



# Python Programming



# Lesson - 1



python™

# Introduction about Python

- Python is an interpreted, high-level, general-purpose programming language.
- Created by **Guido van Rossum** and first released in 1991.





# Introduction about Python

- Python is an easy to learn, powerful programming language.
- It has efficient **high-level data structures** and a simple but effective approach to object-oriented programming.
- The **Python interpreter** and the extensive standard library are **freely available in source** or binary form for all major platforms from the Python Web site, <https://www.python.org/>, and may be freely distributed.



# Introduction about Python

- The Python interpreter is easily extended with new functions and data types implemented in C or C++ (or other languages callable from C).
- Python is also suitable as an extension language for customizable applications.



# Why python ?

- Easy to Learn and Use
- Interpreted Language
- Cross-platform Language
- Free and Open Source
- Object-Oriented Language
- Large Standard Library
- GUI Programming Support
- Dynamically typed language



# How to install python ?

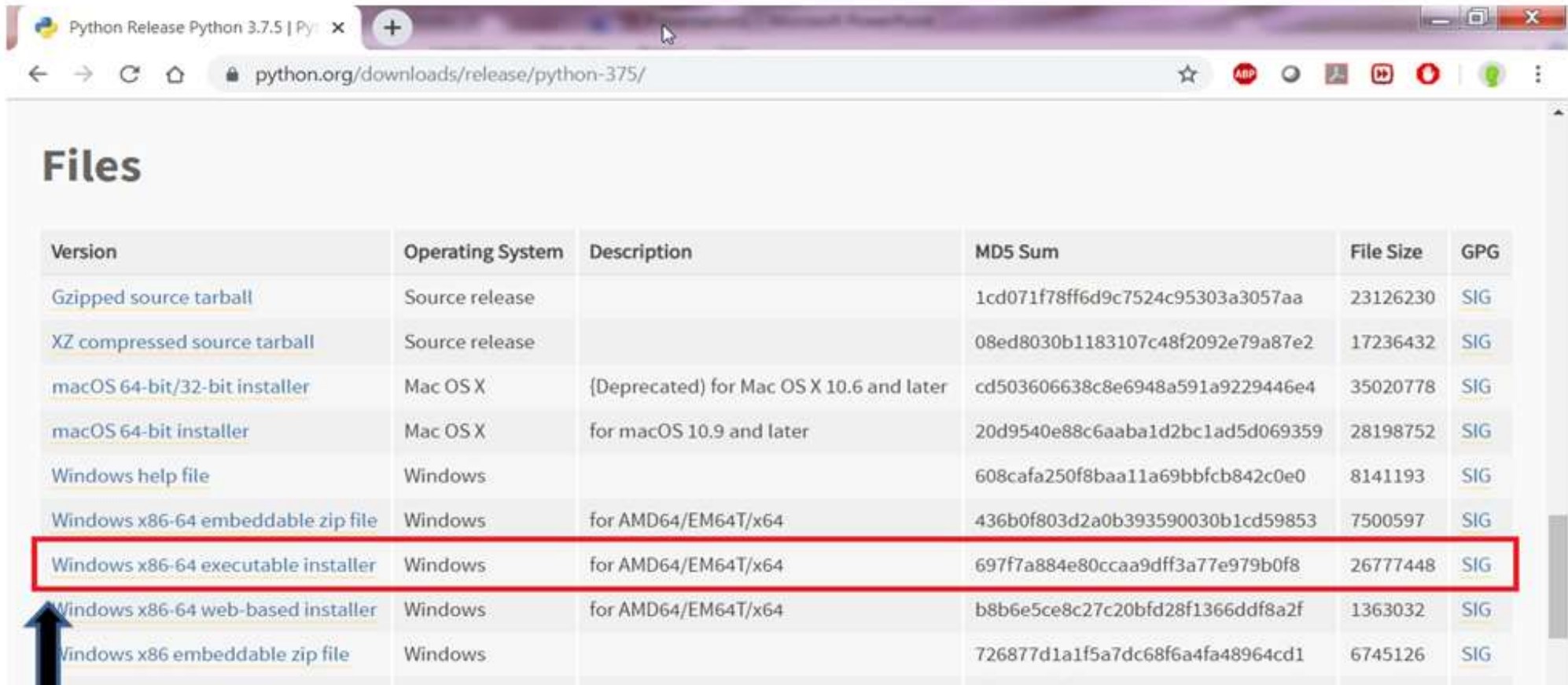
Download and install python

<https://www.python.org/>



Click  
the  
URL

<https://www.python.org/downloads/release/python-375/>



A screenshot of a web browser displaying the Python 3.7.5 download page. The browser's address bar shows the URL 'python.org/downloads/release/python-375/'. The page title is 'Python Release Python 3.7.5 | Py'. The main content area is titled 'Files' and contains a table with download links. The table has six columns: Version, Operating System, Description, MD5 Sum, File Size, and GPG. The row for 'Windows x86-64 executable installer' is highlighted with a red border. An arrow points to this row from the text 'Click the above link' at the bottom left.

Version	Operating System	Description	MD5 Sum	File Size	GPG
<a href="#">Gzipped source tarball</a>	Source release		1cd071f78ff6d9c7524c95303a3057aa	23126230	<a href="#">SIG</a>
<a href="#">XZ compressed source tarball</a>	Source release		08ed8030b1183107c48f2092e79a87e2	17236432	<a href="#">SIG</a>
<a href="#">macOS 64-bit/32-bit installer</a>	Mac OS X	{Deprecated} for Mac OS X 10.6 and later	cd503606638c8e6948a591a9229446e4	35020778	<a href="#">SIG</a>
<a href="#">macOS 64-bit installer</a>	Mac OS X	for macOS 10.9 and later	20d9540e88c6aaba1d2bc1ad5d069359	28198752	<a href="#">SIG</a>
<a href="#">Windows help file</a>	Windows		608cafa250f8baa11a69bbfcb842c0e0	8141193	<a href="#">SIG</a>
<a href="#">Windows x86-64 embeddable zip file</a>	Windows	for AMD64/EM64T/x64	436b0f803d2a0b393590030b1cd59853	7500597	<a href="#">SIG</a>
<a href="#">Windows x86-64 executable installer</a>	Windows	for AMD64/EM64T/x64	697f7a884e80ccaa9dff3a77e979b0f8	26777448	<a href="#">SIG</a>
<a href="#">Windows x86-64 web-based installer</a>	Windows	for AMD64/EM64T/x64	b8b6e5ce8c27c20bfd28f1366ddf8a2f	1363032	<a href="#">SIG</a>
<a href="#">Windows x86 embeddable zip file</a>	Windows		726877d1a1f5a7dc68f6a4fa48964cd1	6745126	<a href="#">SIG</a>

Click the above link



Python Release Python 3.7.5 | Python.org

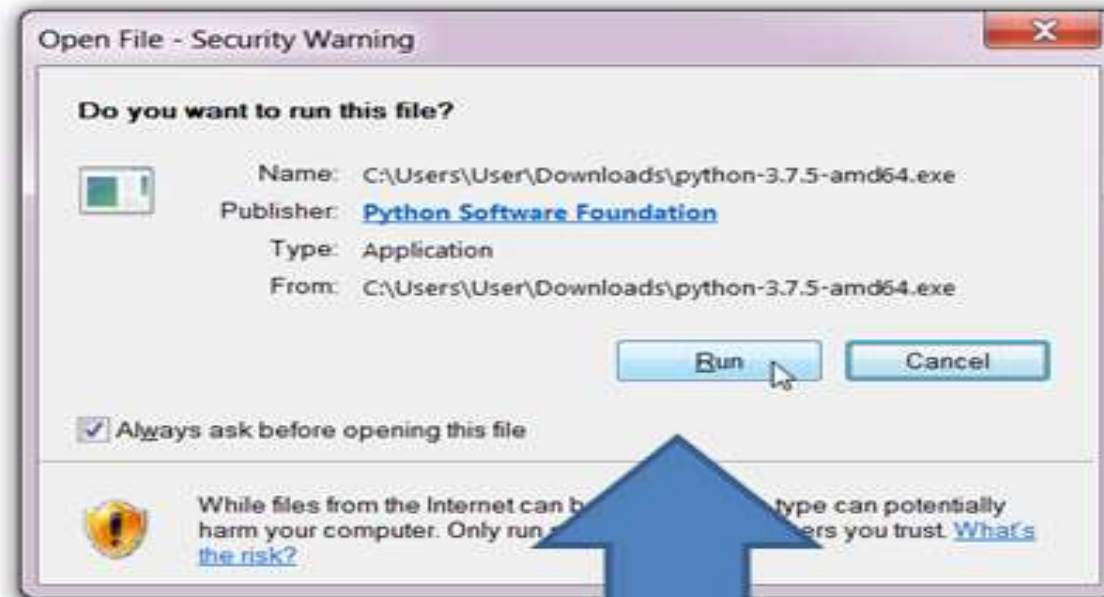
python.org/downloads/release/python-375/

## Files

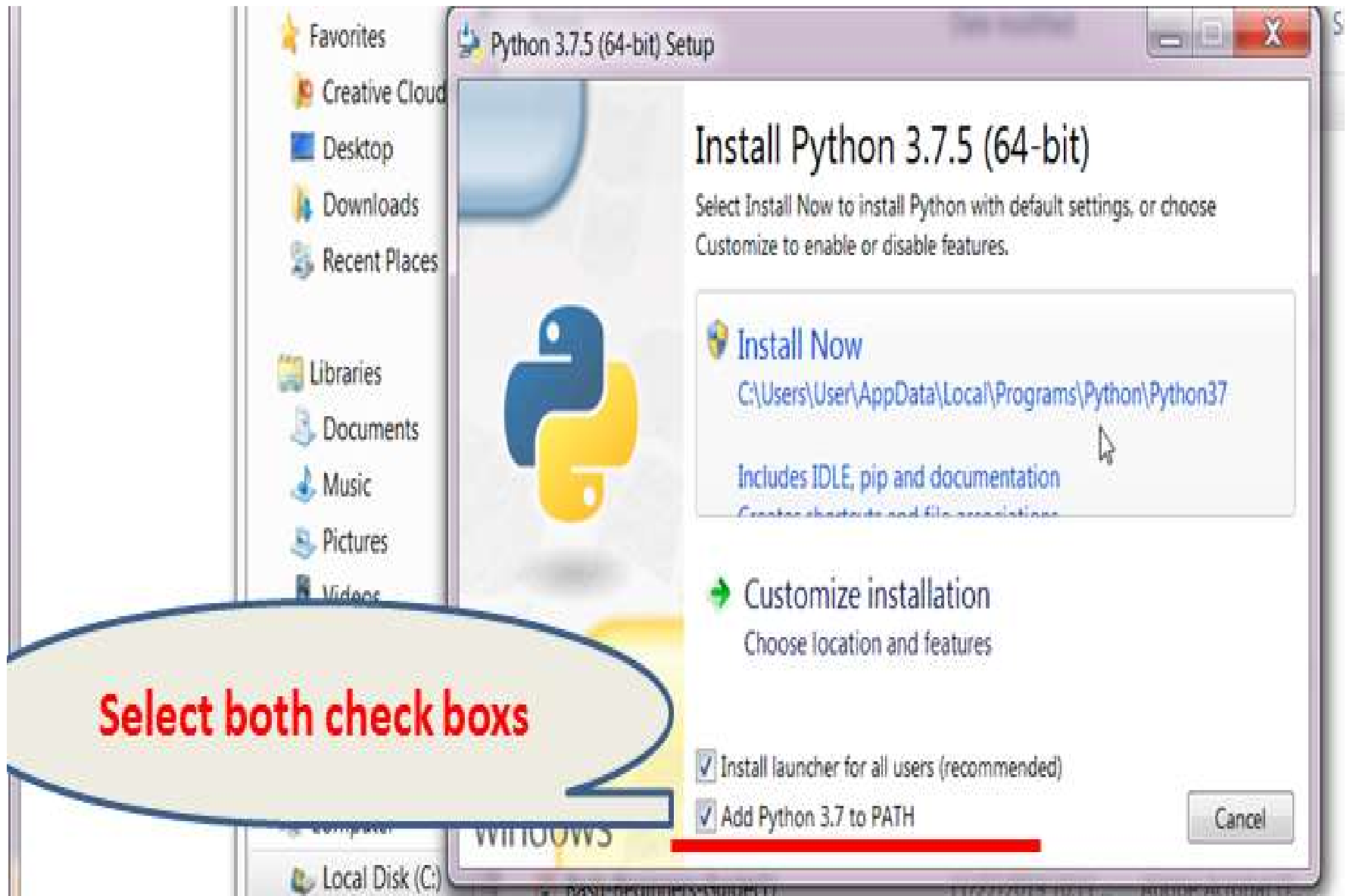
Version	Operating System	Description	MD5 Sum	File Size	PGP
<a href="#">Gzipped source tarball</a>	Source release		1cd071f78ff6d9c7524c95303a3057aa	23126230	<a href="#">SIG</a>
<a href="#">XZ compressed source tarball</a>	Source release		08ed8030b1183107c48f2092e79a87e2	17236432	<a href="#">SIG</a>
<a href="#">macOS 64-bit/32-bit installer</a>	Mac OS X	[Deprecated] for Mac OS X 10.6 and later	cd503606638c8e6948a591a9229446e4	35020778	<a href="#">SIG</a>
<a href="#">macOS 64-bit installer</a>	Mac OS X	for macOS 10.9 and later	20d9540e88c6a0ba1d2bc1ad5d069359	28198752	<a href="#">SIG</a>
<a href="#">Windows help file</a>	Windows		608c9fa250f8baa11a69bbfcb842c0e0	8141193	<a href="#">SIG</a>
<a href="#">Windows x86-64 embeddable zip file</a>	Windows	for AMD64/EM64T/x64	436b0f803d2a0b393590030b1cd59853	7500597	<a href="#">SIG</a>
<a href="#">Windows x86-64 executable installer</a>	Windows	for AMD64/EM64T/x64	697f7a884e80ccaa9dff3a77e979b0f8	26777448	<a href="#">SIG</a>
<a href="#">Windows x86-64 web-based installer</a>	Windows	for AMD64/EM64T/x64	b8b6e5ce8c27c20bf428f1366dd8a2f	1363032	<a href="#">SIG</a>
<a href="#">Windows x86 embeddable zip file</a>	Windows		726877d1a1f5a7dc68f6a4fa48964cd1	6745126	<a href="#">SIG</a>
<a href="#">Windows x86 executable installer</a>	Windows		cfe9a828af6111d5951b74093d70ee89	25766192	<a href="#">SIG</a>
<a href="#">Windows x86 web-based installer</a>	Windows		ea946f4b76ce63d366d6ed0e32c11370	1324872	<a href="#">SIG</a>

python-3.7.5-amd64.exe

Show all X



Click **Run** button



# Test your python version

```
Microsoft Windows [Version 6.1.7601]  
Copyright (c) 2009 Microsoft Corporation. All rights reserved.
```

```
C:\Users\Karthikeyan>python -V  
Python 3.7.6
```

```
C:\Users\Karthikeyan>python --version  
Python 3.7.6
```

