python™

THE ULTIMATE BEGINNER'S GUIDE!

Python
The Ultimate Beginner's Guide!

Andrew Johansen

Table of Contents

Introduction

I want to thank you and congratulate you for purchasing this book…

"Python: The Ultimate Beginner's Guide!"

This book contains proven steps and strategies on learning Python Programming quickly and easily.

Python is a powerful and flexible programming language. It uses concise and easy-to-learn syntax which enables programmers to write more codes and develop more complex programs in a much shorter time.

Python: The Ultimate Beginner's Guide provides all essential programming concepts and information you need to start developing your own Python program. The book provides a comprehensive walk-through of Python programming in a clear, straightforward manner that beginners will appreciate. Important concepts are introduced through a step-by-step discussion and reinforced by relevant examples and illustrations. You can use this book as a guide to help you explore, harness, and gain appreciation of the capabilities and features of Python.

Thanks again for purchasing this book, I hope you enjoy it!

Chapter 1 Getting Acquainted with Python

Python is an open source, high-level programming language developed by Guido van Rossum in the late 1980s and presently administered by Python Software Foundation. It came from the ABC language that he helped create early on in his career.

Python is a powerful language that you can use to create games, write GUIs, and develop web applications.

It is a high-level language. Reading and writing codes in Python is much like reading and writing regular English statements. Because they are not written in machine-readable language, Python programs need to be processed before machines can run them.

Python is an interpreted language. This means that every time a program is run, its interpreter runs through the code and translates it into machine-readable byte code.

Python is an object-oriented language that allows users to manage and control data structures or objects to create and run programs. Everything in Python is, in fact, first class. All objects, data types, functions, methods, and classes take equal position in Python.

Programming languages are created to satisfy the needs of programmers and users for an effective tool to develop applications that impact lives, lifestyles, economy, and society. They help make lives better by increasing productivity, enhancing communication, and improving efficiency. Languages die and become obsolete when they fail to live up to expectations and are replaced and superseded by languages that are more powerful. Python is a programming language that has stood the test of time and has remained relevant across industries and businesses and among programmers, and individual users. It is a living, thriving, and highly useful language that is highly recommended as a first programming language for those who want to dive into and experience programming.

Advantages of Using Python

Here are reasons why you would prefer to learn and use Python over other high level languages:

Readability

Python programs use clear, simple, and concise instructions that are easy to read even by those who have no substantial programming background. Programs written in Python are, therefore, easier to maintain, debug, or enhance.

Higher productivity

Codes used in Python are considerably shorter, simpler, and less verbose than other high-level programming languages such as Java and C++. In addition, it has well-designed built-in features and standard library as well as access to third party modules and source libraries. These features make programming in Python more efficient.

Less learning time

Python is relatively easy to learn. Many find Python a good first language for learning programming because it uses simple syntax and shorter codes.

Runs across different platforms

Python works on Windows, Linux/UNIX, Mac OS X, other operating systems and small-form devices. It also runs on microcontrollers used in appliances, toys, remote controls, embedded devices, and other similar devices.

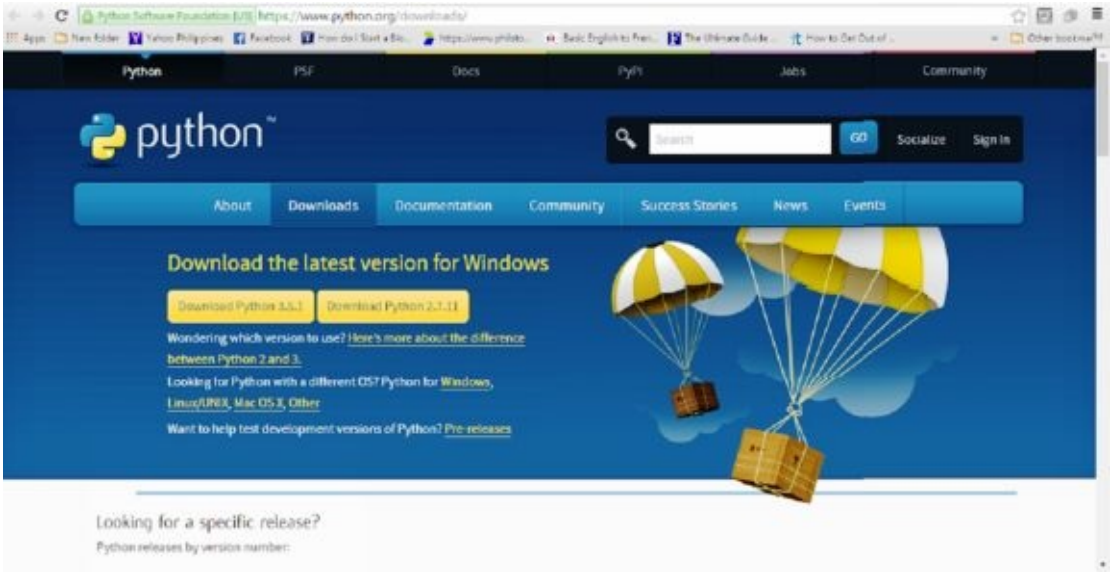
Chapter 2 Installing Python

Installing Python in Windows

To install Python, you must first download the installation package of your preferred version from this link:

https://www.python.org/downloads/

On this page, you will be asked to choose between the two latest versions for Python 2 and 3: Python 3.5.1 and Python 2.7.11. Alternatively, if you are looking for a specific release, you can scroll down the page to find download links for earlier versions.



You would normally opt to download the latest version, which is Python 3.5.1. This was released on December 7, 2015. However, you may opt for the latest version of Python 2, 2.7.11. Your preferences will usually depend on which version will be most usable for your project. While Python 3 is the present and future of the language, issues such as third party utility or compatibility may require you to download Python 2.

Installing Python in Mac

If you’re using a Mac, you can download the installation package from this link:

https://www.python.org/downloads/mac-osx/

Running the Installation file:

Once you’re finished with the download, you can proceed to installation by clicking on the downloaded .exe file. Standard installation will include IDLE, pip, and documentation.

Chapter 3 Interacting with Python

Python is a flexible and dynamic language that you can use in different ways. You can use it interactively when you simply want to test a code or a statement on a line-by-line basis or when you're exploring its features. You can use it in script mode when you want to interpret an entire file of statements or application program.

To use Python interactively, you can use either the Command Line window or the IDLE Development Environment.

Command Line Interaction

The command line is the most straightforward way to work with Python. You can easily visualize how Python works as it responds to every completed command entered on the >>> prompt. It may not be the most preferred interaction with Python, but it is the simplest way to explore how Python works.

Starting Python

There are different ways to access Python's command line depending on the operating system installed on your machine:

- If you're using Windows, you can start the Python command line by clicking on its icon or menu item on the Start menu.

- You may also go to the folder containing the shortcut or the installed files and click on the Python command line.

- If you're using GNU/Linux, UNIX, and Mac OS systems, you have to run the Terminal Tool and enter the Python command to start your session.

We use commands to tell the computer what to do. When you want Python to do something for you, you have to instruct it by entering commands that it is familiar with. Python will then translate these commands to instructions that your computer or device can understand and execute.

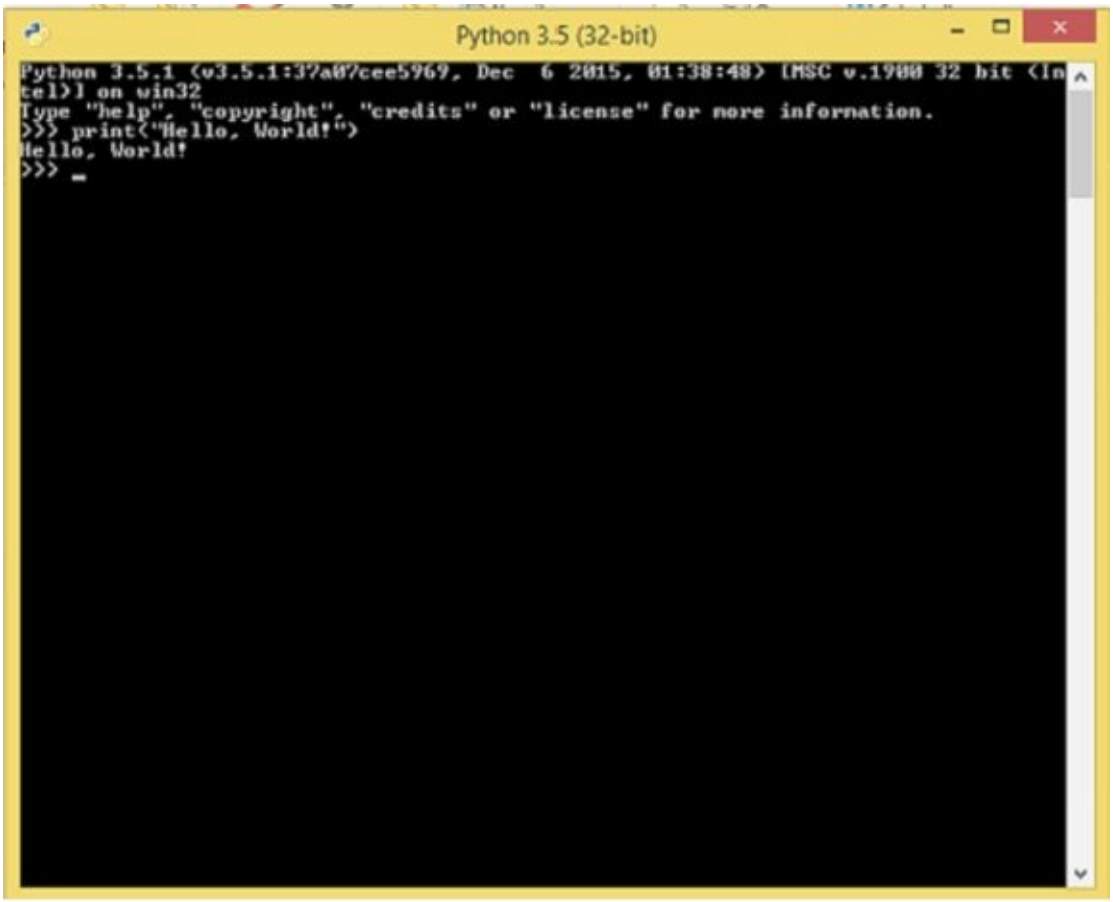
To see how Python works, you can use the print command to print the universal program “Hello, World!”

