

# Usman Ghias – COD Crafters

## Python Tutorial

```
In [103]: import sys
import keyword
import operator
from datetime import datetime
import os
```

### Keywords

Keywords are the reserved words in Python and can't be used as an identifier

```
In [3]: print(keyword.kwlist) # List all Python Keywords
```

```
['False', 'None', 'True', 'and', 'as', 'assert', 'async', 'await', 'break', 'class', 'continue', 'def', 'del', 'elif', 'else', 'except', 'finally', 'for', 'from', 'global', 'if', 'import', 'in', 'is', 'lambda', 'nonlocal', 'not', 'or', 'pass', 'raise', 'return', 'try', 'while', 'with', 'yield']
```

```
In [4]: len(keyword.kwlist) # Python contains 35 keywords
```

```
Out[4]: 35
```

### Identifiers

An identifier is a name given to entities like class, functions, variables, etc. It helps to differentiate one entity from another.

```
In [13]: 1var = 10 # Identifier can't start with a digit
```

```
File "<ipython-input-13-37e58aaf2d3b>", line 1
 1var = 10 # Identifier can't start with a digit
          ^
SyntaxError: invalid syntax
```

```
In [14]: val2@ = 35 # Identifier can't use special symbols
```

```
File "<ipython-input-14-cfbf60736601>", line 1
val2@ = 35 # Identifier can't use special symbols
          ^
SyntaxError: invalid syntax
```

```
[15]: import = 125 # Keywords can't be used as identifiers
```

In

```
File "<ipython-input-15-f7061d4fc9ba>", line 1
    import = 125 # Keywords can't be used as identifiers
               ^
SyntaxError: invalid syntax
```

In [16]:

```
"""
Correct way of defining an identifier
(Identifiers can be a combination of letters in lowercase (a to z) or uppercase (
"""
val2 = 10
```

In [17]:

```
val_ = 99
```

## Comments in Python

Comments can be used to explain the code for more readability.

In [18]:

```
# Single Line comment
val1 = 10
```

In [19]:

```
# Multiple
# line
# comment
val1 = 10
```

```
Multiple
line
comment
...  
val1 = 10
```

```
Multiple
line
comment
...  
val1 = 10
```

In [20]:

```
...  
val1 = 10
```

In [21]:

```
"""
```

In

## Statements

Instructions that a Python interpreter can execute.

```
[27]: # Single Line statement
p1 = 10 + 20
p1
```

```
Out[27]: 30
```

```
In [28]: # Single Line statement
p2 = ['a', 'b', 'c', 'd']
p2
```

```
Out[28]: ['a', 'b', 'c', 'd']
```

```
In [26]: # Multiple Line statement
p1 = 20 + 30 \
+ 40 + 50 + \
+ 70 + 80
p1
```

```
Out[26]: 290
```

```
In [29]: # Multiple Line statement
p2 = ['a',
      'b',
      'c',
      'd']
p2
```

```
Out[29]: ['a', 'b', 'c', 'd']
```

## Indentation

Indentation refers to the spaces at the beginning of a code line. It is very important as Python uses indentation to indicate a block of code. If the indentation is not correct we will end up with **IndentationError** error.

```
if p == 10:
    print ('P is equal to 10') # correct indentation
```

```
In [37]: p = 10
```

In

P is equal to 10

```
In [38]: # if indentation is skipped we will encounter "IndentationError: expected an inde
p = 10
if p == 10:

print ('P is equal to 10')
      File "<ipython-input-38-d7879ffaae93>", line 3
      print ('P is equal to 10')
      ^
IndentationError: expected an indented block
```

```
[39]: for i in range(0,5):
      print(i)          # correct indentation
```

```
0
1
2
3
4
```

```
In [43]: # if indentation is skipped we will encounter "IndentationError: expected an inde
for i in range(0,5): print(i)
      File "<ipython-input-43-4a6de03bf63e>", line 2
      print(i)
      ^
IndentationError: expected an indented block
```

```
In [45]: for i in range(0,5): print(i) # correct indentation but less readable
```

```
0
1
2
3
4

j=20
for i in range(0,5):
    print(i) # inside the for loop
print(j) # outside the for loop
```

```
0
1
2
3
4
20
```

```
In [48]: 1
```

In

## Docstrings

- 1) Docstrings provide a convenient way of associating documentation with functions, classes, methods or modules.
- 2) They appear right after the definition of a function, method, class, or module.

```
In [49]: def square(num):
    '''Square Function:- This function will return the square of a number'''
    return num**2
```

```
[51]: square(2)
```

```
Out[51]: 4
```

```
In [52]: square.__doc__ # We can access the Docstring using __doc__ method
```

```
Out[52]: 'Square Function :- This function will return the square of a number'
```

```
In [53]: def evenodd(num):
    '''evenodd Function :- This function will test whether a number is Even or Odd
    if num % 2 == 0:
        print("Even Number")
    else:
        print("Odd Number")
```

```
In [54]: evenodd(3)
```

```
Odd Number
```

```
In [55]: evenodd(2)
```

```
Even Number
```

```
In [56]: evenodd.__doc__
```

```
Out[56]: 'evenodd Function :- This function will test whether a number is Even or Odd'
```

## Variables

A Python variable is a reserved memory location to store values. A variable is created the moment you first assign a value to it.

```
In [75]:
```

```
p = 30
```

```
In [76]: ''' id() function returns the "identity" of the
object.
The identity of an object - Is an integer
```

In

```

- Guaranteed to be unique
- Constant for this object during its lifetime.
...
id(p)

```

Out[76]: 140735029552432

In [77]: `hex(id(p)) # Memory address of the variable`

Out[77]: '0x7fff6d71a530'

```

[94]: p = 20 #Creates an integer object with value 20 and assigns the variable p to p
      q = 20 # Create new reference q which will point to value 20. p & q will be pointing
      r = q # variable r will also point to the same location where p & q are pointing
      p, type(p), hex(id(p)) # Variable P is pointing to memory Location '0x7fff6d71a3

```

Out[94]: (20, int, '0x7fff6d71a3f0')

In [95]: `q, type(q), hex(id(q))`

Out[95]: (20, int, '0x7fff6d71a3f0')

In [96]: `r, type(r), hex(id(r))`

Out[96]: (20, int, '0x7fff6d71a3f0')

Diagram illustrating variable references:

```

graph TD
    p --> val[20  
0x7fff6d71a3f0]
    q --> val
    r --> val

```

In [146]: `p = p + 10 # Variable Overwriting`  
`p`

Out[146]: 30

In

## Variable Assignment

```
In [100]: intvar = 10 # Integer variable
           floatvar = 2.57 # Float Variable
           strvar = "Python Language" # String variable

           print(intvar)
           print(floatvar)
           print(strvar)
```

```
10
2.57
Python Language
```

Usman Ghias

## Multiple Assignments

```
In [102]: intvar , floatvar , strvar = 10,2.57,"Python Language" # Using commas to separate
           print(intvar)
           print(floatvar)
           print(strvar)
```

```
10
2.57
Python Language
```

```
In [105]: p1 = p2 = p3 = p4 = 44 # All variables pointing to same value
           print(p1,p2,p3,p4)
```

```
44 44 44 44
```

## Data Types

### Numeric

```
In [135]: val1 = 10 # Integer data type
           print(val1)
           print(type(val1)) # type of object
           print(sys.getsizeof(val1)) # size of integer object in bytes
           print(val1, " is Integer?", isinstance(val1, int)) # val1 is an instance of int
           c

10
<class 'int'>
28
10  is Integer? True
```

```
In [126]: val2 = 92.78 # Float data type
           print(val2)
           print(type(val2)) # type of object
           print(sys.getsizeof(val2)) # size of float object in bytes
           print(val2, " is float?", isinstance(val2, float)) # Val2 is an instance of float
           c

92.78
<class 'float'>
24
92.78  is float? True
```

```
In [136]: val3 = 25 + 10j # Complex data type
           print(val3)
           print(type(val3)) # type of object
           print(sys.getsizeof(val3)) # size of float object in bytes
           print(val3, " is complex?", isinstance(val3, complex)) # val3 is an instance of
           c

(25+10j)
<class 'complex'>
```

```
32
(25+10j)  is complex? True
```

```
In [119]: sys.getsizeof(int()) # size of integer object in bytes
```

```
Out[119]: 24
```

```
In [120]: sys.getsizeof(float()) # size of float object in bytes
```

```
Out[120]: 24
```

```
In [138]: sys.getsizeof(complex()) # size of complex object in bytes
```

```
Out[138]: 32
```