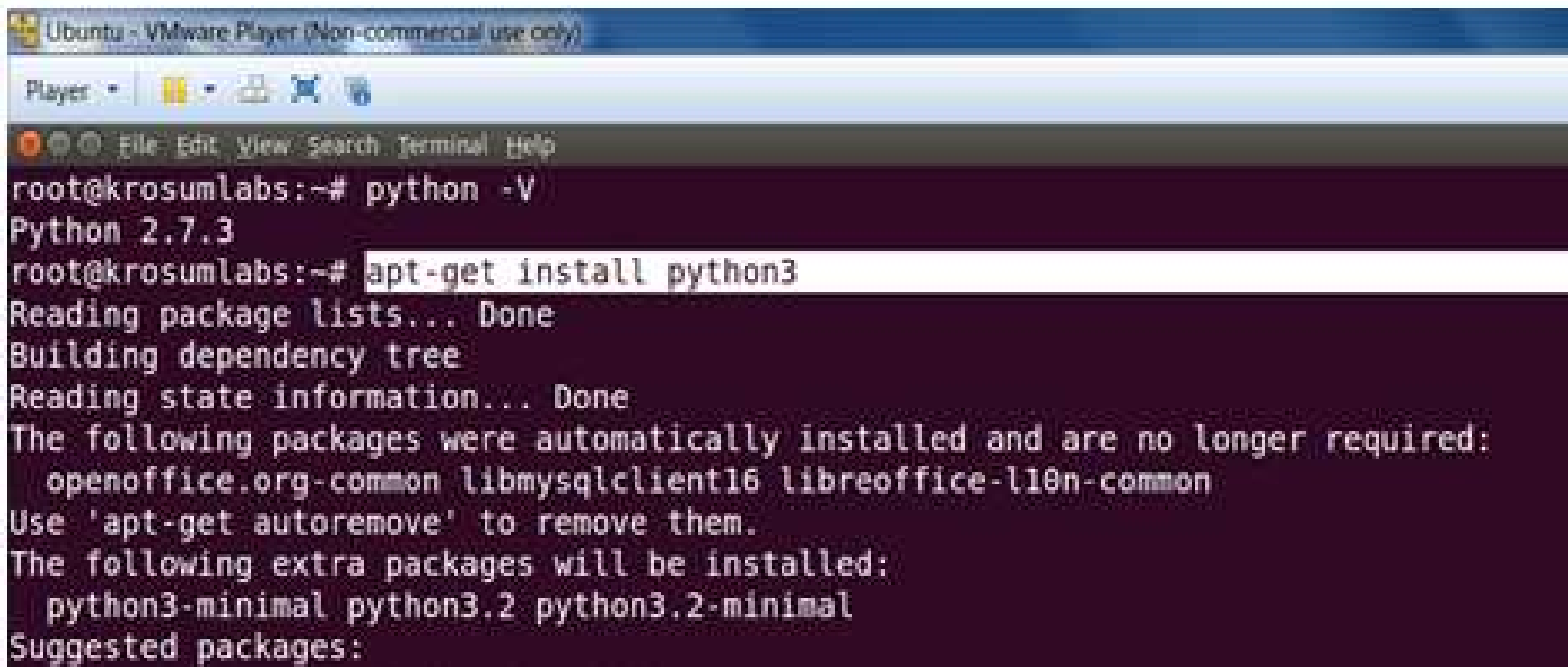
```
C:\Users\Karthikeyan>
```

After completion of successful installation, **open a new command line shell** and type the above commands.

**Note:** `python -V` ( V uppercase char)

# Linux

- `root@hostname~]# yum install python3 {Enter}`
- `root@hostname~]# apt-get install python3 {Enter}`



```
Ubuntu - VMware Player (Non-commercial use only)
Player
File Edit View Search Terminal Help
root@krosumlabs:~# python -V
Python 2.7.3
root@krosumlabs:~# apt-get install python3
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following packages were automatically installed and are no longer required:
  openoffice.org-common libmysqlclient16 libreoffice-l10n-common
Use 'apt-get autoremove' to remove them.
The following extra packages will be installed:
  python3-minimal python3.2 python3.2-minimal
Suggested packages:
```



# Test your python – in Linux

- **root@hostname~]# python -V**  
python 2.7.5
- **root@hostname~]# python3 -V**  
python 3.7.5
- **root@hostname~]# python3 --version**  
python 3.7.5

**Note:** python3 -V ( V uppercase char)



python™

# How to run python program?

1. Python subshell
2. Editor(notepad,notepad++) or IDEs  
(Eclipse,pycharm,padre etc.,)



# Understanding the python program execution.

```
C:\> python filename.py
```

```
root@hostname~]# python filename.py
```

```
root@hostname~]# python3 filename.py
```



# Python comments

- Single line comment #
- Multiline comment

“”

Multiline  
comments

“”

# print(); type(); dir()

- **print()** – display message to monitor
- `print(named_variable)`
- `print(“user defined string”)`
- Ex: `print(“Hello”)`
- `print(10)`
  
- **type()** – To determine python type/class
- `type(named_variable)` (or) `type(value)`
- Ex: `type(10) -> <class ‘int’>`
  
- **dir()** - which returns list of the attributes and methods of any object (say functions , modules, strings, lists, dictionaries etc.)
- `dir(“named_variable”)` (or) `dir(value)`
- Ex: `dir(10)`

# Quiz

**Q1. How to check python version?**

- A. python -v
- B. python - -version
- C. python -V
- D. option B and C both
- E. Option B only

# Quiz

**Q2. Is python, a case sensitive language?**

A. Yes

B. No

# Quiz

**Q3. How to check the type of a value in python?**

- A. `print()`
- B. `type()`
- C. `dir()`



# Lesson - 2

# Data types in Python

- Numbers (int,float,complex)
- String (str)
- Bytes (bytes)
- Boolean( bool )
- NoneType(None)
  
- Python containers (collections)
  - List (list)
  - Tuple (tuple)
  - Dictionary (dict)
  - Set (set)

# Variable

- variable – namespace – it's holding a value
- **Syntax:-**

**variablename = value**

var=10

name='root'

cost=14.53

status=True

Here **var**, **name** , **cost** and **status** are variables



# Activity

Q1. what are declarations are invalid declarations

A. \$var=10

B. 5var=10

C. VAR=10

D. Var=10

E. var=10

F. F\_name=""

G. s name=""

# Activity

Write a python program

Step 1: open an IDLE or any std editor

Step 2: create a file p1.py

Step 3: Within p1.py, declare variables and initialize them with value corresponding to employee details ( empName,empID,empCost)

Step 4: use print() to display employee details.

# String(str)

- String (str) – A string is a sequence of chars. – immutable
- Strings can be created by enclosing characters inside a single quote or double-quotes.  
Ex: 'Welcome' "Welcome"
- Triple quotes can be used in Python but generally used to represent multiline strings and docstrings.
- Ex: """Sample  
Python  
Test code"""



# String(str)

```
s='Welcome to python'
```

```
print(type(s))
```

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

```
print(len(s)) # length of python string
```

```
17
```

```
print(s)
```

```
Welcome to python
```



# String(str)

**s='aF4^k G'** # it alpha,number,space,specialchars

**s='abcaba'** # string allows duplicate chars

**S='line1\nline2\nline3'** # string can hold **escape chars**

**S='''line1**

**Line2**

**Line3'''** # string can hold **multiline** statement ( multiline string )

# String(str)

- **String Indexing**
- We can access individual characters using indexing and a range of characters using slicing.
- S='abcd'   #   s   |   a   |   b   |   c   |   d   |  
                  #       |   0   |   1   |   2   |   3   |   ← index
- String index starts from 0 (zero)

# String(str)

- **How to access individual index ?**
- String Name [index] => Value / IndexError
- S='abcd'    #   s   | a   | b   | c   | d   |  
                  #        | 0   | 1   | 2   | 3   | ← index
- S[1] => 'b'
- S[5] => IndexError



# String(str)

- Trying to access a character out of index range will raise an **IndexError**.
- The index must be an integer.
- We can't use floats or other types, this will result into **TypeError**
- Python allows negative indexing for its sequences.
- The index of -1 refers to the last item, -2 to the second last item and so on.
- `S[-1] => 'd'`



# String(str)

- **String Slicing**
- We can access a range of items in a string by using the slicing operator **:(colon)**
- **String\_name[n:m] # from nth string into m-1 string**

S='abcdefg'   # s | a | b | c | d | e | f |  
                  0   1   2   3   4   5

S[1:4] # from 1<sup>st</sup> index to 3<sup>rd</sup> (4-1) index

\_\_\_ result : 'bcd'

# String(str)

- **String methods**
- `help(str)` – help docs about string (str) document
- `help(str.upper)` – help docs about particular method
- `Object.function()` # method call
- `“abc”.upper() => ‘ABC’`
- `“abc”.title() => ‘Abc’`
- `“abc”.isupper() => False`

# Activity

Q1. Given a string

S="Sample python code"

From the given string, extract "code" and display it to the console.

Q2. Given a string

S="x:y:z"

(i) Display last 2 chars

(ii) Calculate string total length

# Activity

**Q3. Given a String**

**S1="root:x:bin:bash\n"**

**S2="root:x:bin:bash\t"**

**S3="root:"**

Is it possible to remove \n \t and : chars from the above string? If so, How?

# typecasting

- Changing one type to another type
- `a=10`
- `type(a) -><class 'int'>`

convert to float -> `float(a) -> 10.0`

convert to string -> `str(a) -> '10'`

Convert to boolean -> `bool(a) -> True`

`bool(0) -> False`

# typecasting

- Given type is float -> convert to int
- `int(10.0)` -> 10
  
- Given type is str -> convert to int /float
- `S='45'`
- `int(S)` -> 45
- `float(s)` -> 45.0
- `V='ab'`
- `int(V)` -> **ValueError**

# Activity

Q1. Given:

**V1=100**

**V2=245.34**

**V3='56'**

**V4=0**

**(i)** convert V1 to string type

**(ii)** convert V2 to int type

**(iii)** convert V3 to float type

**(iv)** convert V4 to boolean



# Basic I/O operation



Python 2.x - `raw_input()`

Python 3.x - `input()`



# input()



← input("prompt message:")

input() – program can prompt the user for input.

All input is stored as a **string**.

# input()

## Prompting for a value

### Syntax :-

variable=input("prompt message")

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

Enter your name:Karthik ← user input

# print()

- The **print()** function **prints** the specified message to the monitor (STDOUT)
- **print("message")**





# Example 1

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

```
Enter your name:karthik
```

```
>>> print(name)
```

```
karthik
```

```
>>>
```

```
>>> type(name)
```

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

```
>>>
```

```
>>> print("Hello...{}".format(name))
```

```
Hello...karthik
```



# Example 2

```
>>> N=input("Enter any two digits:")
```

```
Enter any two digits:56
```

```
>>> print(N)
```

```
56
```

```
>>>
```

```
>>> type(N)
```

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

```
>>>N
```

```
>>>'56'
```



# Prompting for numeric input

```
>>> N=int(input("Enter any two digits:"))
```

```
Enter any two digits:56
```

```
>>> print(N)
```

```
56
```

```
>>>
```

```
>>> type(N)
```

```
<class 'int'>
```

```
>>>N
```

```
>>>56
```



# Prompting for numeric input

```
>>> pi=float(input("Enter pi value:"))
```

```
Enter pi value: 3.15
```

```
>>> print(pi)
```

```
3.15
```

```
>>> type(pi)
```

```
<class 'float'>
```

# Activity

Q1. write a python program (Modify **p1.py** file )

Step 1: Create a new file : p2.py

Step 2: Read the employee details from <STDIN>

Step 3: Use **type()** & display input types <STDIN>

Step 4: Use **print()** & display employee details line by line



# Activity

Q2. write a python program

Step 1 : create a filename p3.py

Step 2: Read an application name, application port number and service name from <STDIN>

Step 3: Use print() to display application details

Note : use escape chars to display application details line by line



# Lesson - 3

# Operators

- + addition
- - subtraction
- /
- // ( floor division – whole number)
- \*\* exponentiation
- % modulus (remainder after division)
- == != < <= > >= - Comparison operators
- and or not – logical operators
- in not in - membership operators
- is is not identity operators

# Operators

- Example operators.py # python 2.x – examples

```
print 2*2
```

```
print 2**3
```

```
print 10%3
```

```
print 1.0/2.0
```

```
print 1/2
```

Output:

4

8

1

0.5

0

- Note the difference between floating point division and integer division in the last two lines

**`+=` but not `++`**

- Python has incorporated operators like `+=`, but `++` (or `--`) do not work in Python

# Activity

Write a python program

Step 1: create a filename p4.py

Step 2 : read any two disks partition name from <STDIN>

Step 3 : read an individual partition size from <STDIN>

Step 4: calculate sum of partition size

Step 5: use multiline statement & display input details in below format

**Expected Result:**

**Python p4.py**

**Enter a disk partition: /dev/sda1**

**Enter /dev/sda1 partition Size: 100**

**Enter a disk partition:/dev/sda2**

**Enter /dev/sda2 partition Size:200**

**Partition /dev/sda1 Size : 100**

**Partition /dev/sda2 Size : 200**

-----

**Total Partition Size: 300**

-----

# String operators

- `s1="Welcome"`
- `s2="Python"`
- `print(s1+"to"+s2) # WelcometoPython`
  
- `s1="welcome"`
- `print(s1*3) # WelcomeWelcomeWelcome`
  
- `count=1230`
- `print("Total Sales count is:"+str(count))`
- `# Total Sales count is:1230`

# Examples

- `s1 = "sales"`
- `s1 == "sales"`  
True
- `s1 == "SALES"`  
False
- `s1 != "SALES"`  
True



# Activity

Predict the output of below expressions

Q1. “Admin” == “admin”

Q2. 5062 > 5000

Q3. int(“60”) < int(“75”)

Q4. “Raj” != “raj”

Q5. float(“1.34”) > 0.045

# Logical operators

- Test more than one condition

## Logical **and** operator

Condition1	Condition2	Result
<b>True</b>	<b>True</b>	<b>True</b>
True	False	False
False	True	False
False	False	False

## Logical **or** operator

Condition1	Condition2	Result
<b>True</b>	<b>True</b>	<b>True</b>
<b>True</b>	<b>False</b>	<b>True</b>
<b>False</b>	<b>True</b>	<b>True</b>
False	False	False

## Logical **not** operator

**not** True => False

**not** False => True

# Logical operators

- counter=560
- counter >500 **and** counter<600
- service="apache2"
- service == "apache2" **or** service == "httpd"
- S="root"
- **not** S == "root"

# Membership operators

- **in not in => True / False**
- **“searchPattern” in inputString => True/False**
- **“e” in “hello” => True**
- **“E” in “hello” => False**
- **“E” not in “hello” => True**

# Identity operators

- **‘is’ operator** – Evaluates to true if the variables on either side of the operator point to the same object and false otherwise
  - `x=100`
  - `type(x) is int`  
True
- **‘is not’ operator** – Evaluates to false if the variables on either side of the operator point to the same object and true otherwise.
  - `type(x) is str`  
False
  - `type(x) is not str`  
True

# Activity

## Predict the result

Q1. sname="xerox"

sname == "xerox" **and** sname == "XEROX"

Q2. port=6590

port > 6000 **and** port < 7000

Q3. app="TestApp"

app="testapp1" **or** app == "testapp" **or** app == "TestApp"



python™

# Python Conditional Statement

- Testing (or) Validation (or) Decision making
- Conditional code block will execute only one time.
- Conditional statements are handled by **if** statements.

