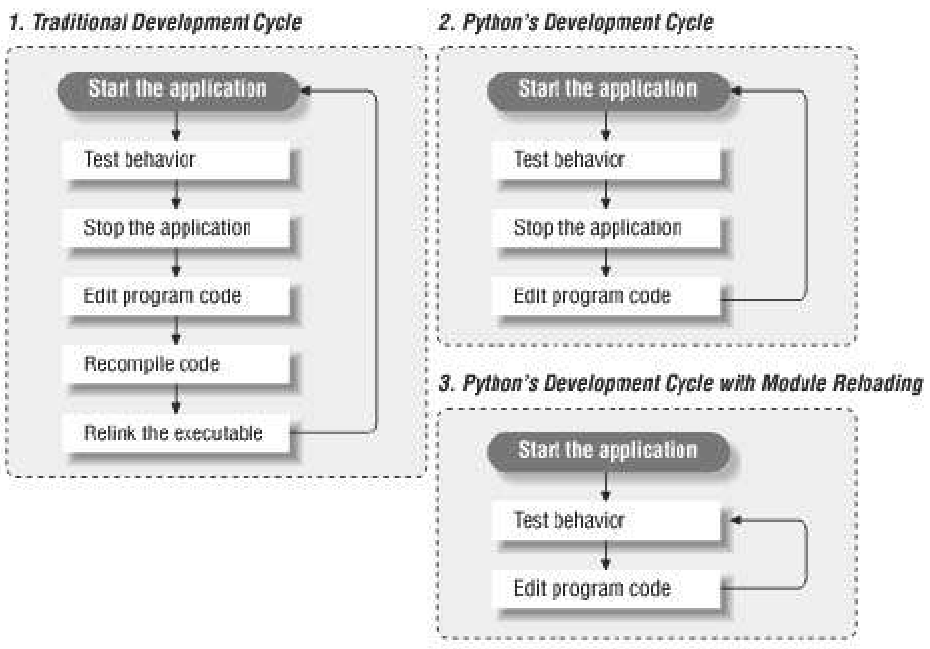
PYTHON NOTES

UNIT 1

The Programming Cycle for Python:

Python's development cycle is dramatically shorter than that of traditional tools. In **Python**, there are no compile or link steps – **Python** programs simply import modules at runtime and use the objects they contain. Because of this, **Python** programs run immediately after changes are made.



Because Python is interpreted, there's a rapid turnaround after program changes. And because Python's parser is embedded in Python-based systems, it's easy to modify programs at runtime. For example, we saw how GUI programs developed with Python allow developers to change the code that handles a button press while the GUI remains active; the effect of the code change may be observed immediately when the button is pressed again. There's no need to stop and rebuild. More generally, the entire development process in Python is an exercise in rapid prototyping. Python lends itself to experimental, interactive program development, and encourages developing systems incrementally by testing components in isolation and putting them together later.

Python IDE:

Python IDE (Integrated Development Environment) understand your code much better than a text editor. It usually provides features such as build automation, code lining, testing and debugging. This can significantly speed up your work. The downside is that IDEs can be complicated to use.

List of some famous python IDE are as follows:

1. PyCharm
2. Jupyter
3. Qt designer
4. Spyder
5. Atom

Python Variables:

Python variables are dynamically typed, it means we do not need to declare the data type of variables.

Syntax,

```
a=5
b=”Hello”
c=4.6
print(a)
print(b)
print(c)
```

output:

```
5
Hello
4.6
```

Multiple assignment:

```
x=y=z=10
print (x)
print (y)
print (z)
```

output:

```
10
10
10
```

Assigning multiple values to multiple variables:

```
a,b,c=5,7,10

print(a)
print(b)
print(c)
```

output:

```
5
```

```
7
10
```

Python Operators:

Arithmetic Operator	Description
+	add eg. 3+6=9
-	subtract eg. 3+1=4
*	Mult, eg. 3*6=18
/	Devide, eg. 15/6=2.5
%	Modular devision, 15%6=3
//	devide, 15//6= 2
**	Power, eg. 2**4=16

Relational Operators

The following table contains the relational operators that are used to check relations.

Operators	Description
<	Less than
>	Greater than
<=	Less than or equal to
>=	Greater than or equal to
==	Equal to

!=	Not equal to
<>	Not equal to(similar to !=)

eg:

```
>>> 10<20
True
>>> 10>20
False
>>> 10<=10
True
>>> 20>=15
True
>>> 5==6
False
>>> 5!=6
True
>>> 10<>2
True
>>>
```

Assignment Operators

The following table contains the assignment operators that are used to assign values to the variables.

Operators	Description
=	Assignment
/=	Divide and Assign
+=	Add and assign
-=	Subtract and Assign

*=	Multiply and assign
%=	Modulus and assign
**=	Exponent and assign
//=	Floor division and assign

Example

```
>>> c=10
print(c)  o/p=> 10
>>> c+=5
>>> print(c) o/p=> 15
>>> c-=5
>>> print(c)  o/p=> 10
>>> c*=2
>>> print(c)  o/p=> 20
>>> c/=2
>>> print(c)  o/p=> 10
>>> c%=3
>>> print(c)  o/p=> 1
>>> c=5
>>> c**=2
>>> print(c)  o/p=>  25
>>> c//=2
>>> print(c)  o/p=>  12
```

Logical Operators

The following table contains the arithmetic operators that are used to perform arithmetic operations.

Operators	Description
And	Logical AND(When both conditions are true output will be true)

Or	Logical OR (If any one condition is true output will be true)
Not	Logical NOT(Compliment the condition i.e., reverse)

Example

```
a=5>4 and 3>2
print(a)
b=5>4 or 3<2
print(b)
c=not(5>4)
print(c)
```

Output:

```
True
True
False
```

Membership Operators

The following table contains the membership operators.

Operators	Description
In	Returns true if a variable is in sequence of another variable, else false.
not in	Returns true if a variable is not in sequence of another variable, else false.

Example

```
a=10
b=20
list=[10,20,30,40,50]
if (a in list):
   print("a is in given list")
else:
    print("a is not in given list")
if(b not in list):
    print("b is not given in list")
else:
    print("b is given in list")
```

Output:

```
a is in given list
b is given in list
```

Identity Operators

The following table contains the identity operators.

Operators	Description
Is	Returns true if identity of two operands are same, else false
is not	Returns true if identity of two operands are not same, else false.