## Boolean

Boolean data type can have only two possible values **true** or **false**.

```
In [139]: bool1 = True
```

```
In [140]: bool2 = False
```

```
In [143]: print(type(bool1))
```

```
<class 'bool'>
```

```
In [144]: print(type(bool2))
```

```
<class 'bool'>
```

```
In [148]: isinstance(bool1, bool)
```

```
Out[148]: True
```

```
In [235]:
```

```
bool(0)
```

```
Out[235]: False
```

```
In [236]:
```

```
bool(1)
```

```
Out[236]: True
```

```
In [237]: bool(None)
```

```
Out[237]: False
```

```
In [238]: bool (False)
```

```
Out[238]: False
```

# Strings

## String Creation

```
In [193]: str1 = "HELLO PYTHON"
```

```
print(str1) HELLO PYTHON
```

```
In [194]: mystr = 'Hello World' # Define string using single quotes
```

```
print(mystr) Hello World
```

```
In [195]: mystr = "Hello World" # Define string using double quotes
```

```
print(mystr) Hello World
```

```
In [196]: mystr = '''Hello  
World''' # Define string using triple quotes
```

```
print(mystr)
```

```
Hello  
World
```

```
In [197]: mystr = """Hello  
World"""" # Define string using triple quotes
```

```
print(mystr)
```

```
Hello  
World
```

```
In [198]: mystr = ('Happy '  
'Monday '  
'Everyone')
```

```
print(mystr)
```

```
Happy Monday Everyone
```

```
In [199]: mystr2 = 'Woohoo '  
mystr2 = mystr2*5  
mystr2
```

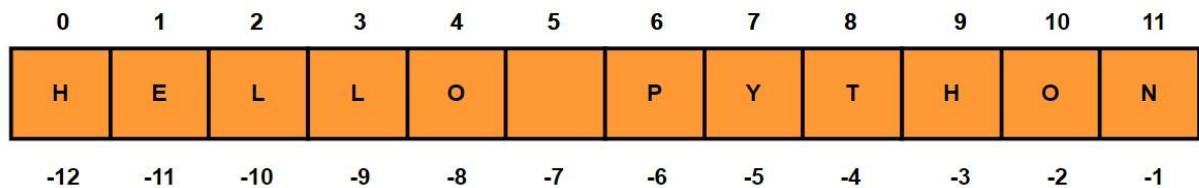
```
Out[199]: 'Woohoo Woohoo Woohoo Woohoo Woohoo '
```

```
In [200]: len(mystr2) # Length of string
```

Out[200]: 35 **String**

## Indexing

### Forward Indexing



### Backward Indexing

In [201]:

str1

Out[201]: 'HELLO PYTHON'

In [202]: str1[0] # First character in string "str1"

Out[202]: 'H'

In [203]: str1[len(str1)-1] # Last character in string using len function

Out[203]: 'N'

In [204]: str1[-1] # Last character in string

Out[204]: 'N'

In [205]: str1[6] #Fetch 7th element of the string

Out[205]: 'P'

In [206]:

str1[5]

Out[206]: ''

## String Slicing

In [207]: str1[0:5] # String slicing - Fetch all characters from 0 to 5 index Location excl

Out[207]: 'HELLO'

```
In [208]: str1[6:12] # String slicing - Retreive all characters between 6 - 12 index loc ex
```

```
Out[208]: 'PYTHON'
```

```
In [209]: str1[-4:] # Retreive last four characters of the string
```

```
Out[209]: 'THON'
```

UsmanGhias

In

```
[210]: str1[-6:] # Retreive last six characters of the string
```

```
Out[210]: 'PYTHON'
```

```
In [211]: str1[:4] # Retreive first four characters of the string
```

```
Out[211]: 'HELL'
```

```
In [212]: str1[:6] # Retreive first six characters of the string
```

```
Out[212]: 'HELLO '
```

## Update & Delete String

```
In [213]:
```

```
str1
```

```
Out[213]: 'HELLO PYTHON'
```

```
In [214]: #Strings are immutable which means elements of a string cannot be changed once they have been assigned.  
str1[0:5] = 'HOLAA'
```

```
TypeError
```

```
Traceback (most recent call last)
```

```
<ipython-input-214-ea670ff3ec72> in <module>
```

```
    1 #Strings are immutable which means elements of a string cannot be changed once they have been assigned. ----> 2 str1[0:5] = 'HOLAA'
```

```
TypeError: 'str' object does not support item assignment
```

```
In [215]: del str1 # Delete a string  
print(srt1)
```

```
NameError
```

```
Traceback (most recent call last)
```

```
<ipython-input-215-7fcc0cc83dcc> in <module>
```

```
    1 del str1 # Delete a string  
----> 2 print(srt1)
```

```
NameError: name 'srt1' is not defined
```

In

## String concatenation

```
In [216]: # String concatenation
s1 = "Hello"
s2 = "Asif"
s3 = s1 + s2
print(s3)
```

HelloAsif

```
[217]: # String concatenation
s1 = "Hello"
s2 = "Asif"
s3 = s1 + " " + s2
print(s3)
```

Hello Asif

## Iterating through a String

```
In [218]: mystr1 = "Hello Everyone"
```

```
In [219]: # Iteration
for i in mystr1:
    print(i)
```

H  
e  
l  
l  
o  
E  
v  
e  
r  
y  
o  
n  
e

```
In [220]: for i in enumerate(mystr1):
    print(i)
(0, 'H')
(1, 'e')
(2, 'l')
(3, 'l')
(4, 'o')
(5, ' ')
(6, 'E')
```

In

```
(7, 'v')
(8, 'e')
(9, 'r')
(10, 'y')
(11, 'o')
(12, 'n')
(13, 'e')
```

```
[221]: list(enumerate(mystr1)) # Enumerate method adds a counter to an iterable and retu
```

```
Out[221]: [(0, 'H'),
(1, 'e'),
(2, 'l'),
(3, 'l'),
(4, 'o'),
(5, ' '),
(6, 'E'),
(7, 'v'),
(8, 'e'),
(9, 'r'),
(10, 'y'),
(11, 'o'),
(12, 'n'),
(13, 'e')]
```

## String Membership

```
In [222]: # String membership
```

```
mystr1 = "Hello Everyone"

print ('Hello' in mystr1) # Check whether substring "Hello" is present in string
print ('Everyone' in mystr1) # Check whether substring "Everyone" is present in
s print ('Hi' in mystr1) # Check whether substring "Hi" is present in string
"mysrt
True
True
False
```

In

## String Partitioning

In [256]:

```
"""
The partition() method searches for a specified string and splits the string into
- The first element contains the part before the argument string.
- The second element contains the argument string.
- The third element contains the part after the argument string.
"""

```

```
str5 = "Natural language processing with Python and R and Java"
L = str5.partition("and")
print(L)
```

```
('Natural language processing with Python ', 'and', ' R and Java')
```

[257]:

```
"""
The rpartition() method searches for the last occurrence of the specified string a
containing three elements.
```

- The first element contains the part before the argument string.
- The second element contains the argument string.
- The third element contains the part after the argument string.

```
str5 = "Natural language processing with Python and R and Java"
L = str5.rpartition("and")
print(L)
```

```
('Natural language processing with Python and R ', 'and', ' Java')
```

## String Functions

In [267]:  

```
mystr2 = "Hello Everyone "
```

Out[267]:  

```
'Hello Everyone '
```

In [268]:  

```
mystr2.strip() # Removes white space from beginning & end
```

Out[268]:  

```
'Hello Everyone'
```

In [270]:  

```
mystr2.rstrip() # Removes all whitespaces at the end of the string
```

Out[270]:  

```
'Hello Everyone'
```

In [269]:  

```
mystr2.lstrip() # Removes all whitespaces at the beginning of the string
```

In

Out[269]: 'Hello Everyone '

In [272]: mystr2 = "\*\*\*\*\*Hello Everyone\*\*\*\*\*All the Best\*\*\*\*\*"  
mystr2

Out[272]: '\*\*\*\*\*Hello Everyone\*\*\*\*\*All the Best\*\*\*\*\*'

In [273]: mystr2.strip('\*') # Removes all '\*' characters from begining &amp; end of the string

Out[273]: 'Hello Everyone\*\*\*\*\*All the Best'

In [274]: mystr2.rstrip('\*') # Removes all '\*' characters at the end of the string

Out[274]: '\*\*\*\*\*Hello Everyone\*\*\*\*\*All the Best'

In [275]: mystr2.lstrip('\*') # Removes all '\*' characters at the begining of the string

Out[275]: 'Hello Everyone\*\*\*\*\*All the Best\*\*\*\*\*'

[276]: mystr2 = "Hello Everyone "

In [277]: mystr2.lower() # Return whole string in Lowercase

Out[277]: ' hello everyone '

In [278]: mystr2.upper() # Return whole string in uppercase

Out[278]: ' HELLO EVERYONE '

In [279]: mystr2.replace("He", "Ho") #Replace substring "He" with "Ho"

Out[279]: ' Hollo Everyone '

In [280]: mystr2.replace(" ", "") # Remove all whitespaces using replace function

Out[280]: 'HelloEveryone'

In [281]: mystr5 = "one two Three one two two three"

In [230]: mystr5.count("one") # Number of times substring "one" occurred in string.