1. Open Python’s command line.

2. At the >>>prompt, type the following:

   print(“Hello, World!”)

3. Press enter to tell Python that you’re done with your command. Very quickly, the command line window will display Hello, World! on the following line:



Python responded correctly because you gave it a command in a format that it requires. To see how it responds when you ask it to print the same string using a wrong syntax for the print command, type and enter the following command on the Python command prompt:

Print(“Hello, World!”)

This is how Python will respond:

Syntax error: invalid syntax

You’ll get syntax error messages whenever you enter invalid or incomplete statements. In this case, you typed print with a capital letter which is a big no to a case-sensitive language like Python.

If you’re just using Python interactively, you can do away with the print command entirely by just typing your statement within quotes such as “Hello, World!”

Exiting Python

To exit from Python, you can type any of these commands:

quit()

exit()

Control-Z then press enter

IDLE: Python’s Integrated Development Environment (IDE)

The IDLE (Integrated Development and Learning Environment) tool is included in Python’s installation package but you can choose to download more sophisticated third party IDEs.

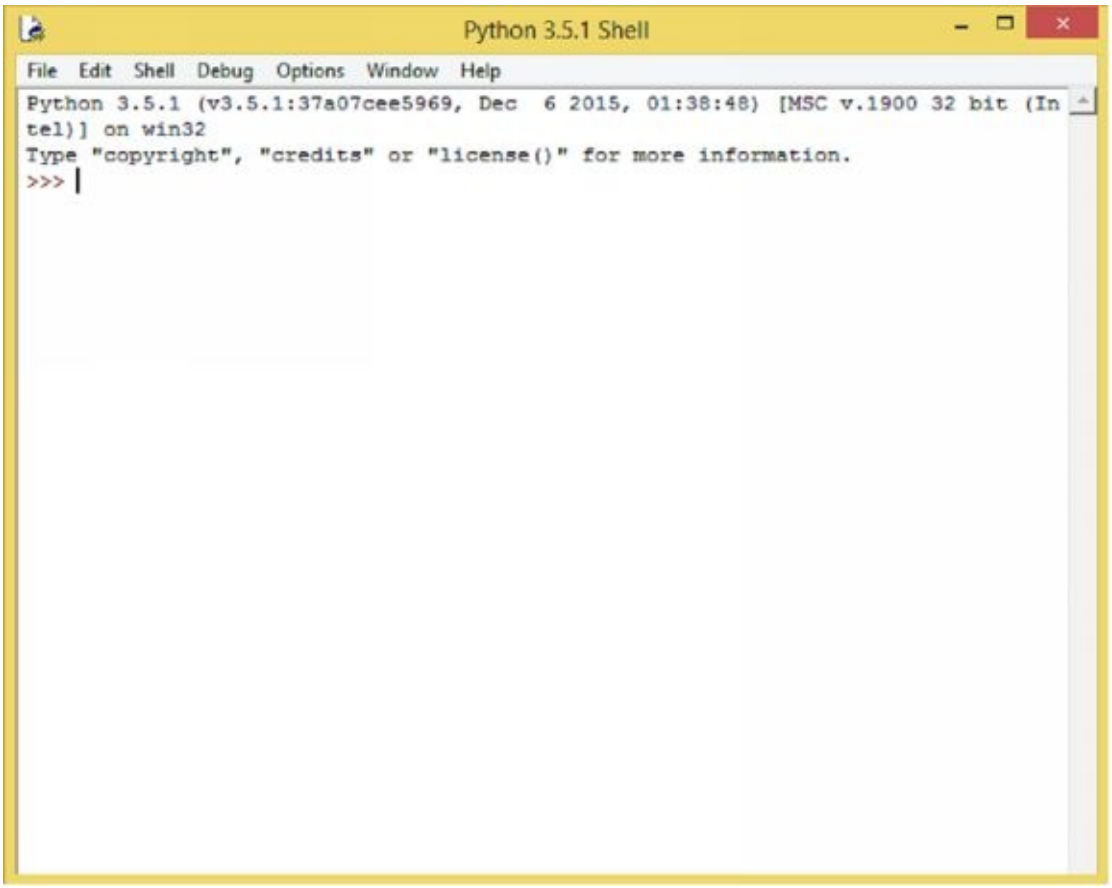
The IDLE tool offers a more efficient platform to write your code and work interactively

with Python. You can access IDLE on the same folder where you found the command line icon or on the start menu. As soon as you click on the IDLE icon, it will take you to the Python Shell window.

The Python Shell Window

The Python Shell Window has dropdown menus and a >>>prompt that you have seen earlier in the command line window. Here you can type and enter statements or expressions for evaluation in the same way that you used the command line earlier. This time however, IDLE's editing menu allows you to scroll back to your previous commands, cut, copy, and paste previous statements and make modifications. IDLE is quite a leap from the command line interaction.

The Python Shell window has the following menu items: File, Edit, Shell, Debug, Options, Windows, and Help.



The Shell and Debug menus provide capabilities you would find useful when creating larger programs.

The Shell menu allows you to restart the shell or search the shell's log to find the most recent reset.

The Debug Menu has useful menu items for tracing the source file of an exception and highlighting the erring line. The Debugger option will usher in an interactive debugger window that will allow you to step through the running program. The Stack Viewer option displays the current Python stack through a new window.

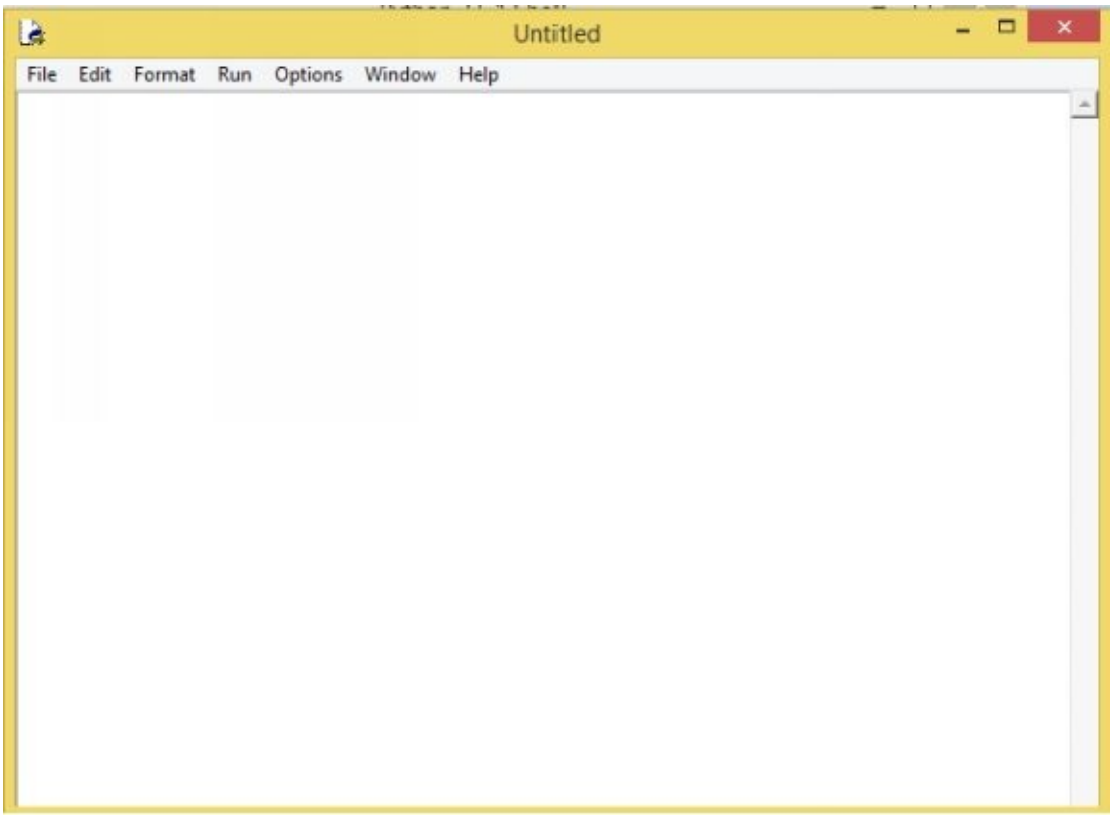
The Options window allows you to configure IDLE to suit your Python working preferences.