# Python Conditional Statement

If statement we can write 3 ways

I) if only style

II) if ..else style

III) if .. elif...else style



# Python Conditional Statement

## What is if statement ?

- **if** is a python keyword.
- **if** statement is used for testing (or) decision making (or) validation.
- **if** only style code block will run the body of code only when if statement is **True**.

## How to use if only style?

**Syntax:-**

```
if(condition):
```

```
<---->True only block
```



# Python Conditional Statement

```
>>> name="root"
>>> name == "root"
True
>>> if(name == "root"):
...     print("Login is success")
...
Login is success
>>>
>>> name = "admin"
```

```
>>> name == "root"
False
>>> if(name == "root"):
...     print("Login is success")
...
>>>
```



# Python Conditional Statement

```
>>> count=50
>>>
>>> count>10
True
>>> if(count>10):
...     print("valid count: {}".format(count))
...
valid count:50
>>>

>>> count<10
False
>>> if(count<10):
...     print("valid count: {}".format(count))
...
>>>
```

# if ..else statement

**if(condition):**

**True block**

**else:**

**False block**

```
>>> count=50
```

```
>>> count>100
```

**False**

```
>>> if(count>100):
```

```
...     print("valid count: {}".format(count))
```

```
... else:
```

```
....     print("invalid count: {}".format(count))
```

```
invalid count:100
```

```
>>>
```

# if ..elif statement

## Multi conditional statement

**if(condition1):**

Trueblock1

**elif(condition2):**

Trueblock2

**elif(condition3):**

True block3

...

**elif(condition N):**

True block N

**else:**

False block

## if ..elif statement

```
>>> name="root"
>>> if(name == "root"):
...     print("Login name is:{}".format(name))
... elif(name == "userA"):
...     print("Login name is:{}".format(name))
... elif(name == "userB"):
...     print("Login name is:{}".format(name))
... else:
...     print("Invalid login name")
...
Login name is:root
>>>
```

## if ..elif statement

```
>>> name="userA"
>>> if(name == "root"):
...     print("Login name is:{}".format(name))
... elif(name == "userA"):
...     print("Login name is:{}".format(name))
... elif(name == "userB"):
...     print("Login name is:{}".format(name))
... else:
...     print("Invalid login name")
...
Login name is:userA
>>>
```

# if ..elif statement

```
>>> name="userB"
>>> if(name == "root"):
...     print("Login name is:{}".format(name))
... elif(name == "userA"):
...     print("Login name is:{}".format(name))
... elif(name == "userB"):
...     print("Login name is:{}".format(name))
... else:
...     print("Invalid login name")
...
Login name is:userB
>>>
```



# if ..elif statement

```
>>> name="userC"
>>> if(name == "root"):
...     print("Login name is:{}".format(name))
... elif(name == "userA"):
...     print("Login name is:{}".format(name))
... elif(name == "userB"):
...     print("Login name is:{}".format(name))
... else:
...     print("Invalid login name")
...
Invalid login name
>>>
```

# Activity

Step 1: create a file name p5.py

Step 2: Declare a variable name uname and initialize it with value “root”

Step 3: read a user name from <STDIN>

Step 4: Test if input user name matched with value in uname.

Step 5: If matched, display message “login is valid” else display “login is invalid.”

# Activity

- Write a python program

Step 1: create a filename p6.py

Step 2: Read a port number from <STDIN>

Step 3: Test whether input port number range between 501-599

Step 4: If matched, initialize the application name as “Test-App1”.

Step 5: else display message “invalid port number.”

# Activity

- Write a python program –
  - Step 1: create file name p7.py
  - Step 2: Read a shell name from <STDIN>
  - Step 3: If input shell name is bash, initialize profile file name as “bashrc”
  - Step 4: If input shell name is ksh, initialize profile filename as “kshrc”
  - Step 5: If input shell name is psh, initialize profile filename as “winprofile”
  - Step 6: If neither of the shell name matches, Initialize with default shell name as “nologin” and profile file name as “/etc/profile”
  - Step 7 : Display shell name and shell profile filename

# Python Looping statements

- General loop is used to execute a block of **statements** or code several times until the given condition becomes false.
- We use **for loop** when we know the number of times to **iterate**.
- while – loop (Condition)
- for – loop (Collection)

# Python Looping statements

## while loop

The while loop in Python is used to iterate over a block of code as long as the test expression (condition) is true.

### Syntax:

**while(condition):**  
    <codeblock>

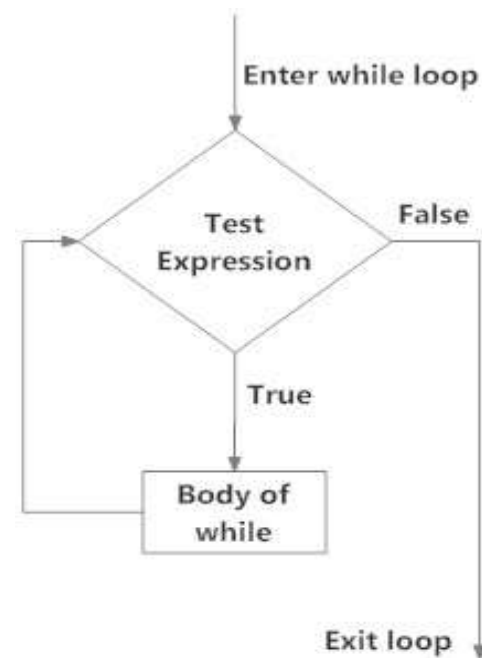


Fig: operation of while loop

# Python Looping statements

## 3 Points to remember

1. Initialization → **`i=0`**
2. Condition → **`while(i<5):`**
3. Increment/Decrement → **`i=i+1`**

# Python Looping statements

```
>>> i=0
```

```
>>> while(i<3):      # 0 < 3 → True
    print("Hello...{}".format(i))
    i=i+1
```

**Hello...0**



# Python Looping statements

```
>>> i=0
```

```
>>> while(i<3): # 1<3 → True
```

```
    print("Hello...{}".format(i))
```

```
    i=i+1
```

**Hello...0**

**Hello...1**

# Python Looping statements

```
>>> i=0
```

```
>>> while(i<3): # 2<3 → True
```

```
    print("Hello...{}".format(i))
```

```
    i=i+1
```

**Hello...0**

**Hello...1**

**Hello...2**

# Python Looping statements

```
>>> i=0
```

```
>>> while(i<3): 3<3 False → Exit from loop
```

```
    print("Hello...{}".format(i))
```

```
    i=i+1
```

```
Hello...0
```

```
Hello...1
```

```
Hello...2
```

```
>>>
```

# Python Looping statements

- For loops are used for sequential traversal.
- **Syntax:-**

```
for variable in collection:  
    code block(s)
```

**Example:-**

```
for v in "abcd":  
    print("Hello..{}".format(v))
```

Hello..'a'

Hello..'b'

Hello..'c'

Hello..'d'

# break ; continue

- break - exit from loop
- continue - continue from next element

# Activity

Write a program:

Step 1: create a file name p8.py

Step 2: declare & initialize the pin number (ex: pin=1234)

Step 3: Use while loop to iterate following statement thrice

- (i) Read a pin number from <STDIN>
- (ii) Compare a input pin with existing pin number
- (iii) If both pin numbers are matched , display pin number is matched at count time & exit from loop.
- (iv) If all 3 attempts fails, display message “ your pin is blocked.”

# Activity

Step 1: create a file name: p9.py

Given String

S="123456578"

Step 2: Calculate sum of numbers

Note : use for loop

# Activity

Write a python program

Step 1: create a new file p10.py

Step 2: Modify the below code using while loop

```
s="abcd"
```

```
for var in s:
```

```
    print(var)
```

Step 3: Display list of characters one by one





# Lesson - 5

# Python - Collections

- List ( list - [ ] )
- Tuple ( tuple – () )
- Dictionary ( dict – { } )
- Set (set)

# List

- **Lists** are just like dynamic sized arrays, declared in other languages.
- List are ordered elements
- A single list may contain mixed data types.
- Lists are **mutable**, and hence, they can be altered even after their creation.

# List

- The elements in a list are indexed according to a definite sequence and the indexing of a list is done with **0** being the **first index**.
- Each element in the list has its definite place in the list, which allows duplicating of elements in the list, with each element having its own distinct place and credibility.
- List supports **indexing** and **slicing**

# List - Examples

- `Listname=[] # Creating a list`
- `DB=['oracle','sql','plsql','mysql','sqlite3']`
- `Emp=['arun','sales',133,1323.23,True]`

# Example

```
L=['D1', 10, 3.45,True,None ]
```

```
# 0      1      2      3      4  <== index
```

```
# -5 -4 -3 -2 -1 <== index
```

```
type(L)    => <class 'list'>
```

```
type(L[0]) => <class 'str'>
```

```
len(L) => 5
```

# List – Index and Slicing

```
Files=['p1.c', 'p2.java', 'p3.cpp', 'p4.py', 'repo.log']
```

```
# 0      1      2      3      4 ← index
```

```
Files[1]    # 'p2.java'
```

```
Files[1:4]  # [ 'p2.java', 'p3.cpp', 'p4.py' ]
```

```
Files[:2]   # ['p1.c', 'p2.java']
```

# Membership operators

# "searchString" in inputList -> True/False

```
fnames=["p1.log","p2.log","p3.log","test.log"]
```

```
if("p3.log" in fnames):
```

```
    print("Yes file p3.log is exists")
```

```
else:
```

```
    print("Sorry file is not exists")
```



# List methods

- `Listname.append(Value)`  
(or)
- `Listname.insert(index, Value)`
- # we can add new data to existing list
  
- `Listname.pop(Index)`
- # we can delete nth data from existing list
  
- `Listname[index]=updated_value`
- # we can modify existing nth data from list

# Example

```
L=[]
```

```
print(len(L))
```

```
# Listname.append(Value) =>None
```

```
L.append("p1.log")
```

```
L.append(100)
```

```
L.append(3.45)
```

```
L.append(True)
```

```
print(L) => ['p1.log',100,3.45,True]
```

# List methods

- `Listname.pop()`
- `Listname.insert(Index, Value)`
- `Listname.index(Value)`
- `Listname.count(value)`

# Activity

Q1. write a python program

Step 1 : Create a file name : p11.py

Step 2: create an empty list

Step 3: display size of list

Step 4: use while loop 5 times

- i) To read a hostname from <STDIN>

- ii) To add a input hostname to existing list

Step 5: using for loop, display list of elements

Step 6: display size of the list

# Activity

Q2. write a python program

Given List

```
DBs=['oracle','sql','mysql','plsql']
```

Step 1: create a file name : **p12.py**

Step 2: read a database name from <STDIN>

Step 3: test input database name is existing or not

Step 4: if input DB name exists, using index(), display index number

Step 5: If input DB does not exist, add the input DB name to the existing list.

Step 6: display list line by line using for loop

# Activity

Q3. write a python program

Given List

Step 1: create a filename p13.py

LB=['0.13','14.4','1.34','3.24','2.44']

Step 2: Calculate sum of load balance

# Tuple

- Tuple – Collection of elements like list
- The difference between the two is that we cannot change the elements of a tuple once it is assigned whereas we can change the elements of a list.  
i.e., tuple is immutable
- `type(( ))` Vs `type([])`

# Tuple

Syntax:-

tuplename=(list of elements)

**tname=(10,20.45,"data",True)**

**len(tname) ==> 4**



# Tuple

- A tuple can also be created without using parentheses. This is known as tuple packing.
- `V1=10`
- `type(V1) ==> <class 'int'>`
- **`V2=10,`**  
`type(V2) ==> <class 'tuple'>`



# Iterating Through a list/tuple

```
F=['p1.log','p2.log','p3.log']  servers=("unix","linux","aix")
```

```
for var in F:  
    print(var)
```

```
p1.log  
p2.log  
p3.log
```

```
for var in servers:  
    print(var)
```

```
unix  
linux  
aix
```

# Tuple operations

- tuple supports indexing and slicing
- tuple supports membership **in not in** operators.
- We typecast list to tuple vice versa  
    `tuple(input_List)`  
    `list(input_tuple)`

# Deleting a Tuple

- we cannot change the elements in a tuple. It means that we cannot delete or remove items from a tuple.
- Deleting a tuple entirely, however, is possible using the function `del()`.
- **`del(tuple_name)`**

# Tuple usages in python

- Since tuples are immutable, iterating through a tuple is faster than with list. So there is a slight performance boost.
- Tuples that contain immutable elements can be used as a key for a dictionary. With lists, this is not possible.
- If you have data that doesn't change, implementing it as tuple will guarantee that it remains write-protected.
- tuple() type of structures used in functions

# Activity

Predict the error message

Q1. `T=(1,2.3,'D1')`  
`T[1]="data1"`

Q2. `T=(10,20,30,40,50)`  
`print(T[-6])`

Q3. `T=(1,2)`  
`del(T[1])`

# Activity

Q1. Write a python program

Step 1: create a filename p14.py

Given tuple

**Products=("P1","P2","P3","P4","P5")**

Step 2: display the list of products except **P2** and **P3**

Note :use for loop statement



# Activity

Write a python program

Step 1: create a filename p15.py

Given Tuple :

```
EMP=('101,leo,sales,1000','102,paul,prod,2000','103,raj,HR,3000'  
)
```

Step 2: use for loop along with split() to get the following expected result.