Out[230]: 2

In [231]: mystr5.count("two") # Number of times substring "two" occurred in string.

Out[231]: 3

In [232]: mystr5.startswith("one") # Return boolean value True if string starts with "one"

Out[232]: True

In

In [233]: `mystr5.endswith("three") # Return boolean value True if string ends with "three"`

Out[233]: True

In [234]: `mystr4 = "one two three four one two two three five five six seven six seven one"`[235]: `mylist = mystr4.split() # Split String into substrings  
mylist`Out[235]: `['one',  
 'two',  
 'three',  
 'four',  
 'one',  
 'two',  
 'two',  
 'three',  
 'five',  
 'five',  
 'six',  
 'seven',  
 'six',  
 'seven',  
 'one',  
 'one',  
 'one',  
 'ten',  
 'eight',  
 'ten',  
 'nine',  
 'eleven',  
 'ten',  
 'ten',  
 'nine']`In [236]: `# Combining string & numbers using format method``item1 = 40  
item2 = 55  
item3 = 77``res = "Cost of item1 , item2 and item3 are {} , {} and {}"``print(res.format(item1,item2,item3))``Cost of item1 , item2 and item3 are 40 , 55 and 77`

In

```
In [237]: # Combining string & numbers using format method
item1 = 40
item2 = 55
item3 = 77

res = "Cost of item3 , item2 and item1 are {2} , {1} and {0}"

print(res.format(item1,item2,item3))
Cost of item3 , item2 and item1 are 77 , 55 and 40
```

Usman Ghias

In

```
[238]: str2 = " WELCOME EVERYONE " str2 = str2.center(100) # center align the string  
using a specific character as t print(str2)
```

WELCOME EVERYONE

```
In [239]: str2 = " WELCOME EVERYONE " str2 = str2.center(100, '*') # center align the  
string using a specific character print(str2)
```

\*\*\*\*\* WELCOME EVERYONE \*\*\*\*\*  
\*\*\*\*\*

```
In [240]: str2 = " WELCOME EVERYONE " str2 = str2.rjust(50) # Right align the string using  
a specific character as the print(str2)
```

WELCOME EVERYONE

```
In [241]: str2 = " WELCOME EVERYONE " str2 = str2.rjust(50, '*') # Right align the string  
using a specific character ('* print(str2)
```

\*\*\*\*\* WELCOME EVERYONE

```
In [242]: str4 = "one two three four five six seven" loc = str4.find("five") # Find the  
Location of word 'five' in the string "str4" print(loc)
```

19

```
In [243]: str4 = "one two three four five six seven" loc = str4.index("five") # Find the  
Location of word 'five' in the string "str4" print(loc)
```

19

```
In [244]: mystr6 = '123456789' print(mystr6.isalpha()) # returns True if all the characters  
in the text are lett print(mystr6.isalnum()) # returns True if a string contains  
only letters or numb print(mystr6.isdecimal()) # returns True if all the  
characters are decimals (0-9) print(mystr6.isnumeric()) # returns True if all the  
characters are numeric (0-9)
```

False

True

True

True

```
[245]: mystr6 = 'abcde' print(mystr6.isalpha()) # returns True if all the characters in  
the text are lett print(mystr6.isalnum()) # returns True if a string contains  
only letters or numb print(mystr6.isdecimal()) # returns True if all the  
characters are decimals (0-9) print(mystr6.isnumeric()) # returns True if all  
the characters are numeric (0-9)
```

True

True

False

False

In

```
In [246]: mystr6 = 'abc12309' print(mystr6.isalpha()) # returns True if all the characters  
in the text are lett print(mystr6.isalnum()) # returns True if a string contains  
only letters or numb print(mystr6.isdecimal()) # returns True if all the  
characters are decimals (0-9) print(mystr6.isnumeric()) # returns True if all the  
characters are numeric (0-9)
```

```
False True  
False  
False
```

```
In [247]: mystr7 = 'ABCDEF' print(mystr7.isupper()) # Returns True if all the characters  
are in upper case print(mystr7.islower()) # Returns True if all the characters  
are in lower case
```

```
True  
False
```

```
In [248]: mystr8 = 'abcdef' print(mystr8.isupper()) # Returns True if all the characters  
are in upper case print(mystr8.islower()) # Returns True if all the characters  
are in lower case
```

```
False  
True
```

```
In [258]: str6 = "one two three four one two two three five five six one ten eight ten nine  
  
loc = str6.rfind("one") # last occurrence of word 'one' in string "str6"  
print(loc)
```

```
51
```

```
In [259]: loc = str6.rindex("one") # last occurrence of word 'one' in string "str6"  
  
print(loc)
```

```
51
```

```
In [264]: txt = " abc def ghi  
  
txt.rstrip()
```

```
Out[264]: ' abc def ghi'
```

```
[265]: txt = " abc def ghi "  
  
txt.lstrip()
```

```
Out[265]: 'abc def ghi '
```

```
In [266]: txt = " abc def ghi "  
  
txt.strip()
```

```
Out[266]: 'abc def ghi'
```

In

## Using Escape Character

```
In [252]: #Using double quotes in the string is not allowed.  
mystr = "My favourite TV Series is "Game of Thrones""  
  
File "<ipython-input-252-0fa35a74da86>", line 2  
mystr = "My favourite TV Series is "Game of Thrones""  
          ^  
SyntaxError: invalid syntax
```

```
In [253]: #Using escape character to allow illegal characters  
mystr = "My favourite series is \"Game of Thrones\""  
print(mystr)  
  
My favourite series is "Game of Thrones"
```

## List

- 1) List is an ordered sequence of items.
- 2) We can have different data types under a list. E.g we can have integer, float and string items in a same list.

### List Creation

```
In [423]: list1 = []      # Empty List  
  
In [491]: print(type(list1))  
  
<class 'list'>  
  
In [424]: list2 = [10,30,60]      # List of integers numbers  
  
In [425]: list3 = [10.77,30.66,60.89]      # List of float numbers
```

In

```
[426]: list4 = ['one', 'two', "three"] # List of strings
```

```
In [427]: list5 = ['Asif', 25, [50, 100], [150, 90]] # Nested Lists
```

```
In [428]: list6 = [100, 'Asif', 17.765] # List of mixed data types
```

```
In [429]: list7 = ['Asif', 25, [50, 100], [150, 90], {'John', 'David'}]
```

```
In [430]: len(list6) #Length of List
```

```
Out[430]: 3
```

## List Indexing

### Forward Indexing



### Backward Indexing

```
In [432]: list2[0] # Retreive first element of the List
```

```
Out[432]: 10
```

```
In [433]: list4[0] # Retreive first element of the List
```

```
Out[433]: 'one'
```

```
In [434]: list4[0][0] # Nested indexing - Access the first character of the first List elem
```

```
Out[434]: 'o'
```

```
In [435]: list4[-1] # Last item of the List
```

```
Out[435]: 'three'
```

```
In [436]: list5[-1] # Last item of the List
```

```
Out[436]: [150, 90]
```

In

## List Slicing

```
[437]: mylist = ['one' , 'two' , 'three' , 'four' , 'five' , 'six' , 'seven' , 'eight']
```

```
In [438]: mylist[0:3] # Return all items from 0th to 3rd index location excluding the item
```

```
Out[438]: ['one', 'two', 'three']
```

```
In [439]: mylist[2:5] # List all items from 2nd to 5th index location excluding the item at
```

```
Out[439]: ['three', 'four', 'five']
```

```
In [440]: mylist[:3] # Return first three items
```

```
Out[440]: ['one', 'two', 'three']
```

```
In [441]: mylist[:2] # Return first two items
```

```
Out[441]: ['one', 'two']
```

```
In [442]: mylist[-3:] # Return last three items
```

```
Out[442]: ['six', 'seven', 'eight']
```

```
In [443]: mylist[-2:] # Return last two items
```

```
Out[443]: ['seven', 'eight']
```

```
In [444]: mylist[-1] # Return last item of the list
```

```
Out[444]: 'eight'
```

```
In [445]: mylist[:] # Return whole list
```

```
Out[445]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

## Add , Remove & Change Items