Example

```
a=20
b=20
if( a is b):
    print  a,b have same identity
else:
    print a, b are different
b=10
if( a is not b):
    print  a,b have different identity
else:
    print a,b have same identity
```

Output

```
>>>
a,b have same identity
```

3. a,b have different identity
4. >>>

Input/Output Instruction:

Output instruction:

Print() function is used to print in python

```
        e.g(i).
        print(“Hello”)
        a=5
        print(a)
o/p=>  Hello
            5
            e.g(ii).
            a=5
            b=6.5
            c = “welcome”
            print(a)          o/p=> 5
            print(b)          o/p=> 6.5
            print(c)           o/p=> welcome
```

print(a,b,c)   o/p=> 5 6.5 welcome

print("a=",a,"b=",b,"c=",c)   o/p=> a=5 b= 6.5 c=welcome

input instruction:

input() function is used to take input in python

there are four method to use input function.

e.g.(i)

```
a=input("Enter Name")
print(a)
```

Output:

```
Enter Name  Rahul
Rahul
```

Eg (ii)

```
b=int(input("Enter any no."))
c=b*b
 print(c)
```

Output:

```
Enter any no. 7
```

Eg (iii)

```
 b=float(input("Enter any no."))
c=b*b
 print(c)
```

Output:

```
Enter any no. 4.5
20.25
```

Eg (iiii)

```
 b=eval(input("Enter any no."))
c=b*b
 print(c)
```

Output:

```
Enter any no. 3
9
```

Notes: * in input method, <u>int keyword</u> is used to store only integer value.
*In input method, <u>float keyword</u> is used to store only decimal value.
*In input method, <u>eval keyword</u> is used to store both decimal and integer value.
*If there is not any keyword(as int or float or eval) then by default it will take input as string.

Python Comments

Python supports two types of comments:

1) Single lined comment:

In case user wants to specify a single line comment, then comment must start with #

Eg:

```
# This is single line comment.
```

2) Multi lined Comment:

Multi lined comment can be given inside triple quotes.

eg:

```
""" This
   Is
   Multipline comment"""
```

eg:

```
#single line comment
print "Hello Python"
"""This is
multiline comment"""
```

Python Keywords

Python Keywords are special reserved words which convey a special meaning to the compiler/interpreter. Each keyword have a special meaning and a specific operation. These keywords can't be used as variable. Following is the List of Python Keywords.

True	False	None	And	As
Asset	Def	class	continue	break
Else	Finally	elif	Del	except
Global	For	if	From	import
Raise	Try	or	return	pass
Nonlocal	In	not	Is	lambda

Identifiers

Identifiers are the names given to the fundamental building blocks in a program.

These can be variables ,class ,object ,functions , lists , dictionaries etc.

There are certain rules defined for naming i.e., Identifiers.

I. An identifier is a long sequence of characters and numbers.

II.No special character except underscore (_) can be used as an identifier.

III.Keyword should not be used as an identifier name.

IV.Python is case sensitive. So using case is significant.

V.First character of an identifier can be character, underscore (_) but not digit.

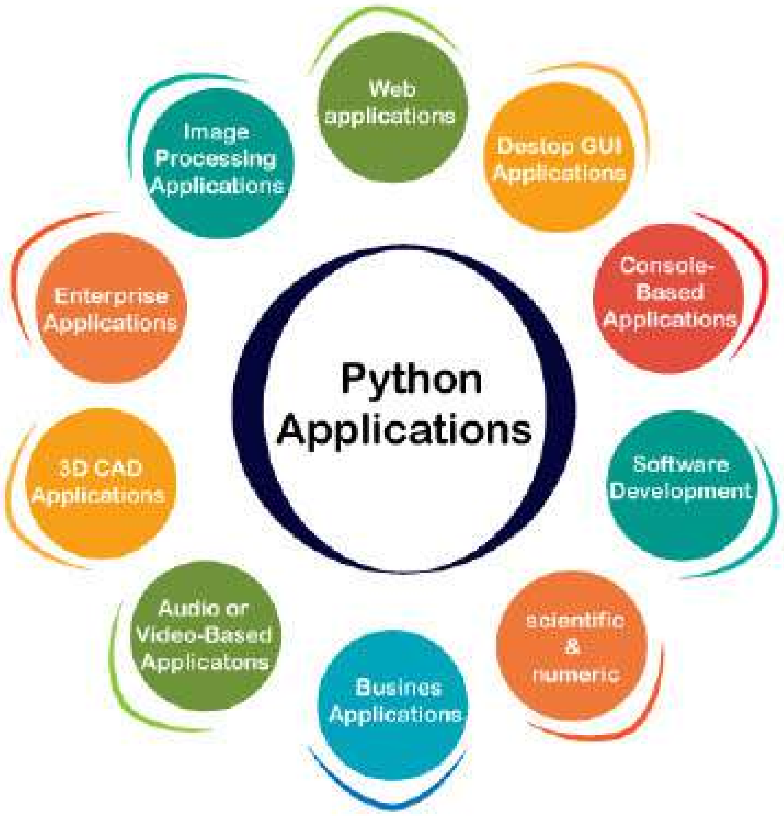
python

Python is a general-purpose, interpreted, interactive, object-oriented, and high-level programming language. Created by **Guido van Rossum**during 1985- 1990, and first released in 1991.

"Python is general purpose programming language that also works nicely as a scripting language."

It is used for:

- web development (server-side)
- software development
- system scripting
- handle database and big data
- complex mathematics
- rapid prototyping



Characteristics of Python Programming:

- It supports functional and structured programming methods as well as OOP.
- It can be used as a scripting language or can be compiled to byte-code for building large applications.
- It provides very high-level dynamic data types and supports dynamic type checking.
- It supports automatic garbage collection.
- It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

Python Syntax compared to other programming languages:

- Python was designed for readability, and has some similarities to the English language with influence from mathematics.
- Python uses new lines to complete a command, as opposed to other programming languages which often use semicolons or parentheses.
- Python relies on indentation, using whitespace, to define scope; such as the scope of loops, functions and classes. Other programming languages often use curly-brackets for this purpose.

Python Features

1) Easy to Learn and Use

Python is easy to learn as compared to other programming languages. Its syntax is straightforward and much the same as the English language. There is no use of the semicolon or curly-bracket, the indentation defines the code block.

2) Expressive Language

Python can perform complex tasks using a few lines of code. A simple example, the hello world program you simply type **print("Hello World")**. It will take only one line to execute, while Java or C takes multiple lines.

3) Interpreted Language

Python is an interpreted language; it means the Python program is executed one line at a time. The advantage of being interpreted language, it makes debugging easy and portable.

4) Cross-platform Language

Python can run equally on different platforms such as Windows, Linux, UNIX, and Macintosh, etc. So, we can say that Python is a portable language. It enables programmers to develop the software for several competing platforms by writing a program only once.