Expected result:-

Emp name is leo working department is sales

Emp name is paul working department is prod

Emp name is raj working department is HR

-----

Sum of Emp's cost is: 6000

-----





# Lesson - 6

# Dictionary

- Python dictionary is an unordered collection of items.
- Syntax:-

`dict_name={"key1":Value,"Key2":Value,.. "Kn": "Vn"}`

Data – { 'Key' : Value }

`app={"port":80,"service":"apache2"}`

Key	Value
port	80
service	apache2

# dict- operations

# Accessing Elements from Dictionary

`dict_name['Key']` → Value / `KeyError`

# adding newdata to existing dictionary

`dict_name['NewKey']=Value`

# modifying existing dictionary element

`dict_name['ExistingKey']=Updated_value`

# deleting nth element

`del(dict_name['Key'])`

# Activity

Step 1 - Open a python shell

Step 2 - create an empty dict (ex: d={})

Step 3 - read a hostname from <STDIN>

read an IPAddress from <STDIN>

Step 4 - add a input details to existing dict

with hostname as a key and IPAddress as its value

Step 5 - display dictionary and it's size

# dict- methods

`dict.get(Key)`

`dict.setdefault(Key, Value)`

`dict.pop("key")`

`dict.keys()`

# Activity

Write a python program

Step 1 : create a file name: p16.py

Step 2 : create an empty dict

Step 3 : use looping statements – 5times

- i) Read a hostname from <STDIN>
- ii) Read a IP-Address from <STDIN>
- iii) Add a input details to existing dict
- iv) with hostname as a key and IP address as it's value

Step 4 : display Key/ value details to monitor

# Dictionary Membership Test

- We can test if a key is in a dictionary or not using the keyword **in**.
- Note that the membership test is only for the keys and not for the values.
- “key” in input\_dictionary → True/False

# Activity

Write a python program – modify p16.py file

Step 1: create a new file p17.py

Step 2: Use membership operator to test whether the input hostname already exists or not.

Step 3: if it's exists already, display pop up message  
**“Sorry your input hostname is exist”**.



# Iterating Through a Dictionary

We can iterate through each key in a dictionary using a for loop.

```
d={"K1":"V1","K2":"V2","K3":"V3"}
```

```
for var in d:
```

```
    print(var)
```

K1

K2

K3

# Activity

Write a python program

Step 1 : create a new file p18.py with existing code of p17.py

Step 2: Using for loop – display key /value details  
i.e., hostname and IP-Address details

# set

- **A set is an unordered collection of items.**  
Every element is unique (no duplicates) and must be immutable (which cannot be changed)
- Sets can be used to perform mathematical set operations like **union, intersection, symmetric difference** etc.

# How to create a set?

- A set is created by placing all the items (elements) inside curly braces {}, separated by comma or by using the built-in function **set()**.
- **var={1,2,3,4,"Data1","Data2"}**
- **>>> type(var)**
- **<class 'set'>**
- **>>> v1=set()**
- **>>> type(v1)**
- **<class 'set'>**

# Empty set

- To make a set without any elements we use the **set()** function without any argument.

```
var={}
```

```
type(var)
```

```
<class 'dict'> ← dictionary
```

```
v1=set()
```

```
type(v1)
```

```
<class 'set'>
```

```
len(v1)
```

```
0
```

- Every element is **unique** (no duplicates) and must be **immutable** (which cannot be changed).
- `>>> v2={10,20,30,10,20,"DATA1","data1","DATA1"}`
- `>>> print(v2)`
- `{10, 'DATA1', 'data1', 20, 30}` # there is no duplicate element

- We cannot access or change an element of set using indexing or slicing. set does not support it.

- `v2={10,20,30}`

`type(v2)`

`<class 'set'>`

`>>> v2[0] ←`

- Traceback (most recent call last):
- File "<stdin>", line 1, in <module>
- `TypeError: 'set' object does not support indexing`

`>>> print(v2)`

`{10, 20, 30}`

# How to change a set in Python?

- set are unordered, indexing have no meaning.
- We cannot access or change an element of set using indexing or slicing.
- We can add single element using the `add()` method and multiple elements using the `update()` method.
- The `update()` method can take tuples, lists, strings or other sets as its argument.





# add() vs update()

```
>>> v3={"Data1","Data2","Data3"}
>>>
>>> len(v3)
3
>>> print(v3)
{'Data1', 'Data2', 'Data3'}
>>>
>>>
>>> v3.add("Data4")
>>> v3
{'Data1', 'Data2', 'Data4', 'Data3'}
>>>
>>> v3.add("Data4")
>>> v3
{'Data1', 'Data2', 'Data4', 'Data3'}
>>>
>>> # avoiding duplicate entry
...
```

```
>>> v4={"Text1","Text2"}
>>>
>>>
>>> v4.update(["Text3\n","Text4\n","Text5\n"])
>>> v4
{'Text1', 'Text2', 'Text3\n', 'Text5\n', 'Text4\n'}
>>>
>>>
>>> v4.update(("Text3\n","Text4\n","Text6\n"))
>>>
>>> v4
{'Text1', 'Text2', 'Text6\n', 'Text3\n', 'Text5\n',
'Text4\n'}
>>>
>>> len(v4)
6
```

# How to remove elements from a set?

- A particular item can be removed from set using methods, `discard()` and `remove()`.
- while using `discard()` if the item does not exist in the set, it remains unchanged.
- But `remove()` will raise an error in such condition.



# remove() vs discard()

```
>>> v3={"Data1","Data2","Data3"}
```

```
>>>
```

```
>>> len(v3)
```

```
3
```

```
>>> print(v3)
```

```
{'Data1', 'Data2', 'Data3'}
```

```
>>>
```

```
>>>
```

```
>>> v3.remove("Data3")
```

```
>>> v3
```

```
{'Data1', 'Data2'}
```

```
>>>
```

```
>>> v3.remove("Data7")
```

```
>>> traceback (most recent call last):
```

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

```
KeyError: 'data7'
```

```
>>> v4={"Text1","Text2"}
```

```
>>>
```

```
>>> v4.discard("Text2")
```

```
>>> v4
```

```
{'Text1'}
```

```
>>>
```

```
>>> v4.discard("Text5")
```

```
>>>
```

```
>>> v4
```

```
{'Text1'}
```

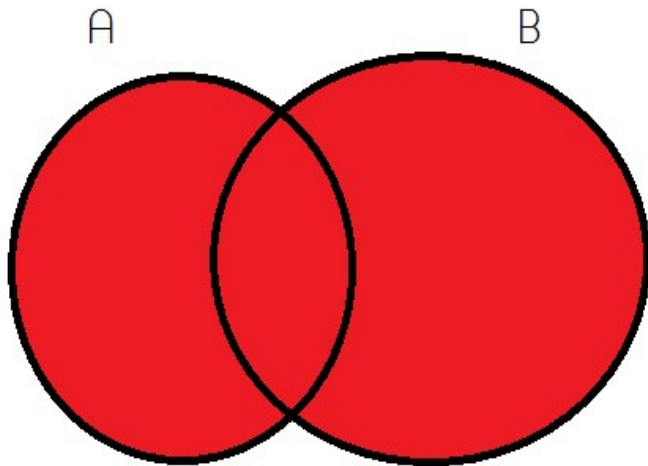
# Python Set Operations

- Sets can be used to carry out mathematical set operations like **union, intersection, difference and symmetric difference**.
- We can do this with operators or methods.

$A = \{1, 2, 3, 4, 5\}$

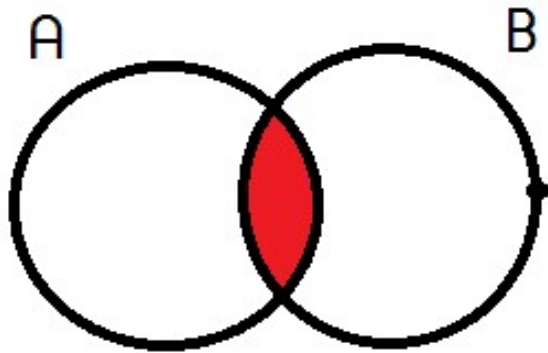
$B = \{4, 5, 6, 7, 8\}$

# Set Union



```
>>> A={1,2,3,4,5}
>>>
>>> B={1,2,3,6,7,8,9}
>>>
A|B
A.union(B) >>> A.union(B)
{1, 2, 3, 4, 5, 6, 7, 8, 9}
B.union(A) >>>
>>> B.union(A)
{1, 2, 3, 4, 5, 6, 7, 8, 9}
>>>
>>> A|B
{1, 2, 3, 4, 5, 6, 7, 8, 9}
>>>
>>> B|A
{1, 2, 3, 4, 5, 6, 7, 8, 9}
>>>
```

# Set Intersection



`A.intersection(B)`  
`B.intersection(A)`

`A & B`  
`B & A`

```
>>> A={1,2,3,4,5}
>>> B={1,2,3,6,7,8,9}
>>>
>>> A&B
{1, 2, 3}
>>>
>>> B&A
{1, 2, 3}
>>>
>>> A.intersection(B)
{1, 2, 3}
>>>
>>> B.intersection(A)
{1, 2, 3}
```

# Activity

Q1. open a python shell

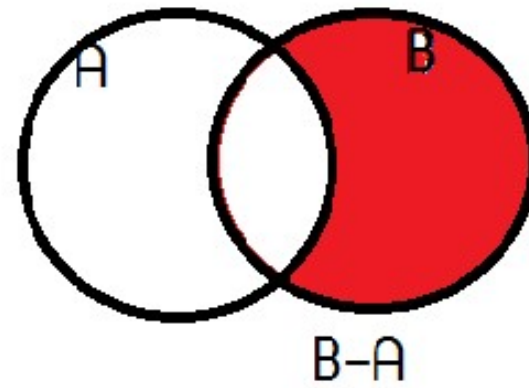
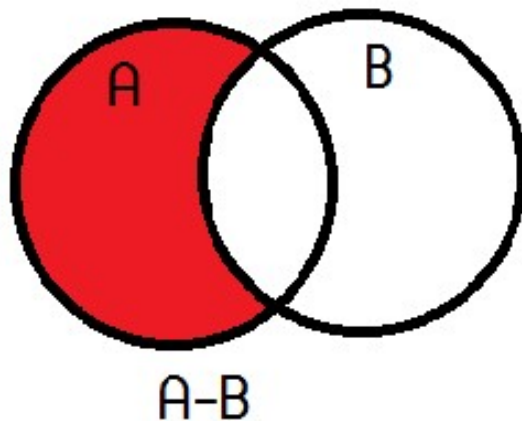
$C = \{ \text{"p1.c"}, \text{"p2.c"}, \text{"p3.java"}, \text{"Demo"} \}$

$D = \{ \text{"p1.java"}, \text{"p1.c"}, \text{"p3.java"}, \text{"p2.c"}, \text{"Demo"}, \text{"D1"} \}$

- A) Filter common files from the above two sets
- B) Combine both sets into single set and omit duplicate elements.
- C) type cast to list

# Set Difference

- Difference of A and B ( $A - B$ ) is a set of elements that are only in A but not in B. Similarly,  $B - A$  is a set of element in B but not in A.





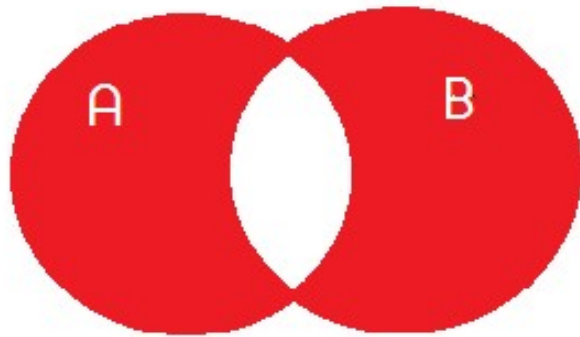
# set difference

```
>>> A={1,2,3,4,5}
>>> B={1,2,3,6,7,8,9}
>>>
>>> A-B
{4, 5}
>>> B-A
{8, 9, 6, 7}
>>>
>>> A.difference(B)
{4, 5}
>>>
>>> B.difference(A)
{8, 9, 6, 7}
>>>
```

# Set Symmetric Difference

- Symmetric Difference of A and B is a set of elements in both A and B except those that are common in both.
- Symmetric difference is performed using  $\wedge$  operator.
- Same can be accomplished using the method **`symmetric_difference()`**.