```
In [446]:
```

```
mylist
```

```
Out[446]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

```
In [447]: mylist.append('nine') # Add an item to the end of the list
```

```
mylist
```

```
Out[447]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight', 'nine']
```

```
In [448]: mylist.insert(9,'ten') # Add item at index location 9
```

```
mylist
```

```
Out[448]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight', 'nine', 'ten']
```

```
[449]: mylist.insert(1,'ONE') # Add item at index location 1
```

```
mylist
```

```
Out[449]: ['one',
```

```
  'ONE',
```

```
  'two',
```

In

```
'three',
'four',
'five',
'six',
'seven',
'eight',
'nine',
'ten']
```

```
In [450]: mylist.remove('ONE') # Remove item "ONE"
mylist
```

```
Out[450]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight', 'nine', 'ten']
```

```
In [451]: mylist.pop() # Remove Last item of the List
mylist
```

```
Out[451]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight', 'nine']
```

```
In [452]: mylist.pop(8) # Remove item at index Location 8
mylist
```

```
Out[452]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

```
In [453]: del mylist[7] # Remove item at index Location 7
mylist
```

```
Out[453]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven']
```

```
In [454]: # Change value of the string
mylist[0] = 1
mylist[1] = 2
mylist[2] = 3
mylist
```

```
Out[454]: [1, 2, 3, 'four', 'five', 'six', 'seven']
```

```
In [455]: mylist.clear() # Empty List / Delete all items in the List
mylist
```

```
Out[455]: []
```

In

```
[456]: del mylist # Delete the whole
list mylist
```

```
NameError
<ipython-input-456-50c7849aa2cb> in <module>
  1 del mylist # Delete the whole list
----> 2 mylist
```

```
Traceback (most recent call last)
```

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

## Copy List

```
In [457]: mylist = ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight', 'nine',
```

```
In [458]: mylist1 = mylist # Create a new reference "myList1"
```

```
In [459]: id(mylist) , id(mylist1) # The address of both myList & myList1 will be the same
```

```
Out[459]: (1537348392776, 1537348392776)
```

```
In [460]: mylist2 = mylist.copy() # Create a copy of the List
```

```
In [461]: id(mylist2) # The address of myList2 will be different from myList because myList
```

```
Out[461]: 1537345955016
```

```
In [462]: mylist[0] = 1
```

```
In [463]:
```

```
mylist
```

```
Out[463]: [1, 'two', 'three', 'four', 'five', 'six', 'seven', 'eight', 'nine', 'ten']
```

```
In [464]: mylist1 # myList1 will be also impacted as it is pointing to the same list
```

```
Out[464]: [1, 'two', 'three', 'four', 'five', 'six', 'seven', 'eight', 'nine', 'ten']
```

```
In [465]: mylist2 # Copy of List won't be impacted due to changes made on the original list
```

```
Out[465]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight', 'nine', 'ten']
```

In

## Join Lists

```
In [466]: list1 = ['one', 'two', 'three', 'four']
list2 = ['five', 'six', 'seven', 'eight']
```

```
In [467]: list3 = list1 + list2 # Join two lists by '+' operator
list3
```

```
Out[467]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

```
[468]: list1.extend(list2) #Append List2 with List1
list1
```

```
Out[468]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

## List Membership

```
In [469]: list1
```

```
Out[469]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

```
In [470]: 'one' in list1 # Check if 'one' exist in the list
```

```
Out[470]: True
```

```
In [471]: 'ten' in list1 # Check if 'ten' exist in the list
```

```
Out[471]: False
```

```
In [472]: if 'three' in list1: # Check if 'three' exist in the list
print('Three is present in the list') else:
print('Three is not present in the list')

Three is present in the list
```

```
In [473]: if 'eleven' in list1: # Check if 'eleven' exist in the list
print('eleven is present in the list') else:
print('eleven is not present in the list') eleven is not
present in the list
```

## Reverse & Sort List

```
In [474]: list1
```

```
Out[474]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

```
In [475]: list1.reverse() # Reverse the list
list1
```

```
Out[475]: ['eight', 'seven', 'six', 'five', 'four', 'three', 'two', 'one']
```

In

```
In [476]: list1 = list1[::-1] # Reverse the List  
list1
```

```
Out[476]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

```
[477]: mylist3 = [9,5,2,99,12,88,34]  
mylist3.sort() # Sort List in ascending order  
mylist3
```

```
Out[477]: [2, 5, 9, 12, 34, 88, 99]
```

```
In [478]: mylist3 = [9,5,2,99,12,88,34]  
mylist3.sort(reverse=True) # Sort List in descending order  
mylist3
```

```
Out[478]: [99, 88, 34, 12, 9, 5, 2]
```

```
In [584]: mylist4 = [88,65,33,21,11,98] sorted(mylist4) # Returns a new sorted list  
and doesn't change original Li Out[584]: [11, 21, 33, 65, 88, 98]
```

```
In [585]:  
mylist4
```

```
Out[585]: [88, 65, 33, 21, 11, 98]
```

## Loop through a list

```
In [481]:  
list1
```

```
Out[481]: ['one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight']
```

```
In [482]: for i in list1:  
    print(i)
```

```
one  
two  
three  
four  
five  
six  
seven  
eight
```

```
In [483]: for i in enumerate(list1):  
    print(i)
```

```
(0, 'one')  
(1, 'two')  
(2, 'three')  
(3, 'four')  
(4, 'five')  
(5, 'six')
```

In

```
(6, 'seven')
(7, 'eight')
```

Count

Usman Ghias

In

```
[485]: list10 = ['one', 'two', 'three', 'four', 'one', 'one', 'two', 'three']
```

```
In [486]: list10.count('one') # Number of times item "one" occurred in the list.
```

Out[486]: 3

```
In [487]: list10.count('two') # Occurrence of item 'two' in the list
```

Out[487]: 2

```
In [489]: list10.count('four') #Occurrence of item 'four' in the list
```

Out[489]: 1

## All / Any

The **all()** method returns:

- **True** - If all elements in a list are true
- **False** - If any element in a list is false

The **any()** function returns True if any element in the list is True. If not, any() returns False.

```
In [816]: L1 = [1,2,3,4,0]
```

```
In [817]: all(L1) # Will Return false as one value is false (Value 0)
```

Out[817]: False

```
In [818]: any(L1) # Will Return True as we have items in the list with True value
```

Out[818]: True

```
In [819]: L2 = [1,2,3,4,True,False]
```

```
In [820]: all(L2) # Returns false as one value is false
```

Out[820]: False

```
In [821]: any(L2) # Will Return True as we have items in the list with True value
```

Out[821]: True

```
In [822]: L3 = [1,2,3,True]
```

```
In [823]: all(L3) # Will return True as all items in the List are True
```

Out[823]: True

In

```
[824]: any(L3) # Will Return True as we have items in the List with True value
```

```
Out[824]: True
```

## List Comprehensions

- List Comprehensions provide an elegant way to create new lists.
- It consists of brackets containing an expression followed by a for clause, then zero or more for or if clauses.

```
In [287]: mystring = "WELCOME" mylist = [ i for i in mystring ] # Iterating through a string Using List Comprehe mylist
```

```
Out[287]: ['W', 'E', 'L', 'C', 'O', 'M', 'E']
```

```
In [289]: mylist1 = [ i for i in range(40) if i % 2 == 0] # Display all even numbers between mylist1
```

```
Out[289]: [0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38]
```

```
In [290]: mylist2 = [ i for i in range(40) if i % 2 == 1] # Display all odd numbers between mylist2
```

```
Out[290]: [1, 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, 37, 39]
```

```
In [325]: mylist3 = [num**2 for num in range(10)] # calculate square of all numbers between mylist3
```

```
Out[325]: [0, 1, 4, 9, 16, 25, 36, 49, 64, 81]
```

[expression for item in list]

[num<sup>\*\*2</sup> for num in range(10)]

```
In [317]: # Multiple whole List by 10
list1 = [2,3,4,5,6,7,8]
list1 = [i*10 for i in list1]
list1
```

```
Out[317]: [20, 30, 40, 50, 60, 70, 80]
```