The Help option opens Python Help and documentation.

The File Window

The items on the File menu allows you to create a new file, open an old file, open a module, and/or save your session. When you click on the 'New File' option, you will be taken to a new window, a simple and standard text editor where you can type or edit your code. Initially, this file window is named 'untitled' but its name will soon change as you save your code.

The File window's menu bar varies only slightly with the Shell Window. It doesn't have the 'Shell' and 'Debug' menu found in the Shell Window but it introduces two new menus: the Run and the Format menu. When you choose to Run your code on the file window, you can see the output on the Shell Window.



The Script Mode

When working in script mode, you won’t automatically see results the way you would in interactive mood. To see an output from a script, you’ll have to run the script and/or invoke the print() function within your code.

Chapter 4 Python Syntax

Python syntax refers to the set of rules that defines how human users and the system should write and interpret a Python program. If you want to write and run your program in Python, you must familiarize yourself with its syntax.

Keywords

Python keywords are reserved words in Python that should not be used as variable, constant, function name, or identifier in your code. Take note of these keywords if you don't want to run into errors when you execute your program:

and	assert
break	class
continue	def
del	elif
else	except
exec	finally
for	from
global	if
import	in
is	lambda
not	or
pass	print
raise	return
try	while
with	yield

Python Identifiers

A Python Identifier is a name given to a function, class, variable, module, or other objects that you'll be using in your Python program. Any entity you'll be using in Python should be appropriately named or identified as they will form part of your program.

Here are Python naming conventions that you should be aware of:

- An identifier can be a combination of uppercase letters, lowercase letters, underscores, and digits (0-9). Hence, the following are valid identifiers: myClass, my_variable, var_1, and print_hello_world.

- Special characters such as %, @, and $ are not allowed within identifiers.
- An identifier should not begin with a number. Hence, 2variable is not valid, but variable2 is acceptable.

- Python is a case-sensitive language and this behavior extends to identifiers. Thus, Labor and labor are two distinct identifiers in Python.

- You cannot use Python keywords as identifiers.

- Class identifiers begin with an uppercase letter, but the rest of the identifiers begin in lowercase.

- You can use underscores to separate multiple words in your identifier.

You should always choose identifiers that will make sense to you even after a long gap. Hence, while it is easy to set your variable to c = 2, you might find it more helpful for future reference if you use a longer but more relevant variable name such as count = 2.

Using Quotations

Python allows the use of quotation marks to indicate string literals. You can use single, double, or triple quotes but you must start and end the string with the same type. You would use the triple quotes when your string runs across several lines.

Python Statements

Statements are instructions that a Python interpreter can execute. When you assign a value to a variable, say my_variable = “dog”, you’re making an assignment statement. An assignment statement may also be as short as c = 3. There are other kinds of statements in Python, like *if* statements, *while* statements, *for* statements, etc.

Multi-line statements

A statement may span over several lines. To break a long statement over multiple lines, you can wrap the expression inside parentheses, braces, and brackets. This is the preferred style for handling multi-line expressions. Another way to wrap multiple lines is by using a backslash (\) at the end of every line to indicate line continuation.

Indentation

While most programming languages such as Java, C, and C++ use braces to denote blocks of code, Python programs are structured through indentation. In Python, blocks of codes are defined by indentation not as a matter of style or preference but as a rigid language requirement. This principle makes Python codes more readable and understandable.

A block of code can be easily identified when you look at a Python program as they start on the same distance to the right. If it has to be more deeply nestled, you can simply indent another block further to the right. For example, here is a segment of a program defining car_rental_cost:

```
def car_rental_cost(days):
  cost = 35 * days
  if days >= 8:
                    cost -= 70
          elif days >= 3:
                    cost -= 20
          return cost
```

You have to make sure that the indent space is consistent within a block. When you use IDLE and other IDEs to input your codes, Python intuitively provides indentation on the subsequent line when you enter a statement that requires indentation. Indentation, by convention, is equivalent to 4 spaces to the right.

Comments

When writing a program, you'll find it helpful to put some notes within your code to describe what it does. A comment is very handy when you have to review or revisit your program. It will also help another programmer who might need to go over the source code. You can write comments within your program by starting the line with a hash (#) symbol. A hash symbol tells the Python interpreter to ignore the comment when running your code.

For multi-line comments, you can use a hash symbol at the beginning of each line. Alternatively, you can also wrap multi-line comment with triple quotes.

Chapter 5 Variables and Data Types

Variables

A variable is like a container that stores values that you can access or change. It is a way of pointing to a memory location used by a program. You can use variables to instruct the computer to save or retrieve data to and from this memory location.

Python differs significantly from languages such as Java, C, or C++ when it comes to dealing with variables. Other languages declare and bind a variable to a specific data type. This means that it can only store a unique data type. Hence, if a variable is of integer type, you can only save integers in that variable when running your program.

Python is a lot more flexible when it comes to handling variables. If you need a variable, you'll just think of a name and declare it by assigning a value. If you need to, you can change the value and data type that the variable stores during program execution.

To illustrate these features:

In Python, you declare a variable by giving it a value:

```
my_variable = 10
```

Take note that when you are declaring a variable, you are not stating that the variable my_variable is equal to 10. What the statement actually means is "my_variable is set to 10".

To increase the value of the variable, you can enter this statement on the command line:

```
>>>my_variable = my_variable + 3
```

To see how Python responded to your statement, invoke the print command with this statement:

```
>>>print(my_variable)
```

You'll see this result on the next line:

```
13
```

To use my_variable to store a literal string "yellow", you'll simply set the variable to "yellow":

```
>>>my_variable = "yellow"
```

To see what's currently store in my_variable, use the print command:

```
>>>print(my_variable)
```

On the next line, you'll see:

```
yellow
```

Data Types

Python handles several data types to facilitate the needs of programmers and application developers for workable data. These include strings, numbers, Booleans, lists, date, and time.

Strings

A string is a sequence of Unicode characters that may be a combination of letters, numbers, and special symbols. To define a string in Python, you can enclose the string in matching single or double quotes:

>>>string1 = “I am enclosed in single quotes.”

>>>string2 = “I am enclosed in double quotes.”

If a literal string enclosed in single quotes contains a single quote, you’ll have to place a backslash (\) before the single quote within the string to escape the character. For example:

>>> string3 = ‘It doesn't look good at all.’

To print string3:

>>> print(string3)

It doesn’t look good at all.

Of course, you wouldn’t have to do this if you used double quotes to enclose the string:

>>>string3 = “It doesn’t seem nice”

Similarly, you’ll have to place a backslash before a double quote if your string is enclosed in double quotes:

>>>txt = “He said: \“You should get the same results no matter how you choose to enclose a string.\””

>>> print(txt)

He said: “You should get the same results no matter how you choose to enclose a string.”

Strings may be indexed or subscripted. In Python, indexing starts from 0 (zero) instead of 1. Hence, a string’s first character has a zero index.

To illustrate how string indexing works in Python, define the string “Hello Python” on the command line:

>>>s = “Hello Python”

This is how Python would index the string:

-12	-11	-10	-9	-8	-6	-6	-5	-4	-3	-2	-1
H	e	l	l	o		P	y	t	h	o	n
0	1	2	3	4	5	6	7	8	9	10	11

To access the first character on the string you just created, type and enter the variable name s and the index 0 within square brackets like this:

>>>s[0]

You’ll get this output:

‘H’

Accessing the first character is easy because you know that its index number is zero. You do not have this advantage when you want to access the last character on the string.

To access the last character, you can use this expression:

>>>s[len(s)-1]

You’ll get the output:

‘n’

The expression introduces you to the *len* function. There is actually an easier way to access the last item on the string:

>>>s[-1]

‘n’

To access the penultimate character:

>>>s[-2]

‘o’

Besides indexing, you can use other functions and mathematical operators on a string.

Concatenating Strings

Strings can be added together with plus (+) operator. To concatenate the string “Hello Python”:

>>> “Hello” + “Python”

‘HelloPython’

Repeating Strings

You can easily repeat strings or its concatenation with the * operator. For example:

Entering “**^**” * 5 will yield:

‘**^****^****^****^****^**’

You'll get the same result with this:

```
>>>s = "**^**"
>>>s * 5
'**^****^****^****^****^**'
```

Getting the Size of Strings

You can get the size of a string with the len() function. For example, to get the size of the string "World":

```
>>>len("World")
5
```

Slicing Strings

You can create substrings with the slicing notation. You can do this by placing two indices (separated by a colon) within square brackets. The first index marks the start of the substring while the second index indicates the index number of the first character you don't want to include in the substring.