# Set Symmetric Difference



$A \Delta B$

$B \Delta A$

- `>>> A={1,2,3,4,5}`
- `>>>`
- `>>> B={1,2,3,6,7,8,9}`
- `>>>`
- `>>> A^B`
- `{4, 5, 6, 7, 8, 9}`
- `>>>`
- `>>> B^A`
- `{4, 5, 6, 7, 8, 9}`
- `>>>`
- `>>> A.symmetric_difference(B)`
- `{4, 5, 6, 7, 8, 9}`
- `>>>`
- `>>> B.symmetric_difference(A)`
- `{4, 5, 6, 7, 8, 9}`
- `>>>`

# Activity

Predict the result of below set operations

$S1 = \{ 'data1', 'data2', 'data3' \}$

$S2 = \{ 'data2', 'data3', 'data4', 'data5' \}$

`print(S1-S2)`

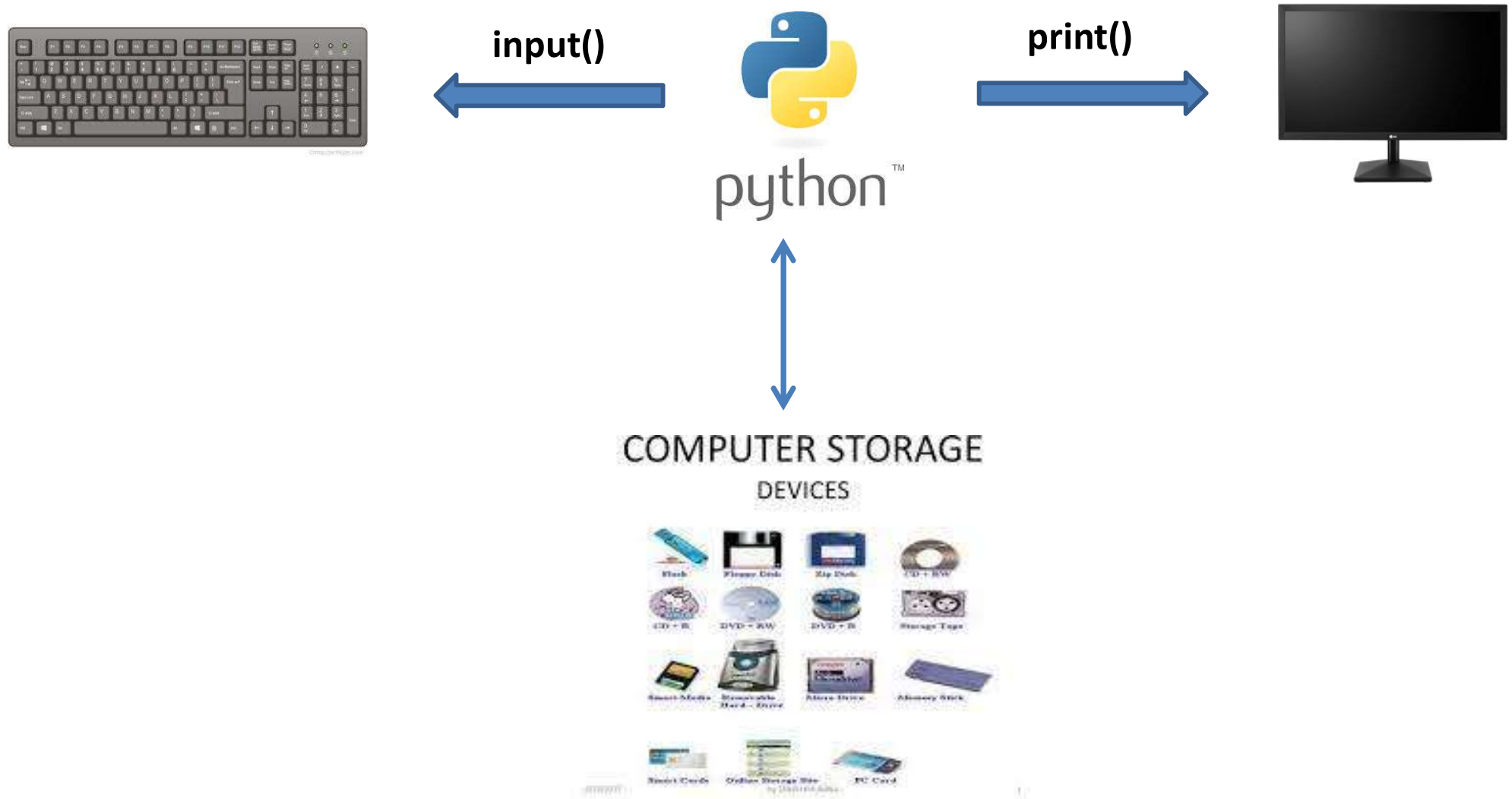
`print(S2-S1)`

`print(S1 ^ S2)`



# Lesson - 7

# File Handling



# File categories

- Reading data from <FILE> → Python → display to monitor
- Python → Create / Write data to FILE
- Reading data from <FILE> → Python → Create/Write data to another FILE

# File – read operation

Open a file => `fileobject=open(inputfile,mode)`

|

Read content `fileobject.read()` / `fileobject.readlines()`

|

Close a file => `fileobject.close()`



# File – create/write operation

Open a file => `fileobject=open(result_file,"w")`  
# w – write ; a –append

|

Read content `fileobject.write( "InputString\n")`

|

Close a file => `fileobject.close()`

# File – read/write operation

```
FH=Open("inputFile","r")
```

```
WH=open("resultFile","w")
```

```
S=FH.read()
```

```
WH.write(S+"\n")
```

```
FH.close()
```

```
WH.close()
```

# Activity

Write a python program

Step 1: Create a filename `p19.py`

Step 2: Read an existing TEXT file from your disk

Step 3: Display file content line by line.

# Activity

Write a python program

Step 1 : create a filename p20.py

Step 2 : create a new emp.csv file under D:\\

Step 3 : write any 5 sample csv content to emp.csv file

Step 4 : close the file

# Activity

Write a python program

- i) create a filename p21.py to demonstrate the **cp** command

Syntax:

`cp oldfile newfile`

# with statement in python

```
with open("inputFile","r") as fileobject:  
    fileobject.read() / fileobject.readlines()
```

```
with open("resultFile","w") as fileobject:  
    fileobject.write("Single String\n")
```

Note : `fileobject.close()` not required



# Examples

with open("D:\\test.log") as FH:

s=FH.read()

print(s)



Reading data from <FILE>

with open("D:\\result.log","w") as WH:

WH.write("data1\n")

WH.write("data2\n")

WH.write("data3\n")



Create/writing data to FILE

with open("D:\\test.log") as FH:

with open("D:\\r1.log","w") as WH:

for var in FH.readlines():

WH.write(var)



Read/write operation

# Activity

Write a python program

Step 1 : Create a filename p22.py

Step 2 : Use **with** statement to modify p20.py and p21.py program



# Activity

Write a python program

Step 1 : create a filename p23.py

Given List

**Net=['interface=eth0','bootproto=dhcp','onboot=none']**

Step 2 : create a new file called property.txt

Step 3 : iterate a given list one by one

Step 4 : write list element into property file

Note : use with statement

# Activity

## Write a python program

Step 1 : create a filename: p24.py

Step 2 : create an empty dict

Step 3 : read a existing property.txt file (read line by line)

Split each line into multiple values

Key = value

Add the split data to existing dictionary

Step 4: use for loop – display key/value details

Step 5: modify following operation

*Onboot -> yes ; bootproto -> static ;*

*Add new IP-address ex: IPADDR=10.20.30.40*

Step 6: display key/value details (Step 4 )

Step 7: create a new property file( p1.txt) and write updated dictionary details in same format.



# Lesson - 8

# What is a function in Python?

- In Python, function is a **group of statements** that perform a specific task.
- Functions help break our program into smaller and modular chunks.

# Syntax of Function

- **def function\_name(parameters):**  
    **"""docstring"""**  
    **statement(s)**
- Keyword **def** marks the start of function header.
- A function name to uniquely identify it.
- Function naming follows the same rules of writing identifiers in Python.
- Parameters (arguments) through which we pass values to a function.
- A colon (:) to mark the end of function header.
- Optional documentation string (docstring) to describe what the function does.
- One or more valid python statements that make up the function body. Statements must have same indentation level.
- An optional return statement to return a value from the function.

# How to call a function in python?

- Once we have defined a function, we can call it from another function, program or even the Python prompt.
- To call a function we simply type the function name with appropriate parameters.
- `function_name()`

# Example

```
>>> def display():  
...     print("Hello I am display block")  
...  
>>> type(display)  
<class 'function'>  
>>>  
>>> display  
<function display at 0x02287108>  
>>> display()  
Hello I am display block  
>>>
```

File : p1.py

```
import os

print("List of files")
os.system("ls")

print("process details:-")
os.system("ps")

print("List of files")
os.system("ls")

print("process details:-")
os.system("ps")
....
print("List of files")
os.system("ls")
```

File : p2.py

0x5432

```
import os
```

```
def f1():
```

```
    print("List of files")
    os.system("ls")
```

0x1234

```
def f2():
```

```
    print("Process details:-")
    os.system("ps")
```

0x5678

```
print("This is main script section")
f1() # 1st function call
print("") # Empty line
f2() # 2nd function call
f1() # again calling f1 block
f2() # again calling f2 block
print("Exit from script section")
```



File : p1.py

```
import os

print("List of files")
os.system("ls")

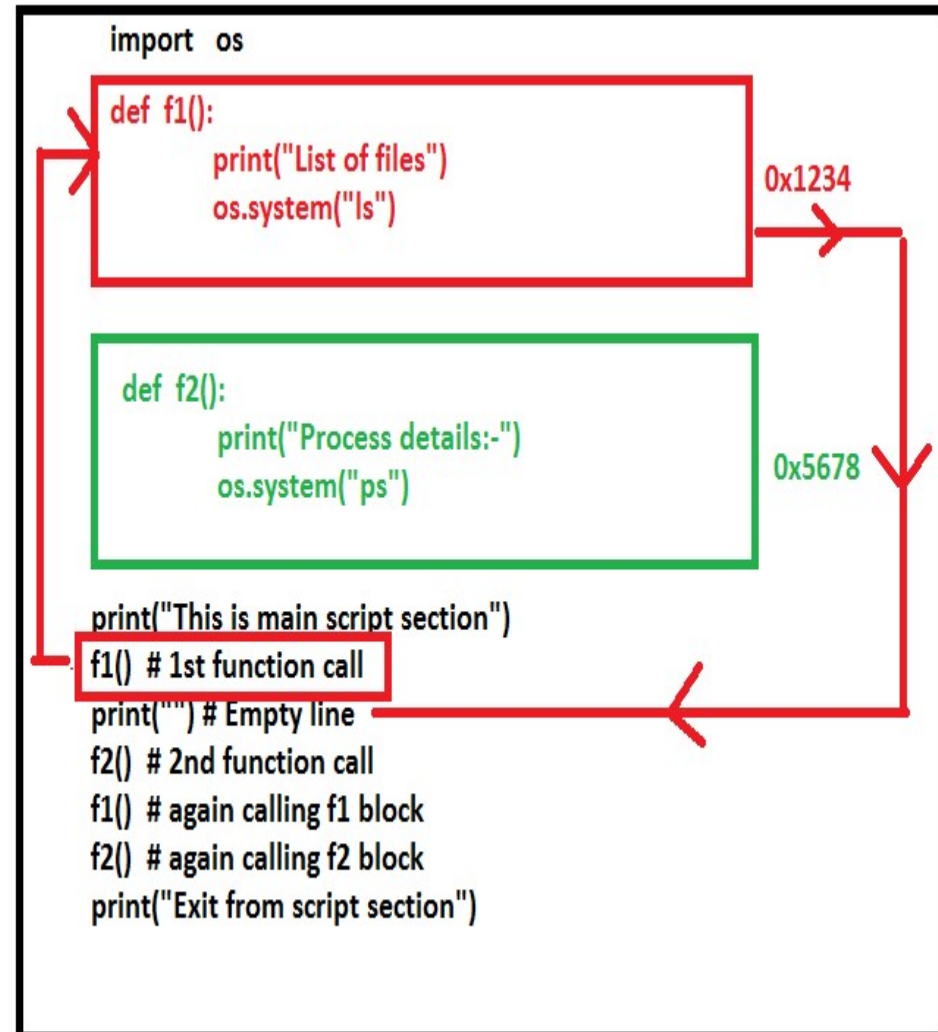
print("process details:-")
os.system("ps")

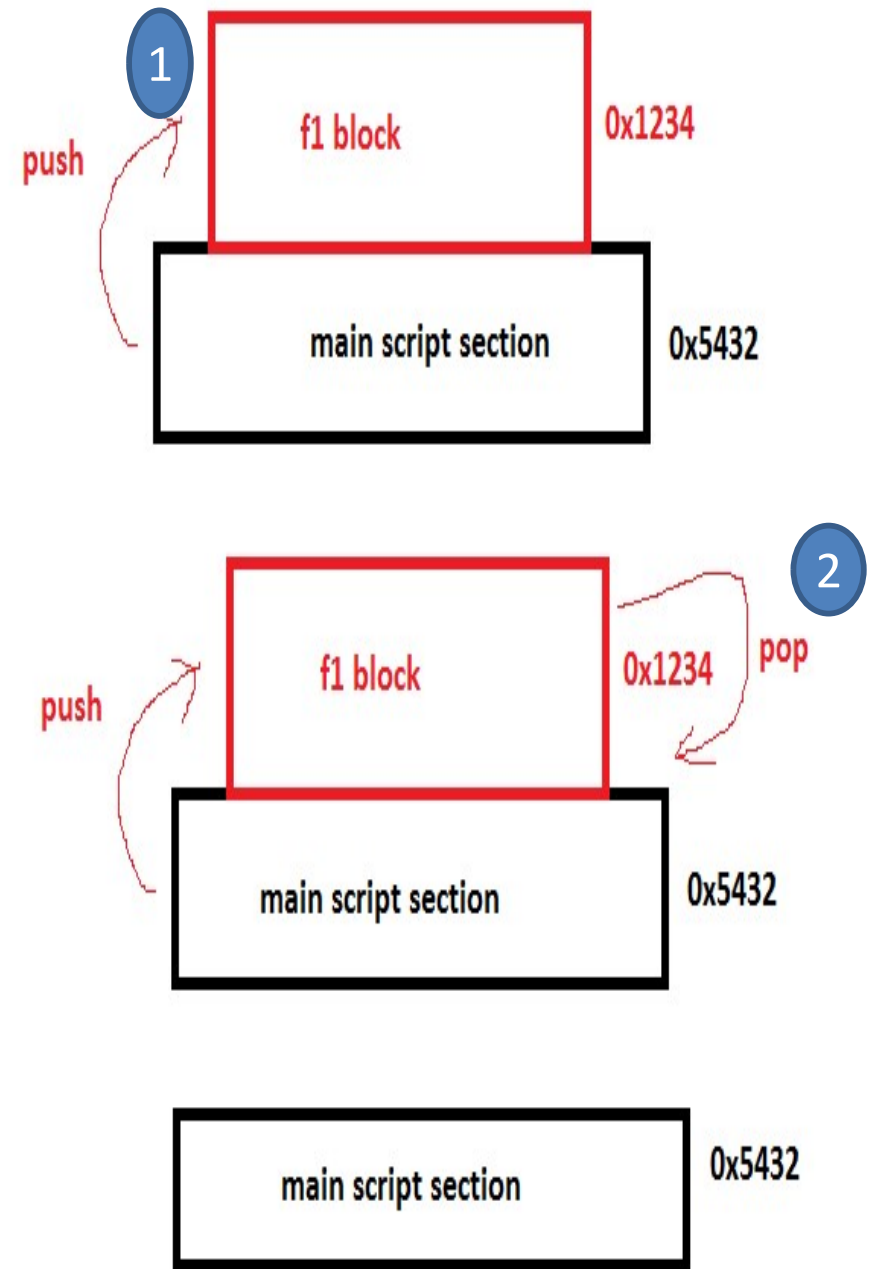
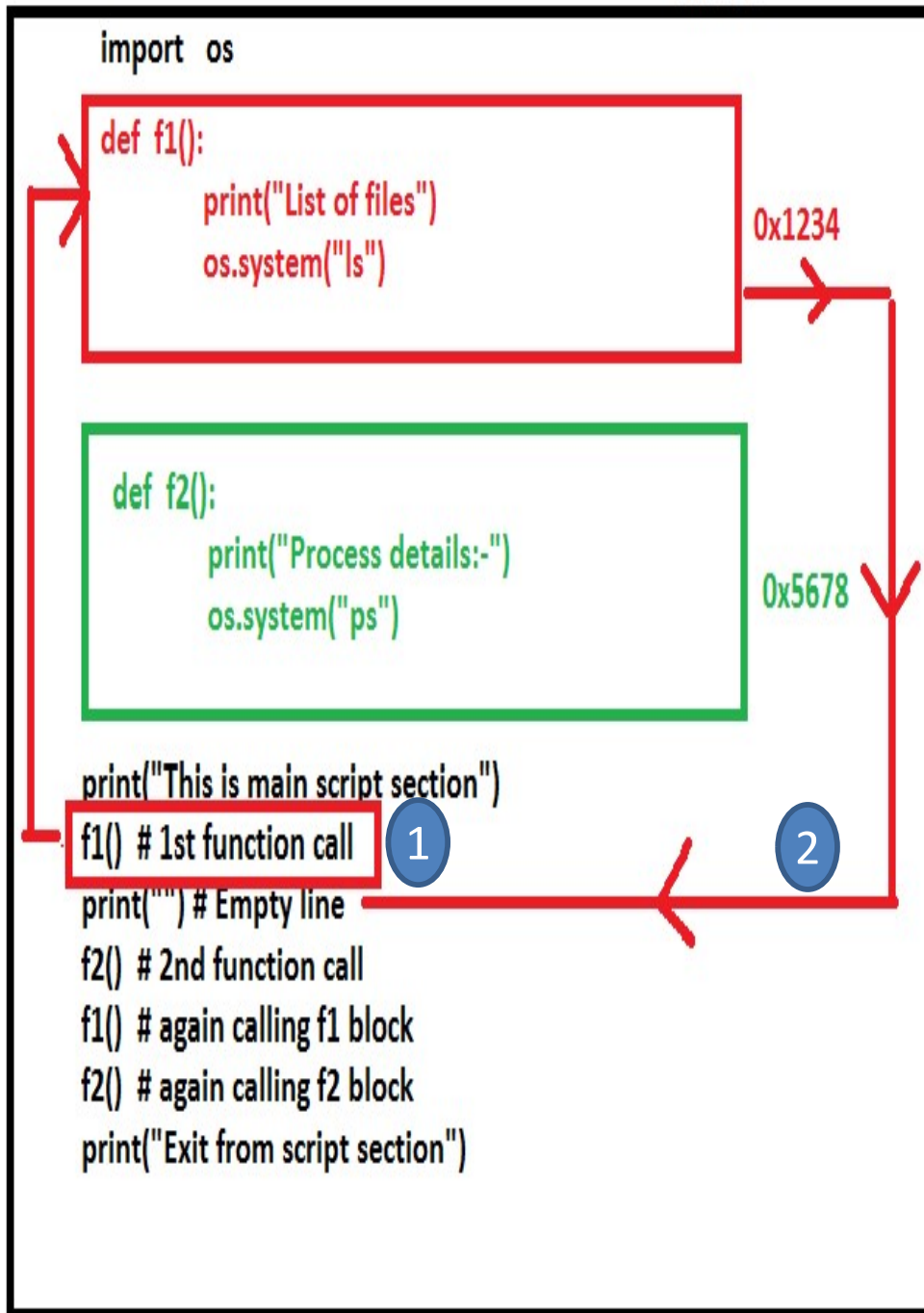
print("List of files")
os.system("ls")

print("process details:-")
os.system("ps")
....
print("List of files")
os.system("ls")
```