In

```
[299]: #List all numbers divisible by 3 , 9 & 12 using nested "if" with List Comprehension
mylist4 = [i for i in range(200) if i % 3 == 0 if i % 9 == 0 if i % 12 == 0]
mylist4
```

```
Out[299]: [0, 36, 72, 108, 144, 180]
```

```
In [309]: # Odd even test
11 = [print("{} is Even Number".format(i)) if i%2==0 else
      print("{} is odd number".format(i))]
```

```
0 is Even Number
is odd number
2 is Even Number
is odd number
4 is Even Number
is odd number
6 is Even Number
is odd number
8 is Even Number
9 is odd number
```

```
In [315]: # Extract numbers from a string
mystr = "One 1 two 2
three 3 four 4 five 5 six 6789"
numbers = [i for i in mystr if i.isdigit()]
```

```
Out[315]: ['1', '2', '3', '4', '5', '6', '7', '8', '9']
```

```
In [316]: # Extract Letters from a string
```

```
mystr = "One 1 two 2 three 3 four 4 five 5 six 6789"
numbers = [i for i in mystr if i.isalpha()]
```

```
Out[316]: ['O',
'n',
'e',
't',
'w',
'o',
't',
'h',
'r',
'e',
'e',
'f',
'o',
'u',
'r',
'f',
'i',
'v',
'e',
's',
```

In

```
'i',  
'x']
```

U  
s  
m  
a  
n  
G  
h  
i  
a  
s

# Tuples

1. Tuple is similar to List except that the objects in tuple are immutable which means we cannot change the elements of a tuple once assigned.
2. When we do not want to change the data over time, tuple is a preferred data type.
3. Iterating over the elements of a tuple is faster compared to iterating over a list.

## Tuple Creation

```
In [533]: tup1 = ()      # Empty tuple
```

```
In [534]: tup2 = (10,30,60)      # tuple of integers numbers
```

```
In [535]: tup3 = (10.77,30.66,60.89)      # tuple of float numbers
```

```
In [536]: tup4 = ('one','two' , "three")  # tuple of strings
```

```
In [537]: tup5 = ('Asif', 25 ,(50, 100),(150, 90))  # Nested tuples
```

```
In [538]: tup6 = (100, 'Asif', 17.765)  # Tuple of mixed data types
```

```
In [539]: tup7 = ('Asif', 25 ,[50, 100],[150, 90] , {'John' , 'David'} , (99,22,33))
```

```
In [540]: len(tup7) #Length of List
```

```
Out[540]: 6
```

## Tuple Indexing

```
In [541]: tup2[0] # Retreive first element of the tuple
```

```
Out[541]: 10
```

```
In [542]: tup4[0] # Retreive first element of the tuple
```

```
Out[542]: 'one'
```

```
In [543]: tup4[0][0] # Nested indexing - Access the first character of the first tuple elem
```

```
Out[543]: 'o'
```

```
In [544]: tup4[-1] # Last item of the tuple
```

```
Out[544]: 'three'
```

```
In [545]: tup5[-1] # Last item of the tuple
```

```
Out[545]: (150, 90)
```

In

## Tuple Slicing

```
In [560]: mytuple = ('one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight')

In [547]: mytuple[0:3] # Return all items from 0th to 3rd index location excluding the item
Out[547]: ('one', 'two', 'three')

In [548]: mytuple[2:5] # List all items from 2nd to 5th index location excluding the item a
Out[548]: ('three', 'four', 'five')

In [549]: mytuple[:3] # Return first three items
Out[549]: ('one', 'two', 'three')

In [550]: mytuple[:2] # Return first two items
Out[550]: ('one', 'two')

In [551]: mytuple[-3:] # Return last three items
Out[551]: ('six', 'seven', 'eight')

In [552]: mytuple[-2:] # Return last two items
Out[552]: ('seven', 'eight')

In [553]: mytuple[-1] # Return last item of the tuple
Out[553]: 'eight'

In [554]: mytuple[:] # Return whole tuple
Out[554]: ('one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight')
```

## Remove & Change Items

```
In [555]: mytuple
Out[555]: ('one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight')
[556]: del mytuple[0] # Tuples are immutable which means we can't DELETE tuple items
```

**TypeError**

Traceback (most recent call last)

```
<ipython-input-556-667a276aa503> in <module>
----> 1 del mytuple[0]
```

**TypeError**: 'tuple' object doesn't support item deletion

```
In [557]: mytuple[0] = 1 # Tuples are immutable which means we can't CHANGE tuple items
```

```
-----
```

```
TypeError
```

```
Traceback (most recent call last)
```

```
<ipython-input-557-4cf492702bfd> in <module>
```

```
----> 1 mytuple[0] = 1
```

```
TypeError: 'tuple' object does not support item assignment
```

```
In [561]: del mytuple # Deleting entire tuple object is possible
```

## Loop through a tuple

```
In [570]:
```

```
mytuple
```

```
Out[570]: ('one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight')
```

```
In [571]: for i in mytuple:
```

```
    print(i)
```

```
one two  
three  
four  
five  
six  
seven  
eight
```

```
In [572]: for i in enumerate(mytuple):
```

```
    print(i)
```

```
(0, 'one')  
(1, 'two')  
(2, 'three')  
(3, 'four')  
(4, 'five')  
(5, 'six')  
(6, 'seven')  
(7, 'eight')
```

**Count**

```
In [573]: mytuple1 = ('one', 'two', 'three', 'four', 'one', 'one', 'two', 'three')
```

```
In [574]: mytuple1.count('one') # Number of times item "one" occurred in the tuple.
```

```
Out[574]: 3
```

```
In [575]: mytuple1.count('two') # Occurrence of item 'two' in the tuple
```

```
Out[575]: 2
```

```
In [576]: mytuple1.count('four') #Occurrence of item 'four' in the tuple
```

In

Out[576]: 1

## Tuple Membership

In [577]:

mytuple

Out[577]: ('one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight')

In [578]: 'one' in mytuple # Check if 'one' exist in the List

Out[578]: True

In [579]: 'ten' in mytuple # Check if 'ten' exist in the List

Out[579]: False

In [581]: if 'three' in mytuple: # Check if 'three' exist in the List  
print('Three is present in the tuple') else:  
print('Three is not present in the tuple')

Three is present in the tuple

In [583]: if 'eleven' in mytuple: # Check if 'eleven' exist in the List  
print('eleven is present in the tuple') else:  
print('eleven is not present in the tuple')

eleven is not present in the tuple

## Index Position

In [586]:

mytuple

Out[586]: ('one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight')

[587]: mytuple.index('one') # Index of first element equal to 'one'

Out[587]: 0

In [590]: mytuple.index('five') # Index of first element equal to 'five'

Out[590]: 4

In [591]:

mytuple1

Out[591]: ('one', 'two', 'three', 'four', 'one', 'one', 'two', 'three')

In [593]: mytuple1.index('one') # Index of first element equal to 'one'

Out[593]: 0

## Sorting

In [594]: mytuple2 = (43, 67, 99, 12, 6, 90, 67)

In [595]: sorted(mytuple2) # Returns a new sorted list and doesn't change original tuple

Out[595]: [6, 12, 43, 67, 67, 90, 99]

In [596]: sorted(mytuple2, reverse=True) # Sort in descending order

Out[596]: [99, 90, 67, 67, 43, 12, 6]

## Sets

- 1) Unordered & Unindexed collection of items.
- 2) Set elements are unique. Duplicate elements are not allowed.
- 3) Set elements are immutable (cannot be changed).
- 4) Set itself is mutable. We can add or remove items from it.

### Set Creation

In [634]: myset = {1, 2, 3, 4, 5} # Set of numbers  
myset

Out[634]: {1, 2, 3, 4, 5}

In [635]: len(myset) #Length of the set

Out[635]: 5

In [636]: my\_set = {1, 1, 2, 2, 3, 4, 5, 5} my\_set #  
Duplicate elements are not allowed.