For example:

```
>>>"Program"[3:5]
```

will result in:

'gr'

```
>>>"Program"[3:6]
```

will yield:

‘gra’

Another way of doing this is by storing “Program” to a variable and manipulating the variable to produce the desired result:

>>>p = “Program”

>>>p [3:6]

‘gra’

If you want the substring to start from a character to the end of the original string, you can just omit the second index. For example:

>>>p = “Program”

>>>p [4:]

‘ram’

Conversely, if you want your substring to start from the first character of the original string, you can omit the first index and write the last index to be included on the substring. For example:

>>>p = “Program”

>>>p [:4]

‘Prog’

The lower() and upper() function

If you have a string like “Grand River” and you have decided that you need your data to be all in lower case, you can use the lower() function to print the string in lower case.

Example:

```
>>>c = “Grand River”
>>>print (c.lower())
grand river
```

Supposing you need you string to be all capitalized, you can invoke the *upper()* function to print the string in uppercase.

Example:

```
>>>print (c.upper())
GRAND RIVER
```

The str() method

The *str()* function makes strings out of non-strings character. This allows programmers to print non-string characters as if they are string characters. This is very handy when you want, for instance, to print an integer along with strings.

Example:

```
>>>pi =3.1416
>>>str(pi)
‘3.1416’

>>>print(“This my favorite number: ” + str(pi))
This my favorite number: 3.1416
```

Numbers

Numeric Data Types

One of the many conveniences of using Python is that you don't really have to declare a numeric value to distinguish its type. Python can readily tell one data type from another when you write and run your statement. It has four built-in numeric data types. Python 3 supports three types: integer, floating-point numbers, and complex numbers. Long integers ('long') no longer form a separate group of integers but are included in the 'int' or integer category.

1. Integer (int)

Integers are whole numbers without decimal point. They can be positive or negative as long as they don't contain a decimal point that would make a number a floating number, a distinct numeric type. Integers have unlimited size in Python 3.

The following numbers and literals are recognized by Python:

Regular integers

Examples: 793, -254, 4

Octal literals (base 8)

To indicate an octal number, you will use the prefix 0o or 0O (zero followed by either a lowercase or uppercase letter 'o').

Example:

```
>>>a = 0O7
```

```
>>>print(a)
7
```

Hexadecimal literals (base 16)

To indicate hexadecimal literals, you will use the prefix ‘0X’ or ‘0x” (zero and uppercase or lowercase letter ‘x’).

Example:

```
>>>hex_lit = 0xA0C
>>>print(hex_lit)
2572
```

Binary literals (base 2)

To signify binary literals, you’ll use the prefix ‘0B’ or ‘0b’ (zero and uppercase or lowercase ‘b’).

Example:

```
>>> c = 0b1100
>>> print(c)
12
```

Converting Integers to their String Representation

Earlier, you have seen how the print command converted literals to their equivalent in integers. Python makes it possible for you to work the other way around by converting

integers to their literal representation. To convert an integer into its string representation, you can use the functions *hex()*, *bin()*, and *oct()*.

Examples:

To convert the integer 7 to its octal literal, type and enter oct(7) on the command prompt. You'll get the output '0o7':

```
>>>oct(7)
'0o7'
```

Here is what happens when you convert the integer 2572 to a hexadecimal literal:

```
>>>hex(2572)
'0xa0c'
```

Finally, see what happens when you use the bin() function to convert the integer 12 to its binary string:

```
>>>bin(12)
'0b1100'
```

You can store the result to a variable by defining a variable with the hex(), bin(), and oct() functions:

For example:

```
>>>x = hex(2572)
>>>x
'0xa0c'
```

To see the object type created and stored in the variable x, you can use and enter the command type():

```
>>>type(x)
```

You should get this result:

```
<class 'str'>
```

2. Floating-point numbers

Also known as floats, floating-point numbers signify real numbers. Floats are written with a decimal point that segregates the integer from the fractional numbers. They may also be written in scientific notation where the uppercase or lowercase letter 'e' signifies the 10^{th} power:

```
>>>6.2e3
6200.0

>>>6.2e2
620
```

3. Complex numbers

Complex numbers are pairs of real and imaginary numbers. They take the form 'a + bJ' where 'a' is a float and the real part of the complex number. On the other side is bJ where 'b' is a float and J or its lowercase indicates the square root of an imaginary number, -1. This makes 'b' the imaginary part of the complex number.

Here are examples of complex numbers at work:

```
>>>a = 2 + 5j
```

```
>>>b = 4 – 2j
>>>c = a + b
>>>print(c)
(6 + 3j)
```

Complex numbers are not extensively used in Python programming.

Conversion of Number Type

You can expect Python to convert expressions with mixed types of numbers to a common type to facilitate evaluation. In some situations, however, you may have to convert one number type to another explicitly, like when the conversion is required by a function parameter. You can type the following expressions to convert a number to another type:

To convert x to a float: >>>float(x)

Example:

```
>>>float(12)
12.0
```

To convert x to a plain integer: int(x)

```
>>>int(12)
12
```

To convert x to a complex number: type complex(x)

```
>>>complex(12)
```

(12+0j)

Date and Time

Most applications require date and time information to make it work efficiently and effectively. In Python, you can use the function datetime.now() to retrieve the current date and time. The command datetime.now() calls on a built-in Python code which gives the current date and time.

To get the date and time from Python, encode the following on the command prompt:

```
>>> from datetime import datetime
>>> datetime.now()
datetime.datetime(2016, 3, 10, 2, 16, 19, 962429)
```

The date and time in this format is almost unintelligible and you might want to get a result that is more readable. One way to do this is by using ‘strftime’ from Python’s standard library.

Try entering these commands and see if you’ll get the format you like.

```
>>>from time import strftime
>>> strftime(“%Y-%m-%d %H:%M:%S”)
‘2016-03-10 02:20:03’
```

Boolean Data Type

Comparisons in Python can only generate one of two possible responses: True or False. These data types are called booleans.

To illustrate, you can create several variables to store Boolean values and print the result:

```
bool_1 = 4 == 2*3
bool_2 = 10 < 2 * 2**3
bool_3 = 8 > 2 * 4 + 1
print(bool_1)
print(bool_2)
print(bool_3)
```

The Python Shell will display these results:

```
False
True
False
```

Lists

A list is a data type that can be used to store any type and number of variables and information.

You can define and assign items to a list with the expression:

```
my_list = [item_1, item_2, item_3]
```

Python also allows creation of an empty list:

```
my_list = []
```

To illustrate, let’s create a list of colors:

colors = [“red”, “orange”, “yellow”, “green”, “indigo”, “white”]

Since this is an indexed list, the first item on colors has zero as its index.

To access the first item on the list, you can print the color with the command:

```
>>> print(colors[0])
red
```

To print the color name of the third color on the list, you can enter:

```
>>> print(colors[4])
indigo
```

To see how many colors are on the list, you can use the len() function:

```
>>> len(colors)
6
```

There are only six colors on your list but you want to have all seven colors of the rainbow in your list. To see what colors are on the list, you can use the print to see what color might be missing:

```
>>> print(colors)
[‘red’, ‘orange’, ‘yellow’, ‘green’, ‘indigo’, ‘white’]
```

It appears that the colors list doesn’t just lack one color name. It also has one member that should not have been included – ‘white’. To remove ‘white’ from the list, you can use the remove() method:

```
>>> colors.remove(“white”)
```

You can view the updated list with the print command:

>>> print(colors)

[‘red’, ‘orange’, ‘yellow’, ‘green’, ‘indigo’]

The list is still short of 2 colors – violet and blue.

To add violet to your colors list, you can use the append command:

>>> colors.append(“violet”)

Let’s check out the updated list with the print command:

>>> print(colors)

[‘red’, ‘orange’, ‘yellow’, ‘green’, ‘indigo’, ‘violet’]

The color ‘violet’ was added to the end of the list. Now, you only need to add one more color - blue. Let’s say you want to have ‘blue’ inserted between ‘green’ and ‘indigo’.

You can use Python’s insert()method with the syntax:

list.insert(index, obj)

The parameters are index and object. Index refers to the position where you want the new item to be located. The object is the item you want to insert.

Applying the syntax to the above example, you’ll have the command:

>>> colors.insert(4, “blue”)

To see the new list:

>>> print(colors)

[‘red’, ‘orange’, ‘yellow’, ‘green’, ‘blue’, ‘indigo’, ‘violet’]

Slicing lists

You can also slice lists in the same way that you slice strings.

For example, if you only want to display the colors ‘green’, ‘blue’, and ‘indigo’, with index of 3, 4, 5 respectively, you can use this command:

>>> colors[3:6]

[‘green’, ‘blue’, ‘indigo’]

Dictionary

A dictionary is like a list but instead of looking up an index to access values, you’ll be using a unique key, which can be a number, string, or tuple. Dictionary values can be anything but the keys must be an immutable data type. A colon separates a key from its value and all are enclosed in curly braces. Here is the dictionary structure:

d = {key_1 : a, key_2 : 2, key_3 : ab}

An empty dictionary will have this format:

d = {}

A dictionary can be a very useful tool for storing and manipulating key-value pairs such as those used in phone books, directory, menu, or log-in data. You can add, modify, or delete existing entries within the dictionary.