5) Free and Open Source

Python is freely available for everyone. It is freely available on its official website ***www.python.org.*** It has a large community across the world that is dedicatedly working towards make new python modules and functions. Anyone can contribute to the Python community. The open-source means, "Anyone can download its source code without paying."

6) Object-Oriented Language

Python supports object-oriented language and concepts of classes and objects come into existence. It supports inheritance, polymorphism, and encapsulation, etc.

7) Extensible

It implies that other languages such as C/C++ can be used to compile the code and thus it can be used further in our Python code. It converts the program into byte code, and any platform can use that byte code.

8) Large Standard Library

It provides a vast range of libraries for the various fields such as machine learning, web developer, and also for the scripting. There are various machine learning libraries, such as Tensor flow, Pandas, Numpy, Keras, and Pytorch, etc. Django, flask, pyramids are the popular framework for Python web development.

9) GUI Programming Support

Graphical User Interface is used for the developing Desktop application. PyQT5, Tkinter, Kivy are the libraries which are used for developing the web application.

10) Integrated

It can be easily integrated with languages like C, C++, and JAVA, etc. Python runs code line by line like C,C++ Java. It makes easy to debug the code.

11) Embeddable

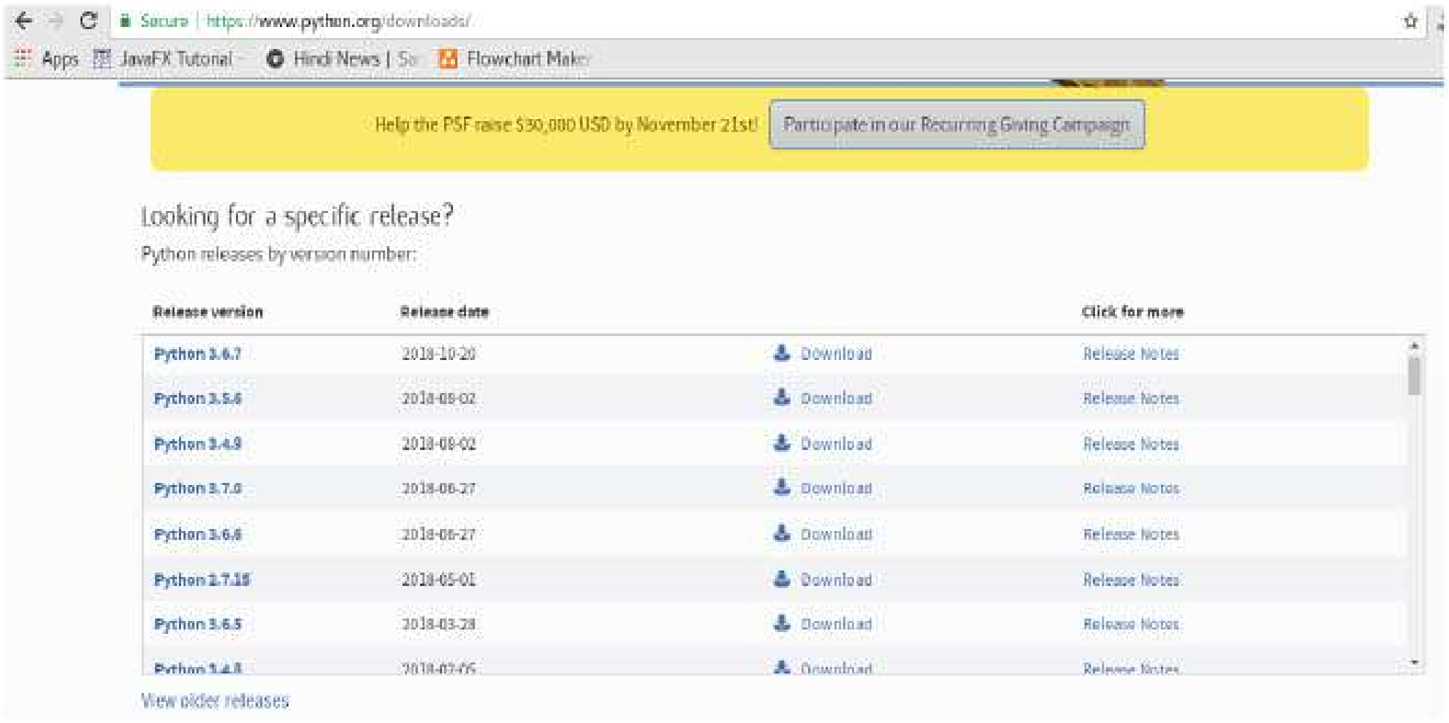
The code of the other programming language can use in the Python source code. We can use Python source code in another programming language as well. It can embed other language into our code.

12) Dynamic Memory Allocation

In Python, we don't need to specify the data-type of the variable. When we assign some value to the variable, it automatically allocates the memory to the variable at run time. Suppose we are assigned integer value 15 to **x**, then we don't need to write **int x = 15.** Just write x = 15.

Installation on Windows

1. Visit the link *https://www.python.org/downloads/* to download the latest release of Python.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Python releases by version number:

Release version	Release date		Click for more
Python 3.6.7	2018-10-20	Download	Release Notes
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Python 3.4.9	2018-08-02	Download	Release Notes
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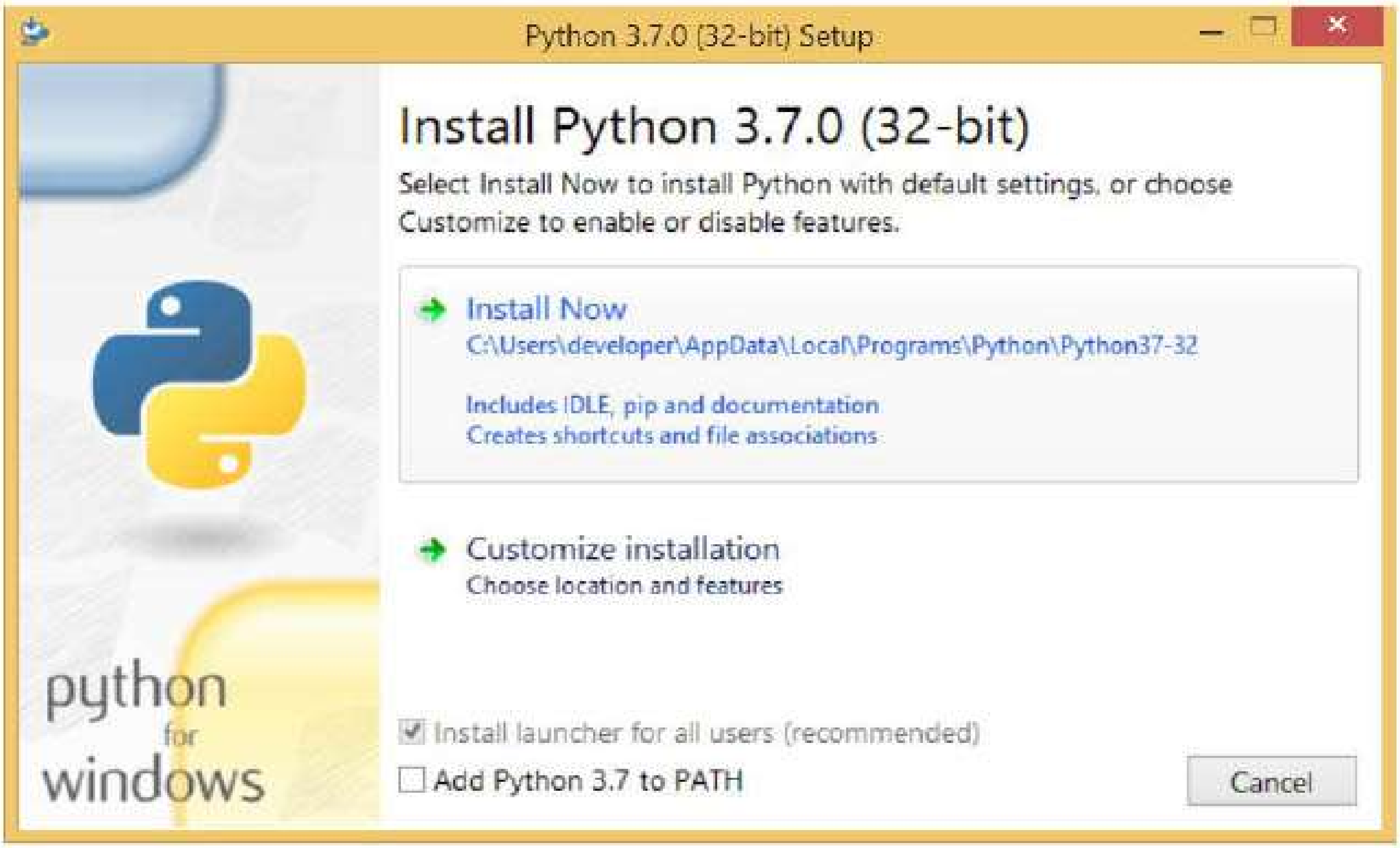
Python 2.7.15	2018-05-01	Download	Release Notes
Python 3.6.5	2018-03-28	Download	Release Notes
Python 3.4.8	2018-02-05	Download	Release Notes

2. Double-click the executable file, which is downloaded; the following window will open.


Python 3.7.0 (32-bit) Setup

Install Python 3.7.0 (32-bit)

Select Install Now to install Python with default settings, or choose Customize to enable or disable features.

→ Install Now
C:\Users\developer\AppData\Local\Programs\Python\Python37-32

Includes IDLE, pip and documentation
Creates shortcuts and file associations

→ Customize installation
Choose location and features

[✓] Install launcher for all users (recommended)
[ ] Add Python 3.7 to PATH

Cancel

Do not forget to check on "Add python to PATH", otherwise you have to set the path manually.

3. To check if you have python installed on a Windows PC, search in the start bar for Python **or** run the following on the Command Line (cmd.exe):

```
C:\Users\Dir Name>python --version
```

4. Python is an interpreted programming language, this means that as a developer you write Python (.py) files in a text editor and then put those files into the python interpreter to be executed.

   Let's write our first Python file, called helloworld.py, which can be done in any text editor.

   helloworld.py

```
print("Hello, World!")
```

   The way to run a python file ("helloworld.py") on the command line is simple as that: Save your file -> Open your command line -> navigate to the directory where you saved your file -> and run:

```
C:\Users\Dir Name>python helloworld.py
```

Python Command Line

To test a short amount of code in python sometimes it is quickest and easiest not to write the code in a file. This is made possible because Python can be run as a command line itself.

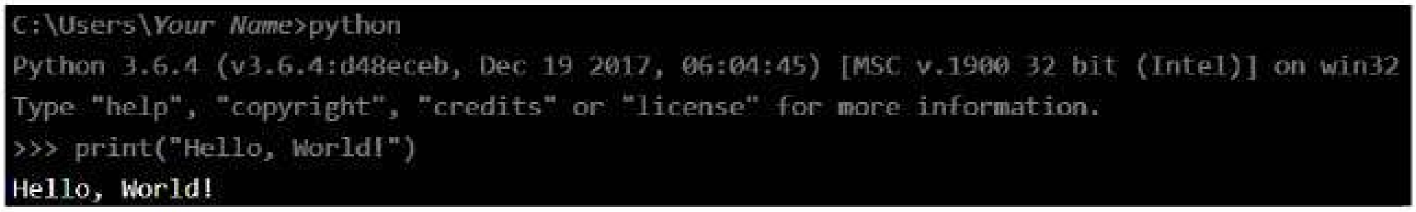
Type the following on the Windows, Mac or Linux command line:

```
C:\Users\Dir Name>python
```

Or, if the "python" command did not work, you can try "py":

```
C:\Users\Dir Name>py
```

From there you can write any python code-



```
C:\Users\Your Name>python
Python 3.6.4 (v3.6.4:d48eceb, Dec 19 2017, 06:04:45) [MSC v.1900 32 bit (Intel)] on win32
Type "help", "copyright", "credits" or "license" for more information.
>>> print("Hello, World!")
Hello, World!
```