File : p2.py

0x5432





# Function call with arguments

- In function call, we can pass any type of values as arguments.

## Syntax :-

```
def function_name(arg1,arg2,arg3):
```

**Code block**

```
function_name(Value1,Value2,Value3)
```

*# function call with arguments*



# Function call with arguments

```
>>> def f1(a1,a2):  
...     print("Function call with arguments")  
...     print(type(a1))  
...     print(type(a2))  
...     print("Exit from function")
```

```
>>> f1(10,2.45) ←  
Function call with arguments  
<class 'int'>  
<class 'float'>  
Exit from function  
>>>  
>>> f1("abc",[]) ←  
Function call with arguments  
<class 'str'>  
<class 'list'>  
Exit from function
```

```
>>> f1((),{}) ←  
Function call with arguments  
<class 'tuple'>  
<class 'dict'>  
Exit from function  
>>>  
>>> f1({"S1","S2"},[]) ←  
Function call with arguments  
<class 'set'>  
<class 'list'>  
Exit from function  
>>>
```

# Function call with arguments

- We can call a function by using the following types of formal arguments-
- Required arguments **def f1(a1,a2,...an)**
- Default arguments **def f2(variable=value)**
- Variable-length arguments **def f3(\*args)**
- Keyword arguments **def f4(\*\*kwargs)**

- **Required Arguments**

- Required arguments are the arguments passed to a function in correct positional order.
- Here, the number of arguments in the function call should match exactly with the function definition.

## Example

```
def f1(a1,a2):  
    print("a1 value:{}\ta2 value:{}".format(a1,a2))
```

**f1(10,1.334) # function call with 2 arguments(int,float)**

**a1 value:10      a2 value:1.334**

**f1("AB",["D1","D2","D3"]) # function call with 2 arguments(str,list)**

**a1 value:AB      a2 value:['D1', 'D2', 'D3']**

- **Default Arguments**
- A default argument is an argument that assumes a default value if a value is not provided in the function call for that argument.
- `def function_name(var=value):`  
    code block

# Function call with arguments

```
>>> def f2 (a1=10,a2=2.46):
```

```
...     print(a1,a2)
```

```
...
```

```
>>> f2() # empty args
```

```
10 2.46
```

```
>>> f2("AB") # single args
```

```
AB 2.46
```

```
>>> f2("AB","SAB")
```

```
AB SAB
```

```
>>> def f3(user="root",port=22):
```

```
...     print(user,port)
```

```
...
```

```
>>> f3() # empty args
```

```
root 22
```

```
>>> f3("userA") # single args
```

```
userA 22
```

```
>>> f3("userA",120)
```

```
userA 120
```





```
def display (user,passwd, ip="127.0.0.1",port=22):  
    print("Login name: {}".format(user))  
    print("Password: {}".format(passwd))  
    print("IP-Address: {}".format(ip))  
    print("PORT Number: {}".format(port))
```

display("userA","Welcome") # required arguments

Login name:userA

Password:Welcome

IP-Address:127.0.0.1

PORT Number:22

display("userA","Welcome","10.20.30.40") # required arguments and default args

Login name:userA

Password:Welcome

IP-Address:10.20.30.40

PORT Number:22

display("userA","Welcome","10.20.30.40",1240) # required arguments and default args

Login name:userA

Password:Welcome

IP-Address:10.20.30.40

PORT Number:1240

# Function call with arguments

- **Variable-length Arguments**
- You may need to process a function for more arguments than you specified while defining the function.
- These arguments are called variable-length arguments and are not named in the function definition, unlike required and default arguments.
- `def f1(*args):`  
    code block

```
>>> def f1(*a1): # variable length arguments
...     print(type(a1))
...     print(a1)
...
>>>
>>> f1() # call with empty argument
<class 'tuple'>
()
>>> f1(10,2.34,"data") # call with args
<class 'tuple'>
(10, 2.34, 'data')
>>>
>>> f1(10,2.34,"data",["D1","D2","D3"]) # call with args
<class 'tuple'>
(10, 2.34, 'data', ['D1', 'D2', 'D3'])
>>>
```

```
>>> def f1(a1,a2=100,*a3): # required args,defaultargs,variablelength args
...     print("A1:{}".format(a1)) # required args
...     print("A2:{}".format(a2)) # default value
...     print("A3:{}".format(a3)) # variable length args-tuple
>>> f1("ab")
A1:ab
A2:100
A3:()
>>> f1("ab","Test")
A1:ab
A2:Test
A3:()
>>> f1("ab","Test","report1","report2","report3")
A1:ab
A2:Test
A3:('report1', 'report2', 'report3')
```



# Function call with arguments



- **Keyword Arguments**

- Keyword arguments are related to the function calls.

When you use keyword arguments in a function call, the caller identifies the arguments by the parameter name.

- This allows you to skip arguments or place them out of order because the Python interpreter is able to use the keywords provided to match the values with parameters.



# Function call with arguments

## Keyword Arguments

```
def f1(**kwargs):  
    code block
```

```
f1(variable=value)
```

```
>>> def f1(**a1): # keyword arguments
```

```
...     print(type(a1))
```

```
...     print(a1)
```

```
>>>
```

```
>>> f1() # empty argument
```

```
<class 'dict'>
```

```
{}
```

```
>>>
```

```
>>> f1(name="root",db="mysql",user="root") # keyword arguments
```

```
<class 'dict'>
```

```
{'name': 'root', 'db': 'mysql', 'user': 'root'}
```

```
>>>
```

```
>>> def f1(**kwargs):
```

```
...     for v in kwargs.keys():
```

```
...         print("{}\t{}".format(v,kwargs[v]))
```

```
>>> f1(name="root",db="mysql",user="root") # keyword arguments
```

```
name  root
```

```
db    mysql
```

```
user  root
```



```
>>> def display(a1,a2=100,*a3,**a4):  
...     print(a1) # required argument  
...     print(a2) # default argument  
...     print(a3) # variable length args  
...     print(a4) # keyword argument  
...
```

```
>>> display("AB") # required argument
```

AB

100

()

{}

```
>>> display("AB","TEST1") # required and default argument
```

AB

TEST1

()

{}

```
>>> display("AB","TEST1","TEST2","TEST3","TEST4")
```

AB

TEST1

('TEST2', 'TEST3', 'TEST4')

{}

```
display ("AB","Test1","Test2","Test3","Test4",user="root",passwd="Welcome",port=80)
```

Test1

('Test2', 'Test3', 'Test4')

{'user': 'root', 'passwd': 'Welcome', 'port': 80}

```
>>>
```



# Scope

```
count=1 # Script section
def f1():
    print("From function definition: {}".format(count))
    port=80 # default scope is local scope
    print("PORT Number: {}".format(port))
```

f1() # function call

From function definition: 1

PORT Number: 80

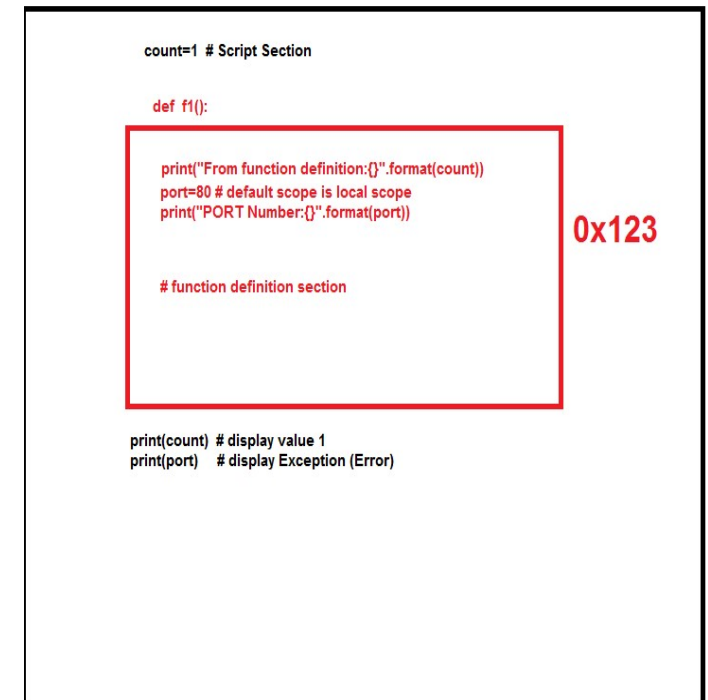
>>> **port # variable port is not defined in script section**

Traceback (most recent call last):

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

NameError: name 'port' is not defined

>>>



# global

- **global** keyword is a keyword that allows a user to modify a variable outside of the current scope.
- **global** keyword is used inside a function only when we want to do assignments or when we want to change a variable.