To see how dictionaries actually work, you can create a dictionary named menu with dish and prices pairs:

menu = {“spam” : 12.50, “carbonara” : 20, “salad” : 15 }

To see how many key-value pairs are stored in the dictionary, you can use the len() function:

```
>>>len(menu)
3
```

To print the current entries in the menu dictionary:

```
>>> print(menu)
{‘salad’: 15, ‘carbonara’: 20, ‘spam’: 12.5}
```

To add another entry in the menu dictionary, you can use this format:

```
d[key_4 : b]
```

Applying this structure to the menu dictionary, you can add the dish-price entry of cake : 6 with:

```
menu[“cake”] = 6
```

To see the updated menu, use the print command:

```
>>> print(menu)
{‘spam’: 12.5, ‘cake’: 6, ‘carbonara’: 20, ‘salad’: 15}
```

Assuming you no longer want to include spam in your menu, you can easily do so with the del command:

```
>>> del menu[“spam”]
```

To see the modified list after deleting spam:

{‘cake’: 6, ‘carbonara’: 20, ‘salad’: 15}

You might want to change the values in any of the keys at one point. For instance, you need to change the price of carbonara from 20 to 22. To do that, you’ll just assign a new value to the key with this command:

>>> menu[“carbonara”] = 22

You can use the print command once more to see the updated menu:

>>> print(menu)

{‘cake’: 6, ‘carbonara’: 22, ‘salad’: 15}

If you want to remove all entries in the dictionary, you can use the function

dict.clear()

To clear all entries in the menu:

>>>dict.clear(menu)

Use the print command to see what happened to the menu dictionary:

>>> print(menu)

{}

The Python Shell displayed an empty dictionary with the clear command. Now that it contains no data at all, you might decide to delete the dictionary. You can do so with the del command:

del dict

To delete the menu dictionary:

del menu

To see what happened, use the print command.

```
>>> print(menu)
Traceback (most recent call last):
  File "<pyshell#19>", line 1, in <module>
    print(menu)
NameError: name 'menu' is not defined
```

You got an error message because menu no longer exists.

Chapter 6 Python Basic Operators

Python operators allow programmers to manipulate data or operands. Here are the types of operators supported by Python:

- Arithmetic Operators
- Assignment Operators
- Relational or Comparison Operators
- Logical Operators
- Identity Operators
- Bitwise Operators
- Membership Operators

Arithmetic Operators

Python does a good job of processing mathematical expressions with its basic arithmetic

operators. You can easily make programs to automate tasks such as computing tax, tips, discounts, or rent.

+	Addition	adds the value of the left and right operands
-	Subtraction	subtracts the value of the right operand from the value of the left operand
*	Multiplication	multiplies the value of the left and right operand
/	Division	divides the value of the left operand by the right operand
**	Exponent	performs exponential calculation
%	Modulus	returns the remainder after dividing the left operand with the right operand
//	Floor Division	division of operands where the solution is a quotient left after removing decimal numbers

Addition, subtraction, multiplication, and division are the most basic operators and are invoked by entering the following expressions:

Addition:

```
>>>1 + 3
4
```

Subtraction:

```
>>>10 – 4
6
```

Multiplication:

```
>>>4 * 2
```

8

Division:

>>>10 / 2

5.o

Exponent

Exponential calculation is invoked by raising the first number to the power defined by the number after the ** operator:

>>>2**3 2 raised to the power of 3

8

Modulus

The modulus operator gives the remainder after performing division:

>>>17 % 5

2

Floor Division

Floor division, on the other hand, returns the quotient after removing fractional numbers:

>>>17 // 5

3

Using Basic Operators to Compute Sales Tax, Tip, and Total Bill

To put your knowledge of variables, data types, and operators to good use, you can design a simple program that will compute the sales tax and tip on a restaurant meal.

Meal cost	$65.50
Sales tax rate	6.6%
Tip	20% of meal + tax

First, set up a variable meal to store the food cost:

```
meal = 65.50
```

Next, set up the tax and tip variable. Assign both variables the decimal value of the percentages given. You can do this by using 100 as divisor.

```
tax = 6.6 / 100
tip = 20 / 100
```

Your tip is based on meal cost and the added sales tax so you need to get the total amount of the meal and the sales tax. One way to do this is by simply creating a new variable to store the total cost of the meal and tax. Another way is by reassigning the variable meal so that it stores both values:

```
meal = meal + meal * tax
```

Now that you have reassigned meal to take care of the meal cost and tax, you're ready to compute for the tip. This time, you can set a new variable to store the value of the tip, meal, and tax. You can use the variable total to hold all values:

```
total = meal * tip
```

Here's your code to compute for the total bill amount:

```
meal = 65.50
tax = 6.6 / 100
tip = 20 / 100
meal = meal + meal * tax
total = meal + meal * tip
```

If you're using the file editor in IDLE, you can save the file in a filename of your choice and Python automatically appends the .py extension. As you may have noticed, the file editor will always prompt you to save your file before it does anything about your code. Just like when naming other data files and types, you should use a filename that's descriptive of the file. In this case, a filename like BillCalculator should do the trick.

To get the total amount, go to the Python Shell and type total:

```
>>>total
83.78760000000001
```

Now you have the bill amount: 83.78760000000001

If you're using the line command window, you can simply enter the above code on a per line basis.

This simple program shows how straightforward Python programming is and how useful it could be in automating tasks. Next time you eat out, you can reuse the program by simply changing the figures on your bill calculator. Think forward and visualize how convenient it could be if you could put your code in a bigger program that will simply ask you to input the bill amount instead of accessing the original code. You can do that with Python.

Assignment Operators

These operators are useful when assigning values to variables:

Operators	Function

=	assigns the value of the right operand to the left operand
+= add and	adds the value of the right and left operand and assigns the total to the left operand
-= subtract and	deducts the value of the right operand from the value of the left operand and assigns the new value to the left operand
*= multiply and	multiplies the left and right operand and assigns the product to the left operand
/= divide and	divides the left operand with the value of the right operand and assigns the quotient to the left operand
**= exponent	performs exponential operation on the left operand and assigns the result to the left operand
//= floor division and	performs floor division on the left operand and assigns the result to the left operand

= Operator

You have seen this operator at work in previous chapters when you have assigned different values to variables. Examples:

a = c

a = b + c

a = 8

a = 8 + 6

s = “I love Python.”

+= add and

The ‘add and’ (+=) operator is simply another way to express x = x + a so that you’ll end up with the statement x += a.

-= subtract and

The ‘subtract and’ (-=) operator is equivalent to the expression x = x – a and is expressed with the statement x-=a

***= multiply and**

The ‘multiply and’ (*=) operator is the equivalent of the statement x = x * a and is expressed with x*=a.

/= divide and

The ‘divide and’ (/=) operator is like saying x = x/a and is expressed with the statement x/=a.

%= modulus and

The ‘modulus and’ (%=) operator is another way to say x = x % a where you’ll end up instead with the expression x%=a.

//= floor division and

The ‘floor division and’ is equivalent to the expression x = x//a and takes the form x//=a.

Relational or Comparison Operators

Relational operators evaluate values on the left and right side of the operator and return the relation as either True or False.

Here are the relational operators in Python:

Operator	Meaning
==	is equal to
<	is less than
>	is greater than
<=	is less than or equal to
>=	is greater than or equal to
!=	is not equal to

Examples:

```
>>> 8 == 6+2
True

>>> 6 != 6
False

>>> -1 > 0
False

>>> 7 >= 5
True
```

Logical Operators

Python supports 3 logical operators:

or

and

not

x or y	If the first argument, x, is false, then it evaluates the second argument, y. Else, it evaluates x.
x and y	If x is false, then it evaluates x. Else, if x is true, it evaluates y.
not x	If x is false, then it returns True. If x is true, it returns False.

Examples:

```
>>> (8>9) and (2<9)
False

>>> (2>1) and (2>9)
False

>>> (2==2) or (9<20)
True

>>> (3!=3) or (9>20)
False


>>> not (8 > 2)
False

>>> not (2 > 10)
True
```

Precedence of Python Operators

Python operators are evaluated according to a set order or priority:

	Description	Operators
1	Exponentiation	**
2	Ccomplement, unary plus, and minus	~, +, -
3	Multiplication, division, modulo, and floor division	*, /, %, //
4	addition and subtraction	+ -
5	Right and left bitwise shift	>>, <<
6	Bitwise ‘AND’	&
7	Regular `OR’ and Bitwise exclusive ‘OR’	|, ^
8	Comparison operators	<= < > >=
9	Equality operators	== !=
10	Assignment operators	=, +=, -=, *-, /=, %= //= **=
11	Identity operators	is, is not
12	Membership operators	in, not in
13	Logical operators	or, and, not

Chapter 7 Python's Built-in Functions

Functions provide efficiency and structure to a programming language. Python has many useful built-in functions to make programming easier, faster, and more powerful.

The input() Function

Programs usually require input that can come from different sources: keyboard, mouse clicks, database, another computer's storage, or the internet. Since the keyboard is the most common way to gather input, Python provided its users the input() function. This function has an optional parameter called the prompt string.