Running the program using IDLE

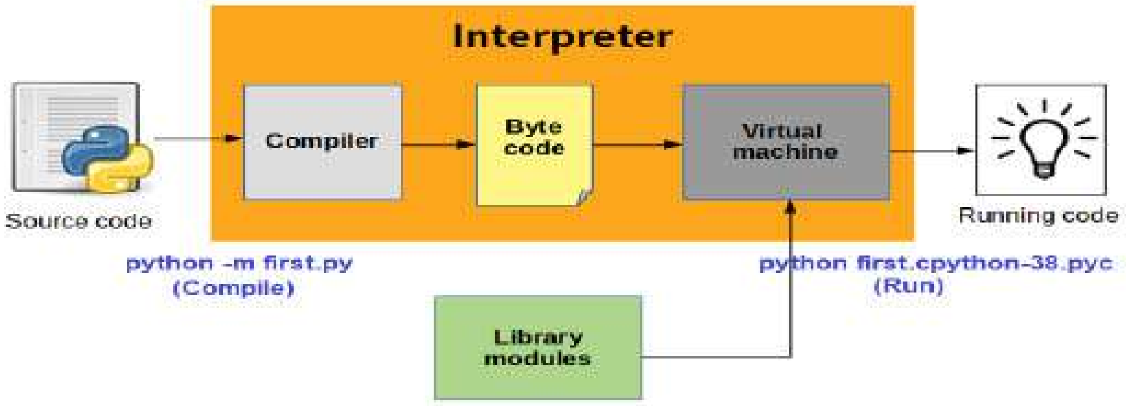
- IDLE is Python's Integrated Development and Learning Environment. It has two main window types, the **Shell window** and the **Editor window**. It is possible to have multiple editor windows simultaneously.
- From start menu you can open IDLE **shell window**. You can again type in print("hello!") and so forth, and the shell will do the printing. As you can see, it's interactive. Python responds to every line of code you enter.
- Opening up a new window (from "File->New File" option) will create a **script file**in editor window. Here, print("hello!") does not immediately produce output. That is because this is a script file editing window, which means the commands won't execute until the file is saved and run.
- You can run the script by going "Run --> Run Module" or simply by hitting F5 (on some systems, Fn + F5).
- Before running, IDLE prompts you to save the script as a file. Choose a name ending in .py ("hello.py") and save it.
- The script will then run in the IDLE shell window. Since you now have a saved script, you can run it again (and again, and again...).
- You can also open IDLE directly from your Python script file. Right click the file, then choose "Edit with IDLE".
- Rather than going through the "Run..." menu, learn to use F5 (on some systems, Fn + F5) to run your script. It's much quicker.

Python | Compiled or Interpreted?

In various books of python programming, it is mentioned that python language is interpreted. But that is half correct the python program is first compiled and then interpreted.

The compilation part is hidden from the programmer. The compilation part is done first when we execute our code and this will generate byte code and internally this byte code gets converted by the python virtual machine(p.v.m) according to the underlying platform(machine+operating system).

The compiled part is get deleted by the python(as soon as you execute your code) just it does not want programmers to get into complexity.

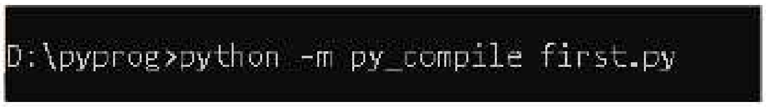


To manually check the compilation process-

first.py

```
print("i am learning python")
print("i am enjoying it")
```

Let, “first.py”isin a folder named “pyprog” in D drive. Then compile using following-

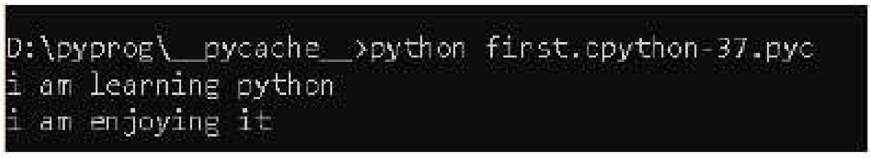


```
D:\pyprog>python -m py_compile first.py
```

Or we can only write: *“python -m first.py”*

as you press enter the byte code will get generated. A folder created and this will contain the byte code of your program.

Now to run the compiled byte code just type the following command:



```
D:\pyprog\__pycache__>python first.cpython-37.pyc
i am learning python
i am enjoying it
```

the extension .pyc is python compiler.
Use -38.pyc (in place of -37.pyc) if python version is 3.8.

Python Syntax

Python provides us the two ways to run a program:

- Using Interactive interpreter prompt
- Using a script file

i) Interactive Mode Programming:

Invoking the interpreter without passing a script file as a parameter brings up the following prompt –

```
$ python
Python2.4.3(#1,Nov112010,13:34:43)
[GCC 4.1.220080704(RedHat4.1.2-48)] on linux2
Type"help","copyright","credits"or"license"for more information.
>>>
```

Type the following text at the Python prompt and press the Enter –

```
>>>print ("Hello, Python!")
```

```
//we have used print() function to print the message on the console.
```

ii) Script Mode Programming

Invoking the interpreter with a script parameter begins execution of the script and continues until the script is finished. When the script is finished, the interpreter is no longer active.

Let us write a simple Python program in a script. Python files have extension .py. Type the following source code in a "test.py" file –

```
print ("Hello, Python!")
```

Now, try to run this program as follows –

```
$ python test.py
```

Python Indentation:

Python uses indentation to indicate a block of code.

```
if True:
   print ("True")
else:
   print ("False")
```

```
O/P: True
```

The number of spaces in the indentation is variable (but it has to be at least one), All statements within the block must be indented the same amount. For example –

```
if True:
   print ("True")
   print("yes")
else:
       print ("False")
       print("no")
```

```
O/P: True
     yes
```

However, the following block generates an error –

```
if True:
print ("True")
else:
print ("False")
```

```
ERROR: "expected an indented block"
```

You have to use the same number of spaces in the same block of code, otherwise Python will give you an error:

```
if 5 > 2:
   print("Five is greater than two!")
        print("Five is greater than two!")
```

```
ERROR: "unexpected indent"
```

```
if 5 > 2:
   print("Five is greater than two!")
print("Five is greater than two!")
```

```
O/P: Five is greater than two!
Five is greater than two!
```

Comments in Python:

Comments start with a #, and Python will render the rest of the line as a comment:

EX:

```
#This is a comment.
print("Hello, World!")
```

triple-quoted string is also ignored by Python interpreter and can be used as a multiline comment:

```
'''
This is a multiline
comment.
'''
```

Multi-Line Statements:

Statements in Python typically end with a new line. But python allow the use of line continuation character (\) to denote that the line should continue. For example –

```
total = item_one + \
item_two + \
item_three
```

Statements contained within the [], {}, or () brackets do not need to use the line continuation character. For example –

```
days = ['Monday', 'Tuesday', 'Wednesday',
        'Thursday', 'Friday']
```

Multiple Statements on a Single Line:

The semicolon (;) allows multiple statements on the single line given that neither statement starts a new code block. Here is a sample snip using the semicolon –

```
import sys; x ='foo';sys.stdout.write(x +'\n')
```

Multiple Statement Groups as Suites:

A group of individual statements, which make a single code block are called suites in Python. Compound or complex statements, such as if, while, def, and class require a header line and a suite.

Header lines begin the statement (with the keyword) and terminate with a colon (:) and are followed by one or more lines which make up the suite. For example –

```
if expression :
   suite
elifexpression :
   suite
else :
   suite
```

Quotation in Python:

Python accepts single ('), double (") and triple (''' or """) quotes to denote string literals, as long as the same type of quote starts and ends the string.