# Rules of global keyword

- If a variable is assigned a value anywhere within the function's body, it's assumed to be a local unless explicitly declared as global.
- Variables that are only referenced inside a function are implicitly global.
- We Use global keyword to use a global variable inside a function.
- There is no need to use global keyword outside a function.

```
>>> def f1():  
...     global port  
...     port=80  
...  
>>> f1() # function call  
>>> print(port) # global value  
80  
>>>
```

# return

- A return statement is used to end the execution of the function call and “returns” the result (value of the expression following the return keyword) to the caller.
- **return** statement can not be used outside the function.
- In python default return value is **None**.

```
>>> def f1():  
...     print("Hello")  
>>> rv=f1()  
Hello  
>>> rv == None  
True  
>>>
```



# python supports all types of return values

```
>>> def f1():  
...     return "abc" # string  
...
```

```
>>> f1()  
'abc'
```

```
>>> def f2():  
...     return 1.355 # float  
...
```

```
>>> f2()  
1.355
```

```
>>> def f3():  
...     return True # boolean  
...
```

```
>>> f3()  
True
```

```
>>> def f4():  
...     return ["D1","D2","D3"] # list  
...
```

```
>>> f4()  
['D1', 'D2', 'D3']
```

```
>>> def f5():  
...     return ("T1","T2") # tuple  
...
```

```
>>> f5()  
('T1', 'T2')
```

```
>>> def f6():  
...     return {"K1":"V1","K2":"V2"} # dict  
...
```

```
>>> f6()  
{'K1': 'V1', 'K2': 'V2'}
```

```
>>>
```

```
>>> def f7():  
...     return {"K1","K2",12,3,4,5.45} # set  
...
```

```
>>> f7()  
{3, 4, 'K2', 12, 'K1', 5.45}
```

```
>>>
```

- In Python, we can return multiple values from a function.
- In python function returns more than one value means the default type will be tuple(immutable).

```
>>> def f1():
```

```
...     return 10
```

```
...
```

```
>>> type(f1())
```

```
<class 'int'>
```

```
>>>
```

```
>>> def f1():
```

```
...     return 10, # more than one value, separated by ,(comma)
```

```
...
```

```
>>> type(f1())
```

```
<class 'tuple'>
```

```
>>>
```

```
>>> def f1():  
...     return 10,3.45,"ab",["D1","D2"],("T1","T2"),{"K1":"V"}  
  
...  
  
>>> type(f1())  
<class 'tuple'>  
  
>>> f1()  
(10, 3.45, 'ab', ['D1', 'D2'], ('T1', 'T2'), {'K1': 'V'})
```



# Activity - identify the errors

**Q1. def f1(a1,a2):**

    print("Hello")

f1(10,20,None)

**Q2. def f2(a1,a2,a3=0,a4):**

    print("Hello")

f2(100,200,300,400)

**Q3. def f3(a1,a2,a3=0):**

    print("Hello")

f3(10)

**Q4. def f4(a1,a2=0,\*a3,\*a4):**

    print("Hello")

f4(10)

**Q5. def f5(\*\*a2,\*a3):**

    print("Hello")

f5()



# Activity

Write a python program

Step 1: create a filename p25.py file by modifying p24.py

Step 2: Convert each step into separate function

Note: Declare local variable inside the function and return the processed value



# Lesson - 9

# Python Modules

- Python module is existing python source file
- Filename extension must be .py
- A module can also include runnable code.
- Reusability

# Module basics

- Each file in Python is considered a module.
- Everything within the file is encapsulated within a namespace (which is the name of the file)
- To access code in another module (file), import that file, and then access the functions or data of that module by prefixing with the name of the module, followed by a period.

File : ab.py

=====

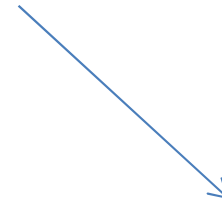
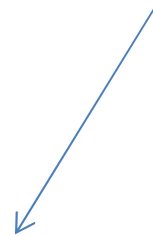
port=80

service="httpd"

def fx():

return 10

=====



**File : p1.py**

```
import ab
print (ab.port)
```

**File: p2.py**

```
import ab
print(ab.port)
print(ab.service)
```

**File: p3.py**

```
import ab
rv=ab.fx()
print("rv={}".format(rv))
```

# What import does

An import statement does three things:

- Finds the file for the given module
  - Compiles it to byte code
  - Runs the module's code to build any objects (top-level code, e.g., variable initialization)
- 
- env variable PYTHONPATH

# Activity

Step 1: Create a new file p26.py by modifying p25.py file

Step 2: remove all function calls.

Step 3: open a python shell and import p26.py file into current working shell

Use `help()` – understand module docs

# Python standard library

- `import sys`
- `sys.version`
- `sys.path`
- `sys.modules`
- `sys.argv`
- `sys.exit()`
- `sys.stdin`
- `sys.stdout`
- `help(sys)`
- `import os`
- `os.system("command")`
- `os.system("dir")`
- `os.system("ps -e|grep bash")`
- `os.popen("dir").read()`
- `os.popen("dir").readlines()`
- `os.listdir(".")`
- `os.mkdir("dirName")`
- `os.chdir("dirName")`
- `help(os)`



# Activity

Step 1: Open a python shell

Step 2: Import os module (`import os`)

Step 3: Display following information

- Display working directory
- Display list of files under current directory and count the total no.of files under current directory
- Display your running python shell process ID(PID)

# Activity

Write a python program

Create a new file p27.py

*File :pa.py*

*ip1=int(input("Enter a IP1 value: "))*

*ip2=int(input("Enter a IP2 value: "))*

*total=ip1+ip2*

*Print("Sum of ip1 and ip2 value:{}".format(total))*

Modify the above code with command line arguments.

# Python standard library

- `import math`
- `import pprint`
- `import json`
- `import re`
- `import time`
- `import cProfile`

- More standard module refer this URL

[The Python Standard Library — Python 3.9.5 documentation](#)

# import vs from ... import

- import brings in a whole module; you need to qualify the names by the module name (e.g., sys.argv)
- “import **from**” copies names from the module into the current module; no need to qualify them (note: these are copies, not links, to the original names)

**from module\_x import junk**

junk() # not module\_x.junk()

**from module\_x import \*** # gets all top-level

# names from module\_x

# Module Packages

- When using import, we can give a directory path instead of a simple name. A directory of Python code is known as a “package”:  
**import dir1.dir2.module**  
**or**  
**from dir1.dir2.module import x**  
will look for a file dir1/dir2/module.py
- Note: dir1 must be within one of the directories in the PYTHONPATH
- Note: dir1 and dir2 must be simple names, not using platform-specific syntax (e.g., no C:\)



# Python pip

# What is Pip?

- **pip** is a tool for installing and managing Python packages.
- pip can be install on various operation systems: Linux, Mac, Windows, etc

# How to install <module> in winx?

- **C:\Users\User>python -m pip install fabric**
- Requirement already satisfied: fabric in  
c:\users\user\appdata\local\programs\p
- site-packages (2.4.0)



# Install Pip on MacOS

- Install pip on MacOS,  
using **easy\_install** command and  
upgrade pip to the latest version:
- **sudo easy\_install pip**
- **sudo pip install --upgrade pip**

# get-pip.py

- For mac os , easy\_install has been deprecated.
- First of all download the **get-pip** file
- **curl <https://bootstrap.pypa.io/get-pip.py> -o get-pip.py**
- **python get-pip.py** # run this file to install pip

# Install Pip in Ubuntu

- Install pip in Ubuntu, using apt-get package manager:
- `sudo apt-get update`
- `sudo apt-get install python-pip`
- `sudo pip install --upgrade pip`

# Install Pip in CentOS

- Install pip in CentOS from [EPEL repository](#), using yum package manager:
- `sudo yum update`
- `sudo yum install epel-release`
- `sudo yum install python-pip`
- # CentOS-7 and higher
- `sudo pip install --upgrade pip`
- # CentOS-6 (the last stable version of PIP that is compatible with Python 2.6)
- `sudo pip install pip==9.0.3`

# To list all modules

- pydoc modules
- `>>> help('modules')`
- # print all names exported by the module  
`print(dir(module))`



# Lesson - 10

# Python Errors & Exceptions

1. Syntax errors
2. Logical errors (Exceptions)

# Python Logical Errors (Exceptions)

- Errors that occur at runtime (after passing the syntax test) are called **exceptions** or logical errors.
- We can view all the built-in exceptions using the built-in `local()` function as follows:
- **`print(dir(locals()['__builtins__']))`**



# Exceptions in Python

- Python has many built-in exceptions that are raised when your program encounters an error
- When these exceptions occur, the Python interpreter stops the current process and passes it to the calling process until it is handled. If not handled, the program will crash.

# Exception block

**try:**

code block

**except** Exception as eobj:

Handle Exception

**else:**

There is no Exception

**finally:**

Always running



# Example

- `var=100`
- `print(VAR)`
- `print("List of files:-")`
- `for v in os.listdir("."):
 print(v)`
- `print("Exit from script")`

```
try:
    var=100
    print(VAR)
except Exception as eobj:
    print(eobj)
```

```
print("List of files:-")
for v in os.listdir("."):
    print(v)
```

```
print("Exit from script")
```

# Raising Exceptions in Python

- In Python programming, exceptions are raised when errors occur at runtime.
- We can also manually raise exceptions using the raise keyword.
- ```
>>> try:  
...     n=input("Enter a login name:")  
...     if n != "root":  
...         raise NameError ("Sorry your login name is not matched")  
... except Exception as eobj:  
...     print(eobj)  
...  
Enter a login name:asfdsad  
Sorry your login name is not matched
```

# Activity

Write a python program

create a new file p28.py

Handle the exceptions in the following cases

*Case 1:*

*port=8080*

*print(PORT)*

*Case 2:*

*F=Open("invalid file")*

*F.readlines()*

*F.close()*

*Case 3:*

*import openpyxl*

*Module Not Found*



# Lesson - 11

# Functional Style programming

- Functional programming decomposes a problem into a set of functions.
- Ideally, functions only take inputs and produce outputs, and don't have any internal state that affects the output produced for a given input.
- Well-known functional languages include the ML family.
- Every function's output must only depend on its input.

# Functional Vs OOPs

- Functional programming can be considered the opposite of object-oriented programming.
- Objects are little capsules containing some internal state along with a collection of method calls that let you modify this state, and programs consist of making the right set of state changes.
- Functional programming wants to avoid state changes as much as possible and works with data flowing between functions.



# List comprehension

- List comprehension offers a shorter syntax when you want to create a new list based on the values of an existing list.
- `newlist = [expression for item in iterable]`

```
L1=[ ] # empty list
```

```
for var in range(5):
```

```
    r=var+100
```

```
    L1.append(r)
```

```
print(L1)
```

```
[ 100, 101, 102, 103, 104 ]
```

Vs `L2=[ var+100 for var in range(5)]`

```
print(L2)
```

```
[100,102,102,103,104]
```



# List comprehension with conditional statements

```
L1=[]
```

```
for var in range(15):
```

```
    if var > 10:
```

```
        r=var+100
```

```
        L1.append(r)
```

```
    else:
```

```
        r=var+500
```

```
        L1.append(r)
```

```
[var+100 if var > 10 else var+500 for var in range(15)]
```

```
L1
```

```
[500, 501, 502, 503, 504, 505, 506, 507, 508, 509, 510, 111, 112, 113, 114]
```



# List comprehension with string methods

```
s='welcome'
```

```
[var.upper() for var in s]
```

```
['W', 'E', 'L', 'C', 'O', 'M', 'E']
```

# Activity

Modify the following code into list comprehension style

```
L=[]  
F=open("D:\\emp.csv")  
for var in F.readlines():  
    var=var.strip()  
    s=var.upper()  
    L.append(s)
```

# Defining an Anonymous Function

## With lambda

- **def** functionName() – named function
- **lambda** – unnamed function
- $\lambda$
- The term *lambda* comes from **lambda calculus**, a formal system of mathematical logic for expressing computation based on function abstraction and application.

# lambda

- `lambda <parameter_list>: <expression>`

| Component                           | Meaning                                                                                             |
|-------------------------------------|-----------------------------------------------------------------------------------------------------|
| <code>lambda</code>                 | The keyword that introduces a lambda expression                                                     |
| <code>&lt;parameter_list&gt;</code> | An optional comma-separated list of parameter names                                                 |
| <code>:</code>                      | Punctuation that separates <code>&lt;parameter_list&gt;</code> from <code>&lt;expression&gt;</code> |
| <code>&lt;expression&gt;</code>     | An expression usually involving the names in <code>&lt;parameter_list&gt;</code>                    |

# lambda expression

- The value of a lambda expression is a callable function like `def functionname`.
- It takes arguments, as specified by `<parameter_list>`, and returns a value, as indicated by `<expression>`

|                                      |    |                                                          |
|--------------------------------------|----|----------------------------------------------------------|
| <code>def fx(a):</code>              |    | <code>lambda a:a+100</code>                              |
| <code>    return a+100</code>        | Vs | <code>&lt;function __main__.&lt;lambda&gt;(a)&gt;</code> |
| <b><code>fx(10) =&gt; 110</code></b> |    | <b><code>fy=lambda a:a+100</code></b>                    |
|                                      |    | <b><code>fy(100) =&gt; 110</code></b>                    |

# Lambda exp and function call

```
f1=lambda a,b:a+b
```

```
f1(10,20) => 30
```

```
f2=lambda a,b:a>b
```

```
f2(100,5) => True
```

```
def f(a1):
```

```
    return a1+100
```

```
f3=lambda a:f(a)
```

```
f3(10) => 110
```



# Activity

Write a python program

Create a new file – p29.py

Modify the below codes into lambda style

*def fx(a):*

*return a+ “.log”*

*Files=[]*

*for var in ['p1', 'p2', 'p3', 'p4', 'p5']:*

*r=fx(var)*

*Files.append(r)*



# Lesson - 12

# functionaltools

- `map`  $\Rightarrow$  `map(function, collection)`
- `filter`  $\Rightarrow$  `filter(function, collection)`
- `reduce`  $\Rightarrow$  `reduce(function, collection)`

# map()

- **map(<function>,collection)**
- map() returns in iterator that yields the results of applying function <function> to each element of <iterable>.

```
L1=[] # empty list
```

```
for var in range(5):  
    r=var+100  
    L1.append(r)  
print(L1)
```

```
L1=[]  
def f1(a):  
    return a+100
```

```
for var in range(5):  
    r=f1(var)  
    L1.append(r)  
print(L1)
```

```
map(f1,range(5))
```

```
<map at 0x502cd90>
```

```
L1=list(map(f1,range(5)))  
print(L1)
```

[100, 101, 102, 103, 104]



# Activity

- `L1=list(map(f1,range(5)))`
- Modify the above code by replacing `f1` with `lambda`

# map

- `map()` – function supports arithmetic, comparison expression
- `list(map(lambda a,b:a+b,[10,20,30,40],[100,200,300,400]))`  
`[110, 220, 330, 440]`
- `list(map(lambda a,b:a>b,[120,20,130,450],[100,200,300,400]))`  
`[True, False, False, True]`

# Activity

**Predict the output**

```
def f1(a):  
    if a == 'p1':  
        return a+".log"  
    elif a == 'p2':  
        return a+".java"  
    elif a == 'p3':  
        return a+".py"  
    else:  
        return a+".txt"  
  
list(map(lambda a:f1(a),['p1','p2','p3','p4','p5']))
```

# filter

- **filter()** allows you to select or filter items from an iterable based on evaluation of the given function.
- **filter(<function>,collection)**
- **filter(<function>, <iterable>)** applies function <function> to each element of <iterable> and returns an iterator that yields all items for which <function> is True.