Out[636]: {1, 2, 3, 4, 5}

In [637]: myset1 = {1.79, 2.08, 3.99, 4.56, 5.45} # Set of float numbers  
myset1

Out[637]: {1.79, 2.08, 3.99, 4.56, 5.45}

In [638]: myset2 = {'Asif', 'John', 'Tyrion'} # Set of Strings  
myset2

Out[638]: {'Asif', 'John', 'Tyrion'}

In [639]: myset3 = {10, 20, "Hola", (11, 22, 32)} # Mixed datatypes  
myset3

Out[639]: {(11, 22, 32), 10, 20, 'Hola'}

In

```
In [640]: myset3 = {10,20, "Hola", [11, 22, 32]} # set doesn't allow mutable items like lists
myset3
```

```
-----
TypeError                                         Traceback (most recent call last)
<ipython-input-640-d23fdc3a319e> in <module>
      1 myset3 = {10,20, "Hola", [11, 22, 32]} # set doesn't allow mutable items like lists
      2 myset3
 TypeError: unhashable type: 'list'
```

```
In [641]: myset4 = set() # Create an empty set
```

```
print(type(myset4))
<class 'set'>
```

```
In [673]: my_set1 = set(['one', 'two', 'three', 'four'])
my_set1
```

```
Out[673]: {'four', 'one', 'three', 'two'}
```

## Loop through a Set

```
[776]: myset = {'one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight'}
```

```
for i in myset:
    print(i)
```

```
eight
one
seven
three
five
two six
four
```

```
In [777]: for i in enumerate(myset):
```

```
print(i)
(0, 'eight') (1,
'one')
(2, 'seven')
(3, 'three')
(4, 'five')
(5, 'two')
(6, 'six') (7,
'four')
```

## Set Membership

In [675]:

```
myset
```

Out[675]: {'eight', 'five', 'four', 'one', 'seven', 'six', 'three', 'two'}

In [676]: 'one' in myset # Check if 'one' exist in the set

Out[676]: True

In [677]: 'ten' in myset # Check if 'ten' exist in the set

Out[677]: False

In [678]: if 'three' in myset: # Check if 'three' exist in the set  
print('Three is present in the set') else:  
print('Three is not present in the set')

Three is present in the set

In [679]: if 'eleven' in myset: # Check if 'eleven' exist in the list  
print('eleven is present in the set') else:  
print('eleven is not present in the set') eleven is not  
present in the set

## Add & Remove Items

In [680]:

```
myset
```

Out[680]: {'eight', 'five', 'four', 'one', 'seven', 'six', 'three', 'two'}

In [681]: myset.add('NINE') # Add item to a set using add() method  
myset

Out[681]: {'NINE', 'eight', 'five', 'four', 'one', 'seven', 'six', 'three', 'two'}

In [683]: myset.update(['TEN', 'ELEVEN', 'TWELVE']) # Add multiple item to a set using update()  
myset

Out[683]: {'ELEVEN',  
'NINE',  
'TEN',  
'TWELVE',  
'eight',  
'five',  
'four',  
'one',  
'seven',  
'six',  
'three',  
'two'}

In

```
In [684]: myset.remove('NINE') # remove item in a set using remove() method
myset
```

```
Out[684]: {'ELEVEN',
 'TEN',
 'TWELVE',
 'eight',
 'five',
 'four',
 'one',
 'seven',
 'six',
 'three',
 'two'}
```

```
In [685]: myset.discard('TEN') # remove item from a set using discard() method
myset
```

```
Out[685]: {'ELEVEN',
 'TWELVE',
 'eight',
 'five',
 'four',
 'one',
 'seven',
 'six',
 'three',
 'two'}
```

```
[688]: myset.clear() # Delete all items in a set
myset
```

```
Out[688]: set()
```

```
In [689]: del myset # Delete the set object
myset
```

```
NameError                                                 Traceback (most recent call last)
<ipython-input-689-0912ea1b8932> in <module>
      1 del myset
----> 2 myset

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

## Copy Set

```
In [705]: myset = {'one', 'two', 'three', 'four', 'five', 'six', 'seven', 'eight'}
myset
```

```
Out[705]: {'eight', 'five', 'four', 'one', 'seven', 'six', 'three', 'two'}
```

```
In [706]: myset1 = myset # Create a new reference "myset1"
myset1
```

```
Out[706]: {'eight', 'five', 'four', 'one', 'seven', 'six', 'three', 'two'}
```

```
In [707]: id(myset), id(myset1) # The address of both myset & myset1 will be the same as
```

```
Out[707]: (1537349033320, 1537349033320)
```

```
In [708]: my_set = myset.copy() # Create a copy of the list
my_set
```

```
Out[708]: {'eight', 'five', 'four', 'one', 'seven', 'six', 'three', 'two'}
```

```
In [710]: id(my_set) # The address of my_set will be different from myset because my_set is
```

```
Out[710]: 1537352902024
```

```
In [711]: myset.add('nine')
myset
```

```
Out[711]: {'eight', 'five', 'four', 'nine', 'one', 'seven', 'six', 'three', 'two'}
```

```
In [712]: myset1 # myset1 will be also impacted as it is pointing to the same Set
```

```
Out[712]: {'eight', 'five', 'four', 'nine', 'one', 'seven', 'six', 'three', 'two'}
```

```
In [713]: my_set # Copy of the set won't be impacted due to changes made on the original Se
```

```
Out[713]: {'eight', 'five', 'four', 'one', 'seven', 'six', 'three', 'two'}
```

## Set Operation

### Union

```
In [757]: A = {1,2,3,4,5}
B = {4,5,6,7,8}
C = {8,9,10}
```

```
In [758]: A | B # Union of A and B (ALL elements from both sets. NO DUPLICATES)
```

```
Out[758]: {1, 2, 3, 4, 5, 6, 7, 8}
```

```
In [759]: A.union(B) # Union of A and B
```

```
Out[759]: {1, 2, 3, 4, 5, 6, 7, 8}
```

```
In [760]: A.union(B, C) # Union of A, B and C.
```

```
Out[760]: {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}
```

In

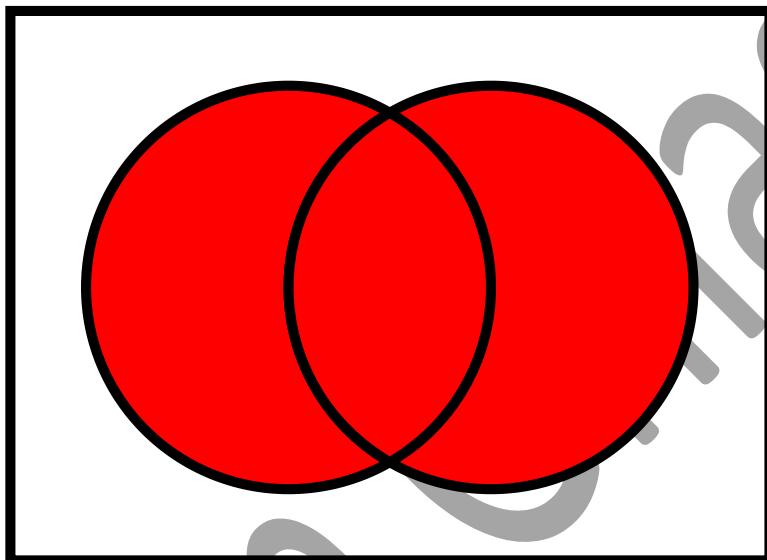
In [761]:

```
"""
Updates the set calling the update() method with union of A , B & C.

For below example Set A will be updated with union of A,B & C.
"""

A.update(B,C)
A
```

Out[761]: {1, 2, 3, 4, 5, 6, 7, 8, 9, 10}



### Intersection

In [762]: A = {1,2,3,4,5}

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

[763]: A &amp; B # Intersection of A and B (Common items in both sets)

Out[763]: {4, 5}

In [764]: A.intersection(B) Intersection of A and B

```
File "<ipython-input-764-f01b60f4d31d>", line 1
    A.intersection(B) Intersection of A and B
          ^

```

```
SyntaxError: invalid syntax
```

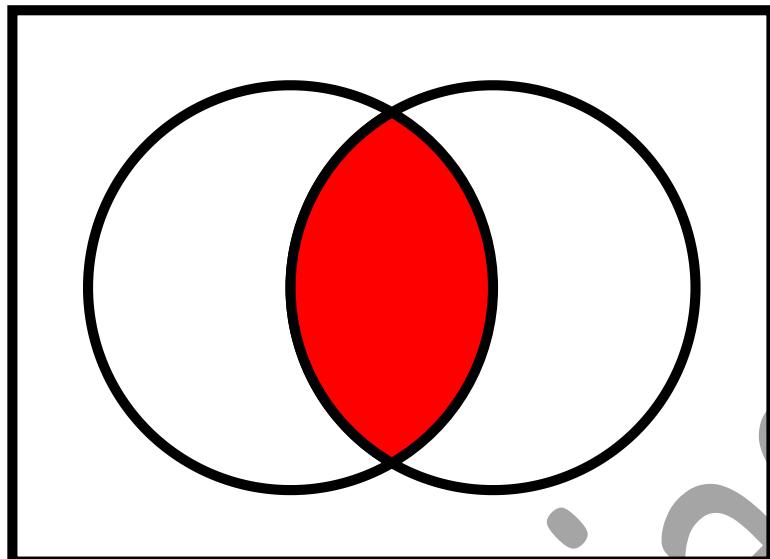
In [765]:

```
"""
Updates the set calling the intersection_update() method with the intersection of

For below example Set A will be updated with the intersection of A & B.
"""

A.intersection_update(B)
A
```

Out[765]: {4, 5}

**Difference**

```
In [766]: A = {1,2,3,4,5}  
B = {4,5,6,7,8}
```

```
In [767]: A - B # set of elements that are only in A but not in B
```

```
Out[767]: {1, 2, 3}
```

```
In [768]: A.difference(B) # Difference of sets
```

```
Out[768]: {1, 2, 3}
```

In

[769]: `B - A # set of elements that are only in B but not in A`Out[769]: `{6, 7, 8}`

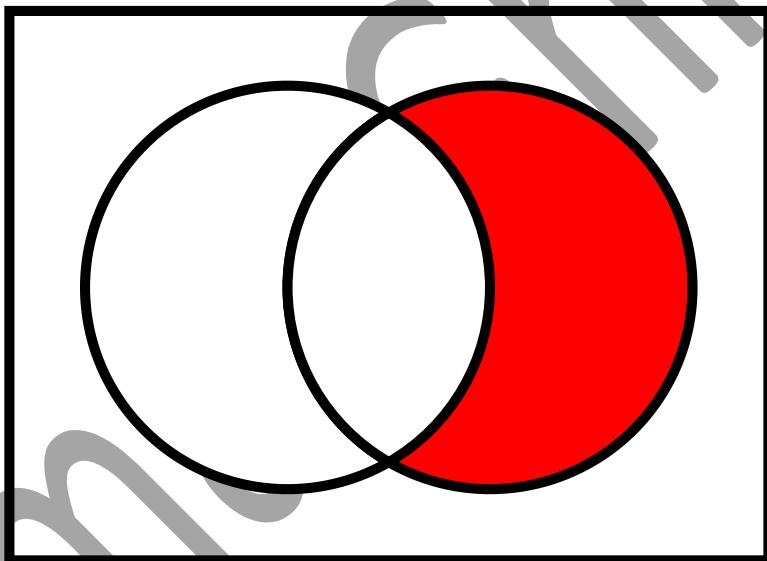
In [770]:

`B.difference(A)`Out[770]: `{6, 7, 8}`

In [771]:

`"""`  
Updates the set calling the difference\_update() method with the difference of set

For below example Set B will be updated with the difference of B &amp; A.

`"""``B.difference_update(A)``B`Out[771]: `{6, 7, 8}`

### Symmetric Difference

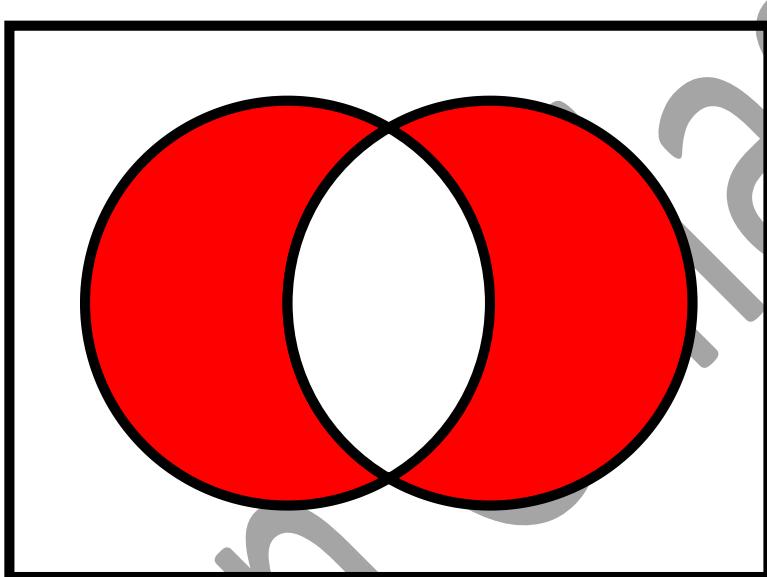
In [772]: `A = {1, 2, 3, 4, 5}``B = {4, 5, 6, 7, 8}`In [773]: `A ^ B # Symmetric difference (Set of elements in A and B but not in both. "EXCLUDING"`Out[773]: `{1, 2, 3, 6, 7, 8}`In [774]: `A.symmetric_difference(B) # Symmetric difference of sets`Out[774]: `{1, 2, 3, 6, 7, 8}`

In

[775]:

```
"""
Updates the set calling the symmetric_difference_update() method with the symmetric_difference_update(B)
For below example Set A will be updated with the symmetric difference of A & B.
"""
A.symmetric_difference_update(B)
A
```

Out[775]: {1, 2, 3, 6, 7, 8}



## Subset , Superset & Disjoint

```
In [784]: A = {1,2,3,4,5,6,7,8,9}  
          B = {3,4,5,6,7,8}  
          C = {10,20,30,40}
```

```
In [785]: B.issubset(A) # Set B is said to be the subset of set A if all elements of B are
```

Out[785]: True

```
In [786]: A.isssuperset(B) # Set A is said to be the superset of set B if all elements of B
```

Out[786]: True

```
In [787]: C.isdisjoint(A) # Two sets are said to be disjoint sets if they have no common elements
```

Out[787]: True

```
In [788]: B.isdisjoint(A) # Two sets are said to be disjoint sets if they have no common elements
```

Out[788]: False

In

## Other Builtin functions

[789]:

A

Out[789]: {1, 2, 3, 4, 5, 6, 7, 8, 9}

In [790]:

sum(A)

Out[790]: 45

In [791]:

max(A)

Out[791]: 9

In [792]:

min(A)

Out[792]: 1

In [793]:

len(A)

Out[793]: 9

In [795]: list(enumerate(A))

Out[795]: [(0, 1), (1, 2), (2, 3), (3, 4), (4, 5), (5, 6), (6, 7), (7, 8), (8, 9)]

In [798]: D= sorted(A,reverse=True)

D

Out[798]: [9, 8, 7, 6, 5, 4, 3, 2, 1]

In [799]:

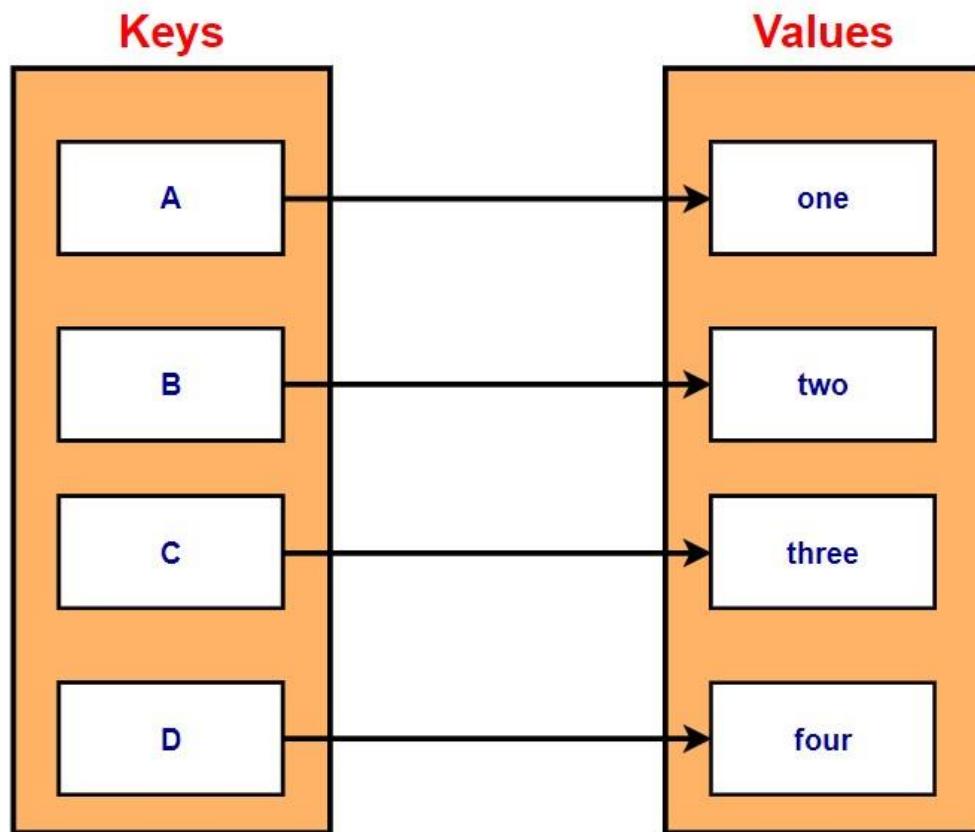
sorted(D)

Out[799]: [1, 2, 3, 4, 5, 6, 7, 8, 9]

## Dictionary

- Dictionary is a mutable data type in Python.
- A python dictionary is a collection of key and value pairs separated by a colon (:) & enclosed in curly braces {}.
- Keys must be unique in a dictionary, duplicate values are allowed.

In