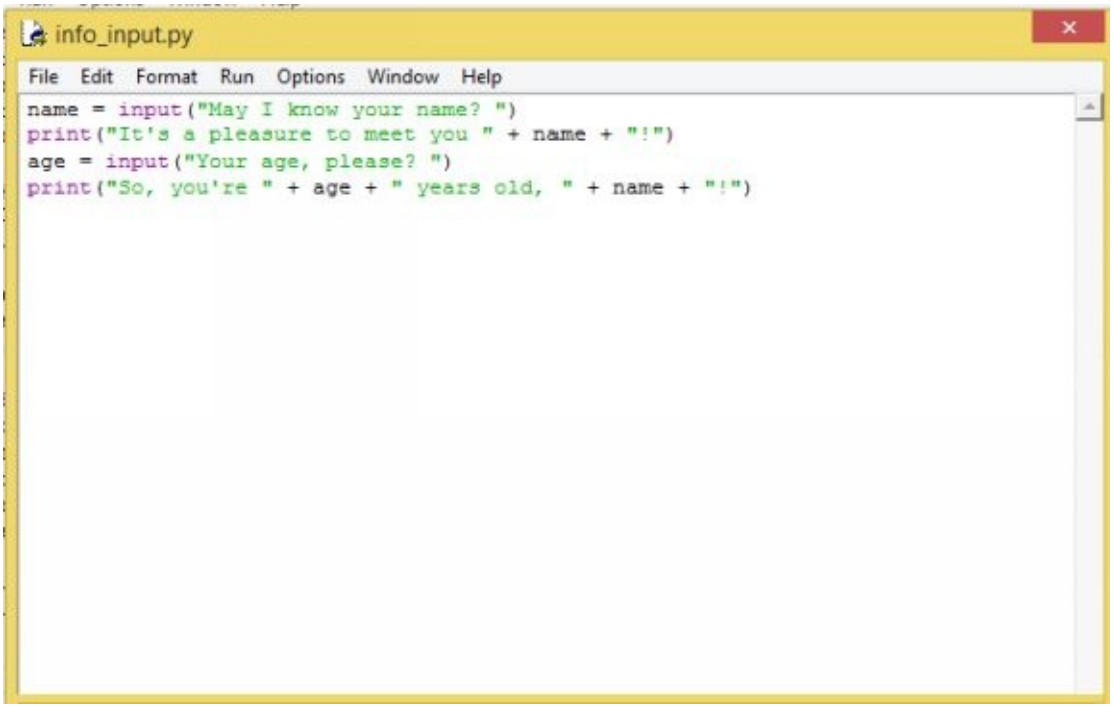
Once the input function is called, the prompt string will be displayed on the screen and the program flow stops until the user has entered an input. The input is then interpreted and the input() function returns the user's input as a string.

To illustrate, here is a sample program that collects keyboard input for name and age:

```
name = input("May I know your name? ")
print("It's a pleasure to meet you " + name + "!")
age = input("Your age, please? ")
print("So, you're " + age + " years old, " + name + "!")
```

Before you save the code, take a close look at the string to be printed on the second line. You'll notice that there is a blank space after 'you' and before the double quote. This space ensures that there will be a space between 'you' and the 'name' input when the print command is executed. The same convention can be seen on the 4th line with the print command where 'you're' is separated by a single space from the 'age' input and 'old' is separated by a space from the 'name' input.

Save the code as info_input.py and run it.



The Python Shell will display the string on the first line:

May I know your name?

A response is needed at this point and the program stops executing until a keyword input is obtained. Let's type and enter the name Jeff to see what happens:

It's a pleasure to meet you Jeff!

Your age, please?

The program has now proceeded to the next input function and is waiting for the keyboard input. Let's enter 22 as Jeff's age and see what the program does next:

So, you're 22 years old, Jeff!

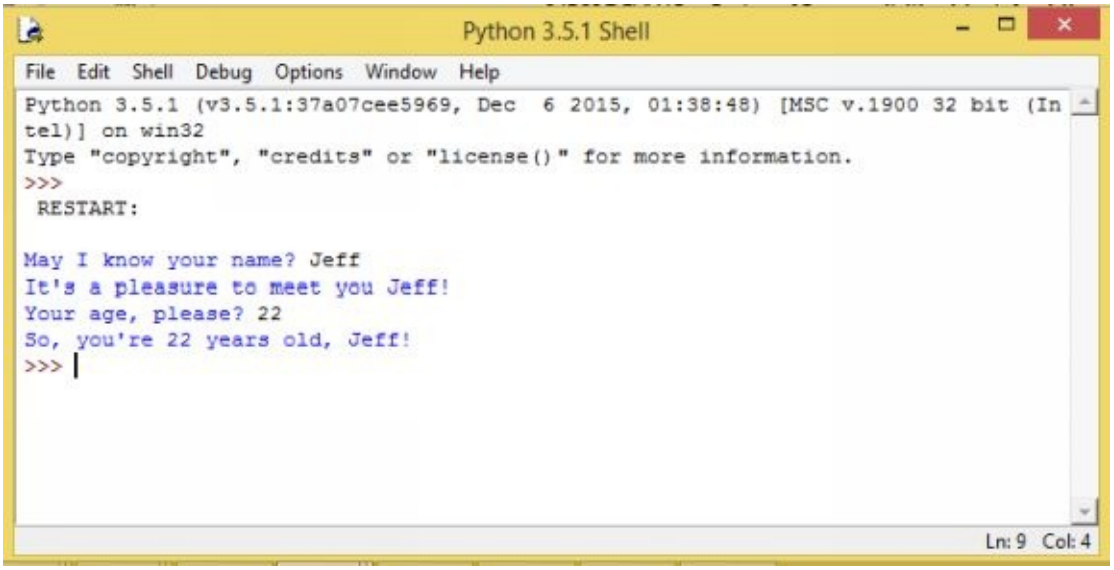
The program printed the last string on the program after a keyboard response was obtained. Here is the entire output on the Python Shell:

May I know your name? Jeff

It's a pleasure to meet you Jeff!

Your age, please? 22

So, you're 22 years old, Jeff!



The range() function

Python has a more efficient way to handle a series of numbers and arithmetic progressions and this is by using one its built-in functions: range(). The range function is particularly useful in 'for loops'.

Here is an example of the *range()* function:

>>> range(5)

range(0, 5)

The expression range(5) above generates an iterator that progresses integers from zero and ends with 4 (5-1). To show the list of numbers, you can use the command list(range(n)):

```
>>>list(range(5))
[0, 1, 2, 3, 4]
```

You can exercise more control over the list output by calling the range() function with two arguments:

range (begin, end)

Example:

```
>>> range(5, 9)
range(5, 9)
```

To show the list:

```
>>> list (range(5, 9))
[5, 6, 7, 8]
```

The above examples of *range()* demonstrated an increment of 1. You can change the way Python increments the number by introducing a third argument, the ‘step’. It can be a negative or positive number, but never zero.

Here is the format:

range(begin, end, step)

Example:

```
>>> range(10, 71, 5)
range(10, 71, 5)
```

Invoking list, we'll see this sequence of numbers:

```
>>> list (range(10, 71, 5))
[10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70]
```

The print() Function

Python 3 turned *print* from a statement into a function. Hence, you must always enclose your print parameters within the round parentheses.

Examples:

```
print("This is Python 3 print function)
print(s)
print(5)
```

The *print()* function can print any number of values within the parentheses; they must be separated by commas. For example:

```
a = 3.14
b = "age"
c = 32

print("a = ", a, b, c)
```

The result:

```
a =  3.14 age 32
```

The Python shell displayed values with blank spaces between them.

abs()

The abs() function returns the absolute value of a single number. It takes an integer or float number as argument and always returns a positive value.

Examples:

```
>>> abs(-10)
10

>>> abs(5)
10
```

When complex numbers are used as argument, the abs() function returns its magnitude:

```
>>> abs(3 + 4j)
5.0
```

max()

The max() function takes two or more arguments and returns the largest one.

Examples:

```
>>> max(9, 12, 6, 15)
15

>>> max(-2, -7, -35, -4)
-2
```

min()

The min() function takes two or more arguments and returns the smallest item.

Examples:

```
>>> min(23, -109, 5, 2)
-109

>>> min(7, 26, 0, 4)
0
```

type()

The type() function returns the data type of the given argument.

Examples:

```
>>> type(“This is a string”)
<class ‘str’>

>>> type(12)
<class ‘int’>

>>> type(2 +3j)
<class ‘complex’>

>>> type(215.65)
<class ‘float’>
```

len()

The len() function returns the length of an object or the number of items in a list given as argument.

Examples:

>>> len(“pneumonoultramicroscopicsilicovolcanoconiosi”)

44

>>> s = (“winter”, “spring”, “summer”, “fall”)

>>> len(s)

4

Here is a list of Phyton’s built-in functions:

abs()	all()	any()
ascii()	bin()	bool()
bytearray()	bytes()	callable()
chr()	classmethod()	compile()
complex()	delattr()	dict()
dir()	divmod()	enumerate()
eval()	exec()	filter()

float()	format()	frozenset()
getattr()	globals()	hasattr()
hash()	help()	hex()
id()	__import__()	input()
int()	isinstance()	issubclass()
iter()	len()	list()
locals()	map()	max()
memoryview()	min()	next()
object()	oct()	open()
ord()	pow()	print()
property()	range()	repr()
reversed()	round()	set()
setattr()	slice()	sorted()
staticmethod()	str()	sum()
super()	tuple()	type()
vars()	zip()	

Chapter 8 Conditional Statements

Conditional statements are common among programming languages and they are used to perform actions or calculations based on whether a condition is evaluated as true or false. If-then-else statements or conditional expressions are essential features of programming languages and they make programs more useful to users.