The triple quotes are used to span the string across multiple lines. For example, all the following are legal –

```
word = 'word'

sentence = "This is a sentence."

paragraph = """This is a paragraph. It is

made up of multiple lines and sentences."""
```

Python Identifiers:

A Python identifier is a name used to identify a variable, function, class, module or other object. An identifier starts with a letter A to Z or a to z or an underscore (_) followed by zero or more letters, underscores and digits (0 to 9).

Python does not allow punctuation characters such as @, $, and % within identifiers. Python is a case sensitive programming language.

Here are naming conventions for Python identifiers –

- Class names start with an uppercase letter. All other identifiers start with a lowercase letter.
- Starting an identifier with a single leading underscore indicates that the identifier is private.
- Starting an identifier with two leading underscores indicates a strongly private identifier.
- If the identifier also ends with two trailing underscores, the identifier is a language-defined special name.

Reserved Words:

The following list shows the Python keywords. These are reserved words and you cannot use them as constant or variable or any other identifier names. All the Python keywords contain lowercase letters only.

And	exec	not
Assert	finally	or
Break	for	pass
Class	from	print
Continue	global	raise
Def	if	return
Del	import	try
Elif	in	while
Else	is	with
Except	lambda	yield

print() Function:

The ***print()*** function prints the specified message to the screen, or other standard output device.The message can be a string, or any other object, the object will be converted into a string before written to the screen.

Syntax:

```
print(object(s), sep=separator, end=end, file=file, flush=flush)
```

- **object(s)-** Any object, and as many as you like. Will be converted to string before printed
- **sep-** Optional. Specify how to separate the objects, if there is more than one. Default is ' '
- **end-** Optional. Specify what to print at the end. Default is '\n' (line feed)
- **file-** Optional. An object with a write method. Default is sys.stdout
- **flush-** Optional. A Boolean, specifying if the output is flushed (True) or buffered (False). Defaultis False.

EX:

```
print("Hello", "how are you?")               #Hello how are you?
print("Hello", "how are you?", sep="---")    #Hello---how are you?
x = ("apple", "banana", "cherry")
print(x)                                     #('apple', 'banana', 'cherry')
```

```
a = 5
print("a =", a)                              # a = 5
# print("a ="+ a)                            # ERROR
print("a ="+ str(a))                         # a =5
b = a
print('a =', a, '= b')                  # a = 5 = b
```

```
a = 5
print("a =", a, sep='00000', end='\n\n\n')
print("a =", a, sep='0', end='')

O/P: a =000005


     a =05
```

If you don’t want characters prefaced by \ to be interpreted as special characters, you can use *raw strings* by adding an ***r* before the first quote:

```
print('C:\some\name')              # C:\some
                                   ame
print(r'C:\some\name')        # C:\some\name
```

Python Variables:

Python variables do not need explicit declaration to reserve memory space.

Variables do not need to be declared with any particular type and can even change type after they have been set.

String variables can be declared either by using single or double quotes

```
counter =100# An integer assignment
miles   =1000.0# A floating point
name    ="John"# A string
```

```
x = 4           # x is of type int
x = "Sally"     # x is now of type str
print(x)
```

Example

```
#Legal variable names:
myvar = "John"
my_var = "John"
 _my_var = "John"
myVar = "John"
 MYVAR = "John"
 myvar2 = "John"

#Illegal variable names:
 2myvar = "John"
 my-var = "John"
 my var = "John"
```

Python allows you to assign values to multiple variables in one line:

<u>Ex</u>: `x, y, z = "Abc", 20, "Xyz"`

<u>Ex</u>: `x = y = z = "India"`

To combine both text and a variable, Python uses the '+' character:

<u>Ex</u>:
```
x = "Easy"
print("Python is " , x)
```

<u>Ex</u>:
```
x = "Python is "
y = "easy"
z =  x + y
```

For numbers, the + character works as a mathematical operator.

If you try to combine a string and a number, Python will give you an error:

```
Ex:    x = 5
       y = "John"
       print(x + y)      # ERROR
```

Global Variables:

Variables that are created outside of a function (as in all of the examples above) are known as global variables. Global variables can be used by everyone, both inside of functions and outside.

```
Ex:    x = "easy"

       def myfunc():
          print("Python is " , x)

       myfunc()
```

If you create a variable with the same name inside a function, this variable will be local, and can only be used inside the function. The global variable with the same name will remain as it was, global and with the original value.

```
Ex:    x = "easy"

       def myfunc():
          x = "programming language"
          print("Python is " , x)

       myfunc()

       print("Python is " , x)
```

```
O/P:  Python is programming language
      Python is easy
```

The "global" keyword:

Normally, when you create a variable inside a function, that variable is local, and can only be used inside that function.

To create a global variable inside a function, you can use the *"global"* keyword.

```
Ex:  def myfunc():
     global x
     x = "easy"

     myfunc()

     print("Python is " , x)
```

Also, use the **global** keyword if you want to change a global variable inside a function.

```
Ex:  x = "easy"

     def myfunc():
       global x
      x = "programming language"

     myfunc()

     print("Python is " , x)
```

```
O/P: Python is programming language
```

Data Types in Python

Python has the following data types built-in by default, in these categories:

Text Type:	Str
Numeric Types:	int, float, complex
Sequence Types:	list, tuple, range
Mapping Type:	Dict (Dictionary)
Set Types:	set, frozenset
Boolean Type:	Bool
Binary Types:	bytes, bytearray, memoryview

You can get the data type of any object by using the **type()** function:

```
x = 5
print(type(x))

O/P: <class 'int'>
```

```
x = “5”
 print(type(x))
O/P: <class 'str'>
```

```
x = 2.5
print(x)
print(type(x))
O/P:2.5
      <class 'float'>
```

```
x = b"Hello"
print(x)
print(type(x))

O/P:b'Hello'
      <class 'bytes'>
```

In Python, the data type is set when you assign a value to a variable

Example	Data Type
`x = "Hello World"`	str
`x = 20`	int
`x = 20.5`	float
`x = 1j`	complex
`x = ["apple", "banana", "cherry"]`	list
`x = ("apple", "banana", "cherry")`	tuple
`x = range(6)`	range
`x = {"name" : "John", "age" : 36}`	dict
`x = {"apple", "banana", "cherry"}`	set
`x = frozenset({"apple", "banana", "cherry"})`	frozenset
`x = True`	bool
`x = b"Hello"`	bytes
`x = bytearray(5)`	bytearray
`x = memoryview(bytes(5))`	memoryview

If you want to specify the data type, you can use the following constructor functions

Example	Data Type
`x = str("Hello World")`	str
`x = int(20)`	int
`x = float(20.5)`	float
`x = complex(1j)`	complex
`x = list(("apple", "banana", "cherry"))`	list
`x = tuple(("apple", "banana", "cherry"))`	tuple
`x = range(6)`	range
`x = dict(name="John", age=36)`	dict
`x = set(("apple", "banana", "cherry"))`	set
`x = frozenset(("apple", "banana", "cherry"))`	frozenset
`x = bool(5)`	bool
`x = bytes(5)`	bytes
`x = bytearray(5)`	bytearray
`x = memoryview(bytes(5))`	memoryview

Python Numbers:

There are three numeric types in Python:

1. **Int** - Integer value can be any length such as integers 10, 2, 29, -20, -150 etc. Python has no restriction on the length of an integer. Its value belongs to **int**

2. **Float** - Float is used to store floating-point numbers like 1.9, 9.902, 15.2, etc. It is accurate upto 15 decimal points.