## Filter- examples

- `filter(lambda a:a>10,range(15))`
- `<filter at 0x507f250>`
- `list(filter(lambda a:a>10,range(15)))`
- `[11, 12, 13, 14]`
  
- `fnames=['p1.log','test.java','p1.c','p2.java','p1.java','p2.cpp']`
- `list(filter(lambda a:a in 'p1.c',fnames)) => ['p1.c']`
  
- `list(filter(lambda a:a == 'p1.c' or a == 'p1.java' or a == 'test.java',fnames))`  
`['test.java', 'p1.c', 'p1.java']`

# Activity

Write a python program

Step 1: Create a new file p30.py

Step 2: Given Depts list

**Depts=['admin','sales','crm','QA','HR','prod']**

Step 3: Filter following departments from the list  
sales,QA,prod

Note : use comprehension and filter function

# reduce

- **reduce() - Reducing an Iterable to a Single Value.**
- In python 3.x to use reduce(), you need to import it from a module called functools.

```
L=[10,20,30,40,50]
```

```
s=0
```

```
for var in L:
```

```
    s=s+var
```

```
print(s) =>150
```

```
from functools import reduce
```

```
print(reduce(lambda s,var:s+var,L)) => 150
```

# Activity

Write a python program

Create a new file : p31.py file

Given **LB=[0.35,2.32,3.23,4.25,0.42]**

Calculate Sum CPU LoadBalance

Test whether the total load balance is above 10.5

if so display warning message “**High cpu utlization**”

Note: use reduce()



# Lesson - 13



# Introduction about python OOPs

- Class
- Object
- Method

# class

- Classes are used to create new user-defined data structures that contain arbitrary information about object.
- We can think class is a blueprint of the object.
- Syntax about class

```
class classname:  
    members
```

**class** is a keyword, class name is user defined.

# Class - Examples

1

```
class box:  
    "empty class"  
    pass
```

```
print(type(box))  
<class 'type'>
```

2

```
class box:  
    bname='Box-1'  
    bsize=134
```

class  
attributes

```
# classname.attribute  
print(box.bname)  
print(box.bsize)
```

```
box.bname="Box-2"  
box.bsize=450
```

We can  
overwrite  
class attrs

```
print(box.bname,box.bsize)
```



# NameError vs AttributeError

```
var=100
```

```
print(VAR) => Name Error
```

```
class Box:
```

```
    var=100
```

```
print(Box.VAR) => Attribute Error
```

# Activity

## **Write a python program**

Step 1: Create a file name: p32.py

Step 2: Create a class name Employee

Step 3: Add following employee attribute details to Employee class

*Employee name (ename), Employee ID(eid)*

and initialize them with default values

Step 4: Display employee details from outside the class

# Object

- While the class is the blueprint, an *instance* is a copy of the class with *actual* values, literally an object belonging to a specific class.
- An object (instance) is an instantiation of a class.
- From single class we can create more than one object.

```
class box:  
    bname='Box-1'  
    bsize=123
```

```
obj1=box()
```

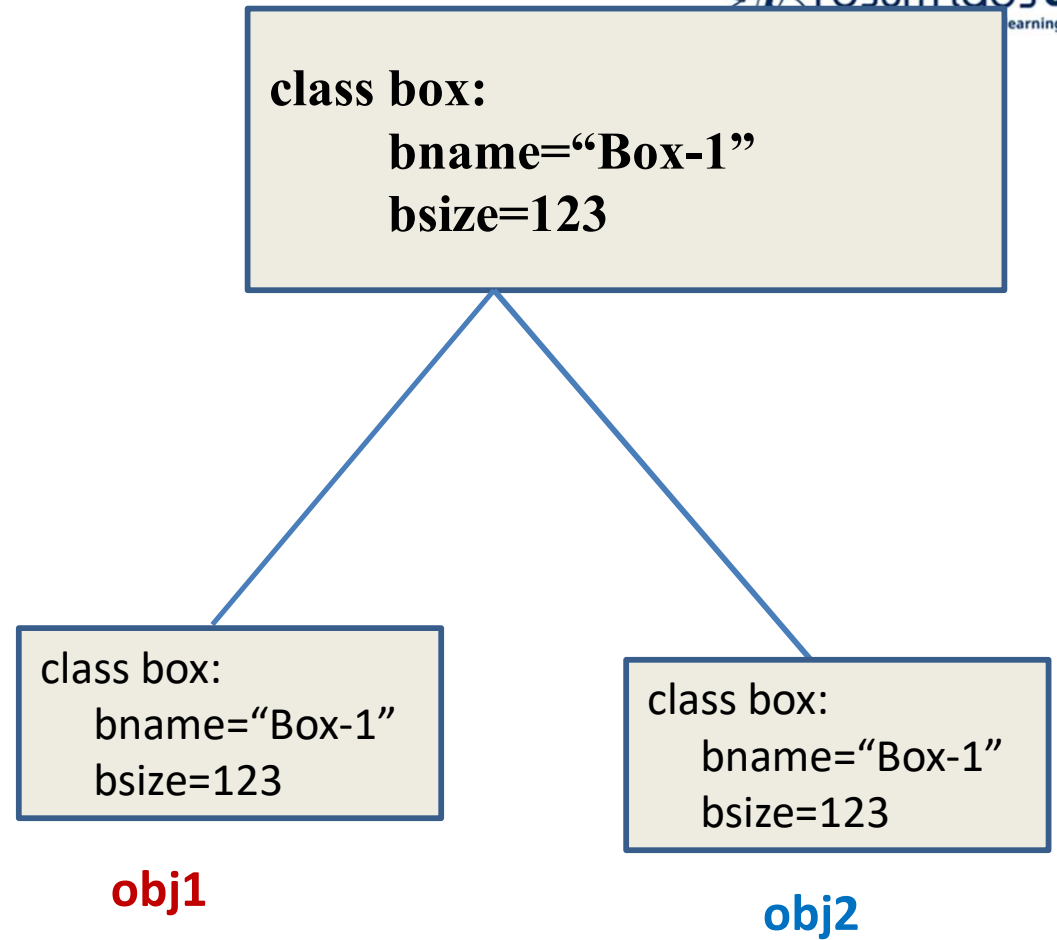
```
obj1
```

```
<__main__.box at 0x507f700>
```

```
obj2=box()
```

```
obj2
```

```
<__main__.box at 0x507ffd0>
```

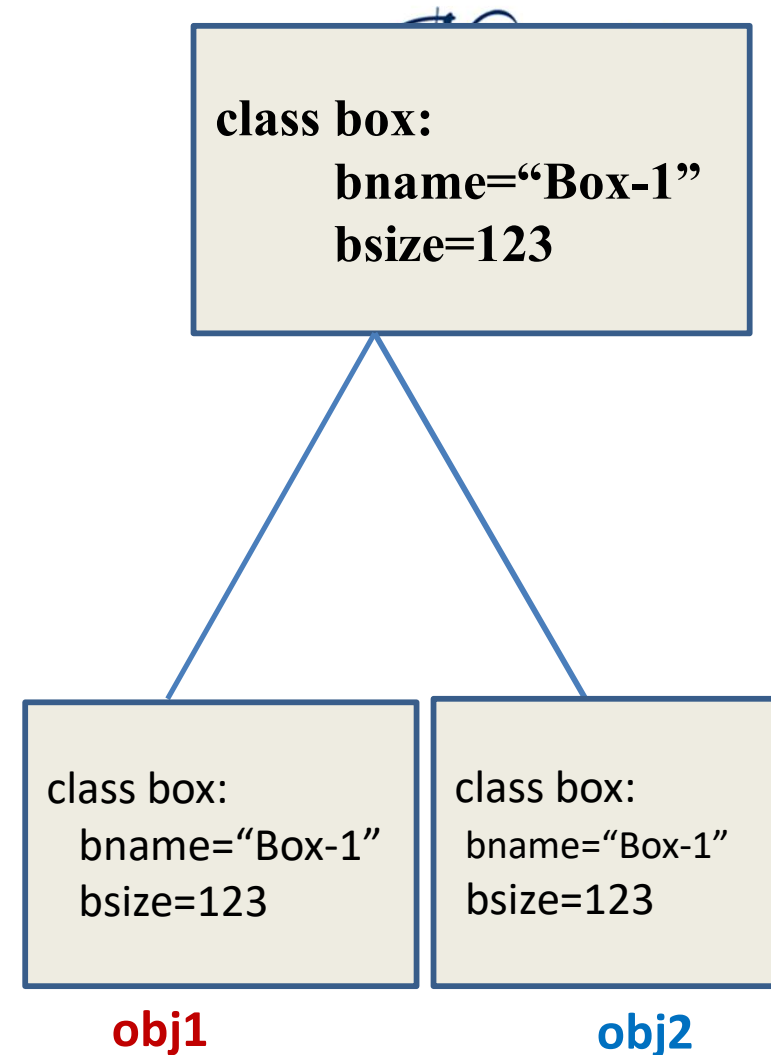




```
class box:  
    bname='Box-1'  
    bsize=123
```

```
obj1=box()  
print(obj1.bname,obj1.bsize)
```

```
obj2=box()  
print(obj2.bname,obj2.bsize)
```





```
class box:
```

```
    bname='Box-1'
```

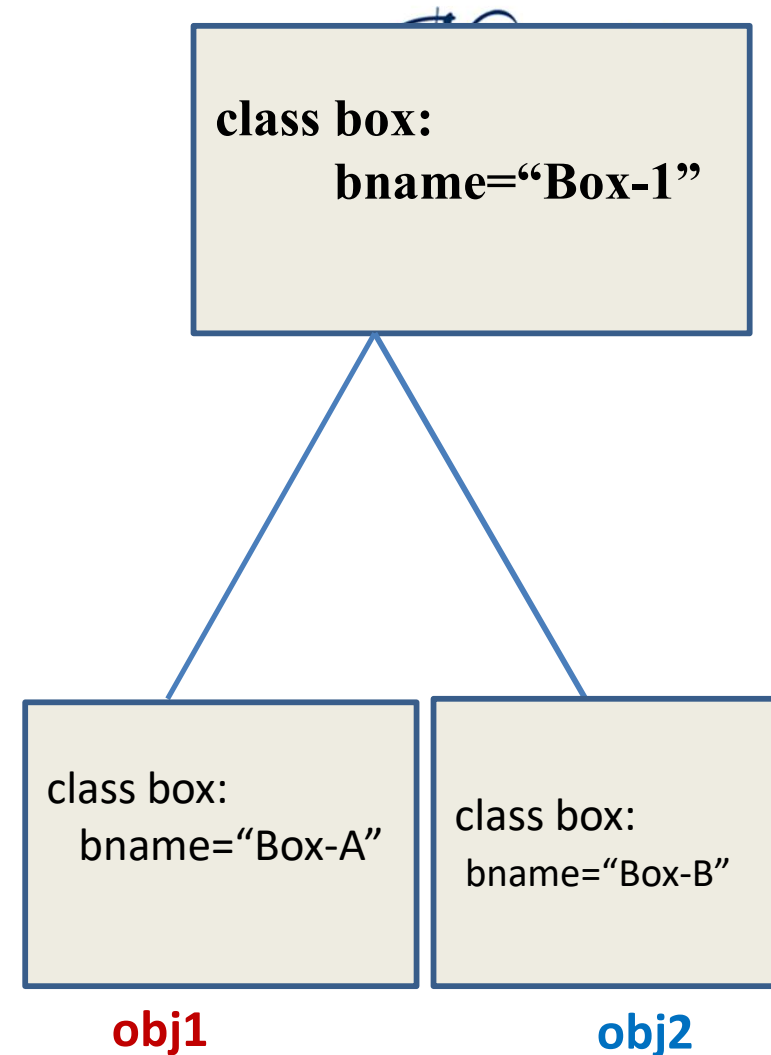
```
obj1=box()
```

```
obj2=box()
```

```
obj1.bname="Box-A"
```

```
obj2.bname="Box-B"
```

```
print (obj1.bname, obj2.bname)
```





# Predict the output

```
class server:  
    sname="default-Sever"
```

```
obj1=server()
```

```
obj1.sname="Unix"
```

```
obj2=server()
```

```
obj2.sname="Linux"
```

```
print(obj1.sname,obj2.sname)  #(A)
```

```
obj1.sname="sunos"
```

```
obj2.sname="aix"
```

```
print(obj1.sname,obj2.sname)  #(B)
```

# Activity

Write a python program

Step 1: Create a new file – p33.py by modifying p32.py

Step 2: Dynamically create multiple objects and initialize them with values

Step 3: Display each employee details (each object)





# Lesson - 14

# Methods

- Methods are functions defined inside the body of a class.
- They are used to define the behaviors of an object.

```
def f1():  
    print("Hello")
```

```
print(type(f1)) => <class 'function'>
```

```
class Cname:
```

```
    def f1():  
        print("Hello")
```

```
obj=Cname()
```

```
print(type(obj.f1)) => <class 'method'>
```



# TypeError

```
def fx():  
    print("Hello")
```

```
fx()
```

```
fx(10) # TypeError: fx() takes 0 positional arguments but 1 was given
```

```
class Cname:  
    def fx():  
        print("Hello")
```

```
obj=Cname()
```

```
obj.fx() # TypeError: fx() takes 0 positional arguments but 1 was given
```

```
class cname:
```

```
    def method1(self):
```

```
        print("MethodCall")
```

```
obj1=cname()
```

```
obj2=cname()
```

```
obj3=cname()
```

```
obj1.method1() # method1(obj1)
```

```
obj2.method1() # method1(obj2)
```

```
obj3.method1() # method1(obj3)
```

```
class box:
```

```
    bname="defaultName"
```

```
    def f1(self,a1):  
        self.bname=a1  
        print("This is initialized block")
```

```
    def f2(self):  
        print("Box Name: {}".format(self.bname))
```

```
obj1=box()
```

```
obj1.f1("Box-1")
```

```
obj1.f2()
```

```
obj2=box()
```

```
obj2.f1("Box-2")
```

```
obj2.f2()
```

# Activity

Write a python program

Step 1: create a new file p34.py by modifying p33.py

Step 2: Create a 3 methods:

    getdata() – To initialize employee details

    display() – To display employee details

    update() – To update employee working  
department

# Private member

**Class attribute - starts with double underscore\_\_**

class One:

    fname="p1.log"           # public variable

    \_\_passwd="welcome"   # user defined private variable

obj=One()

obj.fname => p1.log

obj.\_\_passwd => Attribute Error

One.\_\_passwd => Attribute Error

# How to access private member?

Class attribute - starts with double underscore\_\_  
class One:

```
    fname="p1.log"          # public variable
    __passwd="welcome"      # user defined private variable
    def f1(self):
        print("file name: {}".format(self.fname))
        print("Password: {}".format(self.__passwd))
```

```
obj=One()
obj.f1()
```



# Activity

Write a python program

Step 1: create a new file p35.py by modifying p34.py file

Step 2: replace the existing class attribute as private variables



# Lesson - 15



# CASE STUDIES



Thank you