The if-then-else statement in Python has the following basic structure:

```
if condition1:
    block1_statement
elif condition2:
    block2_statament
else:
    block3_statement
```

This structure will be evaluated as:

If condition1 is True, Python will execute block1_statement. If condition1 is False, condition2 will be executed. If condition2 is evaluated as True, block2_statement will be executed. If condition2 turns out to be False, Python will execute block3_statement.

To illustrate, here is an if-then-else statement built within the function ‘your_choice’:

```
def your_choice(answer):
    if answer > 5:
    print(“You are overaged.”)
    elif answer <= 5 and answer >1:
    print(“Welcome to the Toddler’s Club!”)
    else:
```

```
    print("You are too young for Toddler's Club.")

print(your_choice(6))
print(your_choice(3))
print(your_choice(1))
print(your_choice(0))
```

You will get this output on the Python Shell:

```
You are overaged.
None
Welcome to the Toddler's Club!
None
You are too young for Toddler's Club.
None
You are too young for Toddler's Club.
None
```

Conditional constructs may branch out to multiple 'elif' branches but can only have one 'else' branch at the end. Using the same code block, another elif statement may be inserted to provide for privileged member of the Toddler's club: 2 year-old kids.

```
def your_choice(answer):
    if answer > 5:
        print("You are overaged.")
    elif answer <= 5 and answer >2:
    print("Welcome to the Toddler's Club!")
    elif answer == 2:
    print("Welcome! You are a star member of the Toddler's Club!")
    else:
    print("You are too young for Toddler's Club.")

print(your_choice(6))
```

```
print(your_choice(3))
print(your_choice(1))
print(your_choice(0))
print(your_choice(2))
```

```
You are overaged.
None
Welcome to the Toddler’s Club!
None
You are too young for Toddler’s Club.
None
You are too young for Toddler’s Club.
None
Welcome! You are a star member of the Toddler’s Club!
None
```

Chapter 9 Loops

A loop is a programming construct that enables repetitive processing of a sequence of statements. Python provides two types of loops to its users: the ‘for loop’ and the ‘while loop’. The ‘for’ and ‘while’ loops are iteration statements that allow a block of code (the body of the loop) to be repeated a number of times.

The For Loop

Python implements an iterator-based ‘for loop’. It is a type of ‘for loop’ that iterates over a list of items through an explicit or implicit iterator.

The loop is introduced by the keyword ‘for’ which is followed by a random variable name which will contain the values supplied by the object.

This is the syntax of Python’s ‘for loop’:

```
for variable in list:
    statements
else:
    statements
```

Here is an example of a ‘for loop’ in Python:

```
pizza = [“New York Style Pizza”, “Pan Pizza”, “Thin n Crispy Pizza”, “Stuffed Crust Pizza”]
for choice in pizza:
    if choice == “Pan Pizza”:
    print(“Please pay $16. Thank you!”)
    print(“Delicious, cheesy ” + choice)
```

```
else:
    print(“Cheesy pan pizza is my all-time favorite!”)
print(“Finally, I’m full!”)
```

Run this and you’ll get the following output on Python Shell:

```
Delicious, cheesy New York Style Pizza
Please pay $16. Thank you!
Delicious, cheesy Pan Pizza
Delicious, cheesy Thin n Crispy Pizza
Delicious, cheesy Stuffed Crust Pizza
Cheesy pan pizza is my all-time favorite!
Finally, I’m full!
```

Using a break statement

A Python break statement ends the present loop and instructs the interpreter to starts executing the next statement after the loop. It can be used in both ‘for’ and ‘while’ loops. Besides leading the program to the statement after the loop, a break statement also prevents the execution of the ‘else’ statement.

To illustrate, a break statement may be placed right after the print function of the ‘if statement’:

```
pizza = [“New York Style Pizza”, “Pan Pizza”, “Thin n Crispy Pizza”, “Stuffed Crust Pizza”]
for choice in pizza:
    if choice == “Pan Pizza”:
    print(“Please pay $16. Thank you!”)
    break
    print(“Delicious, cheezy ” + choice)
else:
```

```
    print(“Cheezy pan pizza is my all-time favorite!”)
print(“Finally, I’m full!”)
```

The Python Shell will now show:

```
Delicious, cheezy New York Style Pizza
Please pay $16. Thank you!
Finally, I’m full!
```

Using Continue Statement

The continue statement brings back program control to the start of the loop. You can use it for both ‘for’ and ‘while’ loops.

To illustrate, the continue statement may be placed right after the print function of the ‘for loop’ to replace the break statement:

```
pizza = [“New York Style Pizza”, “Pan Pizza”, “Thin n Crispy Pizza”, “Stuffed Crust Pizza”]
for choice in pizza:
    if choice == “Pan Pizza”:
    print(“Please pay $16. Thank you!”)
    continue
    print(“Delicious, cheesy ” + choice)
else:
    print(“Cheesy pan pizza is my all-time favorite!”)
print(“Finally, I’m full!”)
```

The output will be:

Delicious, cheesy New York Style Pizza

Please pay $16. Thank you!

Delicious, cheesy Thin n Crispy Pizza

Delicious, cheesy Stuffed Crust Pizza

Cheesy pan pizza is my all-time favorite!

Finally, I'm full!

Using the range() Function with the for Loop

The range() function can be combined with the 'for loop' to supply the numbers required by the loop. In the following example, the range(1, x+1) provided the numbers 1 to 50 needed by the 'for loop' to add the sum of 1 until 50:

```
x = 50

total = 0
for number in range(1, x+1):
    total = total + number

print("Sum of 1 until %d: %d" % (x, total))
```

The Python Shell will display:

```
l.py
Sum of 1 until 50: 1275
```

<u>The While Loop</u>

A Python 'while loop' repeatedly carries out a target statement while the condition is true.

The loop iterates as long as the defined condition is true. When it ceases to be true and becomes false, control passes to the first line after the loop.

The ‘while loop’ has the following syntax:

```
while condition
    statement

statement
```

Here is a simple ‘while loop’:

```
counter = 0
while (counter < 10):
    print(‘The count is:’ , counter)
    counter = counter + 1

print(“Done!”)
```

If you run the code, you should see this output:

```
l.py
The count is: 0
The count is: 1
The count is: 2
The count is: 3
The count is: 4
The count is: 5
The count is: 6
The count is: 7
The count is: 8
The count is: 9
Done!
```

Using Pass Statement

The pass statement tells the Python interpreter to ‘do nothing’. The interpreter simply continues with the program’s execution whenever the pass statement is encountered. This attribute makes it a good placeholder whenever Python syntactically requires a line but the program itself does not require action. It can be very useful when you’re creating a program and you need to focus on specific areas of your code, but you still want to reserve some loops or test run the incomplete code.

Here is how you would use a pass statement to fill gaps within a code:

```
def function_name(x):
    pass
```

Chapter 10 User-Defined Functions

A function is a set of statements that perform a specific task, a common structuring element that allows you to use a piece of code repeatedly in different parts of a program. The use of functions improve a program’s clarity and comprehensibility and makes programming more efficient by reducing code duplication and breaking down complex tasks into more manageable pieces. Functions are also known as routines, subroutines, methods, procedures, or subprograms.

They can be passed as arguments, assigned to variables, or stored in collections.

A user-defined Python function is created or defined by the def statement and follows the syntax:

```
def function_name(parameter list):
```

function body/statements

The indented statements make up the body of the function and are executed when the function is called. Once the function is called, parameters inside round brackets become arguments.

Function bodies can have more than one return statement which may be placed anywhere within the function block. Return statements end the function call and return the value of the expression after the return keyword. A return statement with no expression returns the special value ‘None’. In the absence of a return statement within the function body, the end of the function is indicated by the return of the value ‘None’.

The docstring is an optional statement after the function title which explains what the function does. While it is not mandatory, documenting your code with a docstring is a good programming practice.

Here is a simple function that prints I love Pizza!

```
def love_pizza():
    print “I love Pizza!”
```

Here is a function with a parameter and return keyword:

```
def absolute_value(number):

    if number >= 0:
    return number
    else:
    return -number

print(absolute_value(3))
print(absolute_value(-5))
```

In the above example, number is the parameter of the function absolute_value. It acts as a variable name and holds the value of a passed in argument.

Here is the output when the above code is run:

3
5

Following is a function with an if-then-else statement.

```
def shutdown(yn):
    if yn.lower() == “y”:
    return(“Closing files and shutting down”)
    elif yn.lower() == (“n”):
    return(“Shutdown cancelled”)
    else:
    return(“Please check your response.”)

print(shutdown(“y”))
print(shutdown(“n”))
print(shutdown(“x”))
```

Python Shell will display:

Closing files and shutting down
Shutdown cancelled
Please check your response.

Function can take more than one parameter and use them for computations:

```
def calculator(x, y):
    return x * y + 2

print(calculator(2,6))
print(calculator(3,7))
```

Run the code and you'll get the output:

14

23

Functions can call other functions

Functions can perform different types of actions such as do simple calculations and print text. They can also call another function.