3. **complex** - A complex number contains an ordered pair, i.e., x + iy where x and y denote the real and imaginary parts, respectively. The complex numbers like 2.14j, 2.0 + 2.3j, etc.

Ex.

```
x = 1       # int
y = 2.8     # float
z = 1j      # complex
```

Python provides the **type() function to know the data-type of the variable. Similarly, the **isinstance()** function is used to check an object belongs to a particular class.

```
a = 5
print("The type of a", type(a))

b = 40.5
print("The type of b", type(b))

c = 1+3j
print("The type of c", type(c))
print(" c is a complex number", isinstance(1+3j,complex))

O/P:The type of a <class 'int'>
     The type of b <class 'float'>
     The type of c <class 'complex'>
     Cis a complex number True
```

** Float can also be scientific numbers with an "e" to indicate the power of 10.

```
x = 35e3
y = 12E4
z = -87.7e100

print(x)            # 35000.0
print(y)            # 120000.0
print(z)            # -8.77e+101
```

** Complex numbers are written with a "j or J" as the imaginary part.

```
x = 3+5j
y = 5j
z = -5j

print(x)            #(3+5j)
print(type(x))  #<class 'complex'>
print(y)            #5j
print(type(y))  #<class 'complex'>
print(z)            #(-0-5j)
print(type(z))  #<class 'complex'>
```

You can convert from one type to another with the **int(), float(),and **complex()** methods:

```
x = 1      # int
y = 2.8    # float
z = 1j     # complex

#convert from int to float:
a = float(x)

#convert from float to int:
b = int(y)

#convert from int to complex:
c = complex(x)

#convert from float to complex:
d = complex(y)

print(a)                  # 1.0
print(b)                  # 2
print(c)                  # (1+0j)
print(d)                  # (2.8+0j)

print(type(a))        # <class 'float'>
print(type(b))        # <class 'int'>
print(type(c))        # <class 'complex'>
print(type(d))        # <class 'complex'>
```

```
d=int(z)   #TypeError: can't convert complex to int
d=float(z)# TypeError: can't convert complex to float
```

Random Number:

Python has a built-in module called **random** that can be used to make random numbers.

random module functions depend on function random(), which generates the float number between **0.0** and **1.0**

```
import random
print(random.random())              # Generate number between 0 and 1
print(random.randrange(1, 10))      # Generate number between 1 and 10
print(type(random.random()))        # <class 'float'>
print(type(random.randrange(1,10))) # <class 'int'>
```

The random module has a set of methods, below is list of some commonly used methods

Method	Description
randrange()	Returns a random number between the given range
randint()	Returns a random number between the given range
choice()	Returns a random element from the given sequence
choices()	Returns a list with a random selection from the given sequence
shuffle()	Takes a sequence and returns the sequence in a random order
sample()	Returns a given sample of a sequence
random()	Returns a random float number between 0.0 and 1.0
uniform()	Returns a random float number between two given parameters
seed()	Initialize the random number generator
getstate()	Returns the current internal state of the random number generator
setstate()	Restores the internal state of the random number generator
getrandbits()	Returns a number representing the random bits
triangular()	Returns a random float number between two given parameters, you can also set a mode parameter to specify the midpoint between the two other parameters

random.randrange(*start*, *stop*, *step*)

start- Optional. An integer specifying at which position to start. Default 0

stop- Required. An integer specifying at which position to end.

step- Optional. An integer specifying the incrementation. Default 1

random.getrandbits(n)

This method returns an integer formed with bit binary sequence. If n is 2, then it can generate 0, 1, 2 or 3.

random.sample(*sequence*, *k*)

This method returns a list with a randomly selection of a specified number of items (k) from a sequnce.

random.triangular(*low*, *high*, *mode*)

This method returns a random floating number between the two specified numbers (both included), but you can also specify a third parameter, the mode parameter.

The ***mode*** parameter gives you the opportunity to weigh the possible outcome closer to one of the other two parameter values.

Ex:

```
import random

print(random.choice([50, 41, 84, 40, 31]))  # print from (50,41,84,40,31)
print(random.getrandbits(3))                 # Print value b/w (0-7)
print(random.randrange(100, 500, 5)) # Print value b/w (100-500),
                                          value will be multiple of 5.
mylist = ["apple", "banana", "cherry"]
random.shuffle(mylist)
print(mylist)                        #Print apple,banana,cherry in any order
print(random.sample(mylist, k=2))    #Print any 2 from apple,banana,cherry
```

Python Casting:

Casting in python is therefore done using constructor functions:

- **int()** - constructs an integer number from an integer literal, a float literal (by rounding down to the previous whole number), or a string literal (providing the string represents a whole number)
- **float()** - constructs a float number from an integer literal, a float literal or a string literal (providing the string represents a float or an integer)
- **str()** - constructs a string from a wide variety of data types, including strings, integer literals and float literals

Ex:

```
x = int(1)          # x will be 1
y = int(2.8)        # y will be 2
z = int("3")        # z will be 3

a = float(1)        # a will be 1.0
b = float(2.8)      # b will be 2.8
c = float("3")      # c will be 3.0
d = float("4.2")    # d will be 4.2

p = str("s1")       # p will be 's1'
q = str(2)          # q will be '2'
r = str(3.0)        # r will be '3.0'
```

Python Booleans:

Boolean type provides two built-in values, *True* and *False*. It denotes by the class bool. When you compare two values, the expression is evaluated and Python returns the Boolean answer.

```
print(10 > 9)          # True
  print(10 == 9)       # False
  print(10 < 9)        # False
```

```
  a = 200
  b = 33

  if b > a:
      print("b is greater than a")
  else:
      print("b is not greater than a")

O/P:b is not greater than a
```

Most Values are True:

- Almost any value is evaluated to True if it has some sort of content.
- Any string is *True*, except empty strings.
- Any number is True, except 0.
- Any list, tuple, set, and dictionary are True, except empty ones.

