter leftmost digit: 1  
Enter the next digit: 0  
Enter the next digit: 0  
Enter the next digit: 1  
The value is 9
```