For example:

```
def members_total(n):
    return n * 3

def org_total(m):
    return members_total(m) + 5
```

To see what you code does, enter the following print commands:

```
print(org_total(2))
print(org_total(5))
print(org_total(10))
```

You'll get these results:

11

20

35

Scope and lifetime of a local variable

A variable’s scope refers to a program’s sections where it is recognized. Variables and parameters defined within a function have a local scope and are not visible from outside of the function. On the other hand, a variable’s lifetime refers to its period of existence in the memory. Its lifetime coincides with the execution of a function which ends when you return from the function. A variable’s value is discarded once the return is reached and a function won’t be able to recall a variable’s value from its previous value.

Chapter 11 Classes and Object-Oriented Programming

Python is an object-oriented programming language, which means that it manipulates and works with data structures called objects. Objects can be anything that could be named in Python – integers, functions, floats, strings, classes, methods, etc. These objects have equal status in Python. They can be used anywhere an object is required. You can assign them to variables, lists, or dictionaries. They can also be passed as arguments. Every Python object is a class. A class is simply a way of organizing, managing, and creating objects with the same attributes and methods.

In Python, you can define your own classes, inherit from your own defined classes or built-in classes, and instantiate the defined classes.

Class Syntax

To define a class, you can use ‘class’, a reserved keyword, followed by the classname and a colon. By convention, all classes start in uppercase. For example:

```
class Students:
    pass
```

To create a class that takes an object:

```
class Students(object)
```

The __init__() method

Immediately after creating an instance of the class, you have to call the __init__() function. This function initializes the objects it creates. It takes at least the argument ‘self’, a Python convention, which gives identity to the object being created.

Examples:

```
class Students:
    def __init__(self) :
```

```
class Employees(object):
    def __init__(self, name, rate, hours) :
```

A function used in a class is called a method. Hence, the __init__() function is a method when it is used to initialize classes.

Instance Variables

When you add more arguments to the def_init_() besides the self, you'll need to add instance variables so that any instance object of the class will be associated with the instance you create.

For example:

```
class Employees(object):
    def __init__(self, name, rate, hours) :
    name.self = name
    rate.self = rate
    hours.self =hours
```

In the above example, name.self, rate.self, and hours.self are the instance variables.

When you create instances of the class Employees, each member will have access to the variables which were initialized through the __init__ method. To illustrate, you can create or 'instantiate' new members of the class Employees:

```
staff = Employees("Wayne", 20, 8)
```

supervisor = Employees(“Dwight”, 35, 8)

manager = Employees(“Melinda”, 100, 8)

You can then use the print command to see how the instance variables interacted with the members of the class Employees:

print(staff.name, staff.rate, staff.hours)

print(supervisor.name, supervisor.rate, supervisor.hours)

print(manager.name, manager.rate, manager.hours)

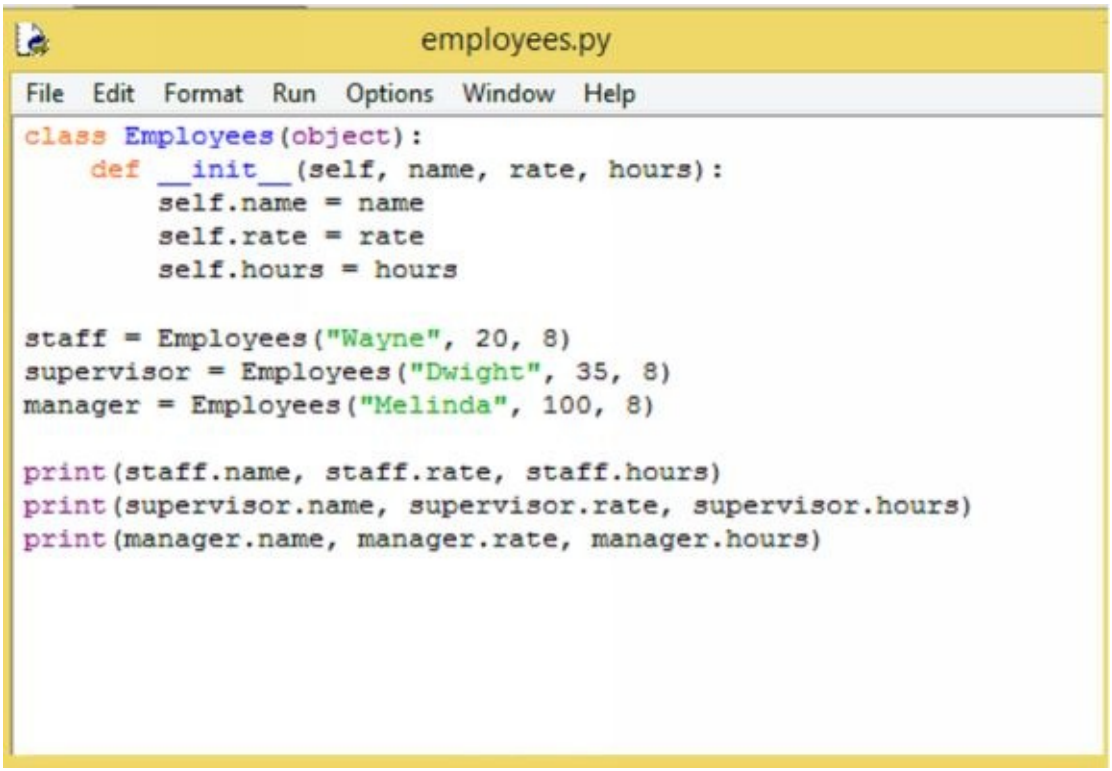
The Python Shell will display this output:

Wayne 20 8

Dwight 35 8

Melinda 100 8

Here is how the entire code was written on the editor/file window:



File window: employees.py

Here’s the output:

Inheritance

Inheritance is a Python process that allows one class to take on the methods and attributes of another. This feature allows users to create more complicated classes that inherit methods or variables from their parent or base classes and makes programming more efficient.

This is the syntax for defining a class that inherits all variables and function from a parent class:

class ChildClass(ParentClass):

To illustrate, you can create a new class, Resigned, that will inherit from the Employees class and take an additional variable, status:

```
class Employees(object):
    def __init__(self, name, rate, hours):
    self.name = name
    self.rate = rate
    self.hours = hours

staff = Employees(“Wayne”, 20, 8)
supervisor = Employees(“Dwight”, 35, 8)
manager = Employees(“Melinda”, 100, 8)

print(staff.name, staff.rate, staff.hours)
print(supervisor.name, supervisor.rate, supervisor.hours)
print(manager.name, manager.rate, manager.hours)

class Resigned(Employees):
    def __init__ (self, name, rate, hours, status):
    self.name = name
    self.rate = rate
    self.hours = hours
    self.status = status

exemp_1 = Resigned(“Dorothy”, 32, 8, “retired”)
exemp_2 = Resigned(“Malcolm”, 48, 8, “resigned”)

print(exemp_1.name, exemp_1.rate, exemp_1.hours, exemp_1.status)
print(exemp_2.name, exemp_2.rate, exemp_2.hours, exemp_2.status)
```

resigned.py

File Edit Format Run Options Window Help

```
class Employees(object):
    def __init__(self, name, rate, hours):
        self.name = name
        self.rate = rate
        self.hours = hours

staff = Employees("Wayne", 20, 8)
supervisor = Employees("Dwight", 35, 8)
manager = Employees("Melinda", 100, 8)

print(staff.name, staff.rate, staff.hours)
print(supervisor.name, supervisor.rate, supervisor.hours)
print(manager.name, manager.rate, manager.hours)

class Resigned(Employees):
    def __init__ (self, name, rate, hours, status):
        self.name = name
        self.rate = rate
        self.hours = hours
        self.status = status

exemp_1 = Resigned("Dorothy", 32, 8, "retired")
exemp_2 = Resigned("Malcolm", 48, 8, "resigned")

print(exemp_1.name, exemp_1.rate, exemp_1.hours, exemp_1.status)
print(exemp_2.name, exemp_2.rate, exemp_2.hours, exemp_2.status)
```

Here is the output on the Python Shell when the code is executed;

Python 3.5.1 Shell

File Edit Shell Debug Options Window Help

```
Python 3.5.1 (v3.5.1:37a07cee5969, Dec  6 2015, 01:38:48) [MSC v.1900 32 bit (Intel)] on win32
Type "copyright", "credits" or "license()" for more information.
>>>
 RESTART: C:/Users/Shawn Michaels/AppData/Local/Programs/Python/Python35-32/resigned.py
Wayne 20 8
Dwight 35 8
Melinda 100 8
Dorothy 32 8 retired
Malcolm 48 8 resigned
>>>
```

Conclusion

Congratulations for finishing this book, I hope it was able to equip you with the essential skills and fundamental knowledge to explore and harness the powerful features of Python as a programming language. By the time you finished reading the book, I am confident that you will be prepared to put your basic programming knowledge to practical everyday uses.

The next step is to take up advanced Python programming courses that will help you create more complex programs such as games, web applications, and productivity tools.

Finally, if you enjoyed this book, please take the time to share your thoughts and post a positive review on Amazon. It'd be greatly appreciated!

Thank you and good luck!