**** bool() function allows you to evaluate any value, and return *True* or *False*.**

```
  bool("abc")     # True

  bool(123)       # True

  bool(["apple", "cherry", "banana"])   # True
```

Some Values are False:

In fact, there are not many values that evaluates to *False,* except:

- empty values, such as (), [], {}, "",
- the number 0, and the value None.

- And the value False evaluates to False.

```
bool(False)      # False
bool(None)       # False
bool(0)               # False
bool("")              # False
bool(())              # False
bool([])              # False
bool({})              # False
```

Object References:

What is actually happening when you make a variable assignment? This is an important question in Python, because the answer differs somewhat from what you'd find in many other programming languages.

Python is a highly object-oriented language. In fact, virtually every item of data in a Python program is an object of a specific type or class.

Consider this code:

```
>>>print(300)
300
```

When presented with the statement print(300), the interpreter does the following:

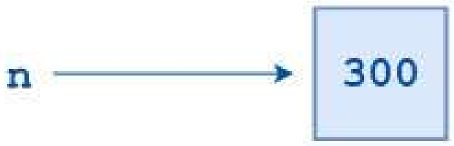
- Creates an integer object
- Gives it the value 300
- Displays it to the console

A Python variable is a symbolic name that is a reference or pointer to an object. Once an object is assigned to a variable, you can refer to the object by that name. But the data itself is still contained within the object.

For example:

```
>>>n=300
```

This assignment creates an integer object with the value 300 and assigns the variable n to point to that object.

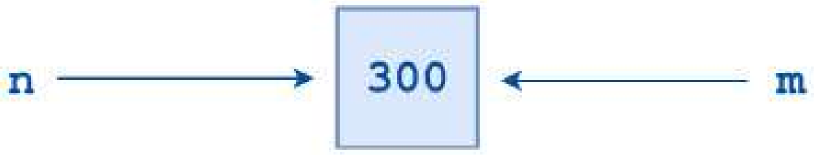


(Variable Assignment)

Now consider the following statement:

```
>>>m=n
```

What happens when it is executed? Python does not create another object. It simply creates a new symbolic name or reference, m, which points to the same object that n points to.

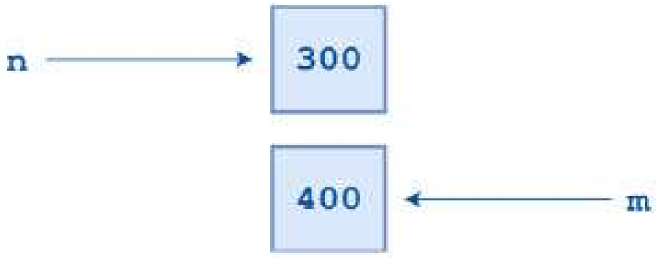


(Multiple References to a Single Object)

Next, suppose you do this:

```
>>>m=400
```

Now Python creates a new integer object with the value 400, and m becomes a reference to it.

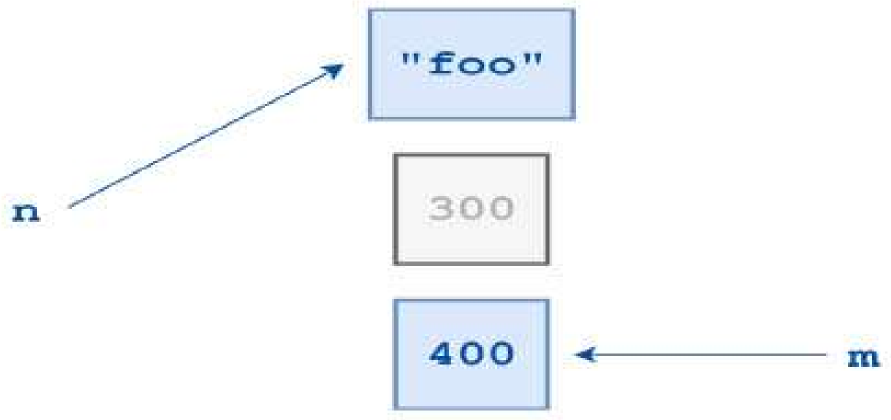


(References to Separate Objects)

Lastly, suppose this statement is executed next:

```
>>>n="foo"
```

Now Python creates a string object with the value "foo" and makes n reference that.There is no longer any reference to the integer object 300. It is orphaned, and there is no way to access it.



(Orphaned Object)

Object Identity:

In Python, every object that is created is given a number that uniquely identifies it. It is guaranteed that no two objects will have the same identifier during any period in which their lifetimes overlap. Once an object's reference count drops to zero and it is garbage collected, as happened to the 300 object above, then its identifying number becomes available and may be used again.

The built-in Python function id() returns an object's integer identifier. Using the id() function, you can verify that two variables indeed point to the same object:

```
>>>n=300
>>>m=n
>>>id(n)
60127840
>>>id(m)
60127840

>>>m=400
>>>id(m)
60127872
```

Ex:

```
a = 3
b = 3
c = a
print(a)            # 3
print(b)            # 3
print(c)            # 3
print(id(a))        # 1360242640
print(id(b))        # 1360242640
print(id(c))        # 1360242640
a=4
print(a)            # 4
print(b)            # 3
print(c)            # 3
print(id(a))        # 1360242656
print(id(b))        # 1360242640
print(id(c))        # 1360242640
```

==

User Input

Python provides two built-in methods to read the data from the keyboard. These methods are given below.

- input(prompt)
- raw_input(prompt)

input():

The input function is used in all latest version of the Python. It takes the input from the user. The Python interpreter automatically identifies whether a user input a string, a number, or a list.

```
name = input("Enter your name: ")
print(name)
```

How input() function works?

- The flow of the program has stopped until the user enters the input.
- The text statement which also knows as prompt is optional to write in **input()** function. This prompt will display the message on the console.
- The **input()** function automatically converts the user input into string. We need to explicitly convert the input using the type casting.
- The **raw_input()** function is used in Python's older version like Python 2.x.

```
name = raw_input("Enter your name : ")
print name
```

** By default, the **input()** function takes input as a string so if we need to enter the integer or float type input then the **input()** function must be type casted.

```
name = input("Enter your name: ")                       # String Input
age = int(input("Enter your age: "))              # Integer Input
marks = float(input("Enter your marks: "))        # Float Input
print("The name is:", name)
print("The age is:", age)
print("The marks is:", marks)
```

==