```
mydict = {'A': 'one', 'B': 'two', 'C': 'three', 'D': 'four'}
```

### Create Dictionary

```
In [947]: mydict = dict() # empty dictionary
mydict
```

```
Out[947]: {}
```

```
In [948]: mydict = {} # empty dictionary
mydict
```

```
Out[948]: {}
```

```
In [949]: mydict = {1: 'one', 2: 'two', 3: 'three'} # dictionary with integer keys
mydict
```

```
Out[949]: {1: 'one', 2: 'two', 3: 'three'}
```

```
In [950]: mydict = dict({1: 'one', 2: 'two', 3: 'three'}) # Create dictionary using dict()
mydict
```

```
Out[950]: {1: 'one', 2: 'two', 3: 'three'}
```

```
[951]: mydict = {'A':'one' , 'B':'two' , 'C':'three'} # dictionary with character keys
mydict
```

```
Out[951]: {'A': 'one', 'B': 'two', 'C': 'three'}
```

```
In [318]: mydict = {1:'one' , 'A':'two' , 3:'three'} # dictionary with mixed keys
mydict
```

```
Out[318]: {1: 'one', 'A': 'two', 3: 'three'}
```

```
In [319]: mydict.keys() # Return Dictionary Keys using keys() method
```

```
Out[319]: dict_keys([1, 'A', 3])
```

```
In [320]: mydict.values() # Return Dictionary Values using values() method
```

```
Out[320]: dict_values(['one', 'two', 'three'])
```

```
In [321]: mydict.items() # Access each key-value pair within a dictionary
```

```
Out[321]: dict_items([(1, 'one'), ('A', 'two'), (3, 'three')])
```

```
In [955]: mydict = {1:'one' , 2:'two' , 'A': ['asif' , 'john' , 'Maria']} # dictionary with
mydict
```

```
Out[955]: {1: 'one', 2: 'two', 'A': ['asif', 'john', 'Maria']}
```

```
In [956]: mydict = {1:'one' , 2:'two' , 'A': ['asif' , 'john' , 'Maria'] , 'B': ('Bat' , 'cat')
mydict
```

```
Out[956]: {1: 'one',
2: 'two',
'A': ['asif', 'john', 'Maria'],
'B': ('Bat', 'cat', 'hat')}
```

```
In [1]: mydict = {1:'one' , 2:'two' , 'A': {'Name': 'asif' , 'Age' : 20} , 'B': ('Bat' , 'cat')
mydict
```

```
Out[1]: {1: 'one',
2: 'two',
'A': {'Name': 'asif', 'Age': 20},
'B': ('Bat', 'cat', 'hat')}
```

```
In [957]: keys = ['a' , 'b' , 'c' , 'd'] mydict3 = dict.fromkeys(keys) # Create a
dictionary from a sequence of keys mydict3
```

```
Out[957]: {'c': None, 'd': None, 'a': None, 'b': None}
```

```
In [958]: keys = ['a' , 'b' , 'c' , 'd']
value = 10
mydict3 = dict.fromkeys(keys , value) # Create a dictionary from a sequence of k
mydict3
```

```
Out[958]: {'c': 10, 'd': 10, 'a': 10, 'b': 10}
```

In

```
In [959]: keys = {'a' , 'b' , 'c' , 'd'}
value = [10,20,30]
mydict3 = dict.fromkeys(keys , value) # Create a dictionary from a sequence of keys
mydict3
```

```
Out[959]: {'c': [10, 20, 30], 'd': [10, 20, 30], 'a': [10, 20, 30], 'b': [10, 20, 30]}
```

```
In [960]: value.append(40)
mydict3
```

```
Out[960]: {'c': [10, 20, 30, 40],
'd': [10, 20, 30, 40],
'a': [10, 20, 30, 40],
'b': [10, 20, 30, 40]}
```

## Accessing Items

```
In [961]: mydict = {1:'one' , 2:'two' , 3:'three' , 4:'four'}
mydict
```

```
Out[961]: {1: 'one', 2: 'two', 3: 'three', 4: 'four'}
```

```
In [962]: mydict[1] # Access item using key
```

```
Out[962]: 'one'
```

```
In [963]: mydict.get(1) # Access item using get() method
```

```
Out[963]: 'one'
```

```
In [964]: mydict1 = {'Name':'Asif' , 'ID': 74123 , 'DOB': 1991 , 'job' : 'Analyst'}
mydict1
```

```
Out[964]: {'Name': 'Asif', 'ID': 74123, 'DOB': 1991, 'job': 'Analyst'}
```

```
In [965]: mydict1['Name'] # Access item using key
```

```
Out[965]: 'Asif'
```

```
In [966]: mydict1.get('job') # Access item using get() method
```

```
Out[966]: 'Analyst'
```

## Add, Remove & Change Items

```
In [967]: mydict1 = {'Name':'Asif' , 'ID': 12345 , 'DOB': 1991 , 'Address' : 'Helsinki'}
mydict1
```

```
Out[967]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Address': 'Helsinki'}
```

```
[968]: mydict1['DOB'] = 1992 # Changing Dictionary Items
mydict1['Address'] = 'Delhi'
mydict1
```

```
Out[968]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1992, 'Address': 'Delhi'}
```

```
In [969]: dict1 = {'DOB':1995}
mydict1.update(dict1)
mydict1
```

```
Out[969]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1995, 'Address': 'Delhi'}
```

```
In [970]: mydict1['Job'] = 'Analyst' # Adding items in the dictionary
mydict1
```

```
Out[970]: {'Name': 'Asif',
 'ID': 12345,
 'DOB': 1995,
 'Address': 'Delhi',
 'Job': 'Analyst'}
```

```
In [971]: mydict1.pop('Job') # Removing items in the dictionary using Pop method
mydict1
```

```
Out[971]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1995, 'Address': 'Delhi'}
```

```
In [972]: mydict1.popitem() # A random item is removed
```

```
Out[972]: ('Address', 'Delhi')
```

```
In [973]: mydict1
```

```
Out[973]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1995}
```

```
In [974]: del[mydict1['ID']] # Removing item using del method
mydict1
```

```
Out[974]: {'Name': 'Asif', 'DOB': 1995}
```

```
In [975]: mydict1.clear() # Delete all items of the dictionary using clear method
mydict1
```

```
Out[975]: {}
```

```
In [976]: del mydict1 # Delete the dictionary object
mydict1
```

---

```
NameError Traceback (most recent call last)
<ipython-input-976-da2fba4eca0f> in <module>
      1 del mydict1 # Delete the dictionary object
----> 2 mydict1
```

```
NameError: name 'mydict1' is not defined
```

In

## Copy Dictionary

```
In [977]: mydict = {'Name':'Asif' , 'ID': 12345 , 'DOB': 1991 , 'Address' : 'Helsinki'}
mydict
```

```
Out[977]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Address': 'Helsinki'}
```

```
In [978]: mydict1 = mydict # Create a new reference "mydict1"
```

```
In [979]: id(mydict) , id(mydict1) # The address of both mydict & mydict1 will be the same
```

```
Out[979]: (1537346312776, 1537346312776)
```

```
In [980]: mydict2 = mydict.copy() # Create a copy of the dictionary
```

```
In [981]: id(mydict2) # The address of mydict2 will be different from mydict because mydict
```

```
Out[981]: 1537345875784
```

```
In [982]: mydict['Address'] = 'Mumbai'
```

```
In [983]:
```

```
mydict
```

```
Out[983]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Address': 'Mumbai'}
```

```
In [984]: mydict1 # mydict1 will be also impacted as it is pointing to the same dictionary
```

```
Out[984]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Address': 'Mumbai'}
```

```
In [985]: mydict2 # Copy of List won't be impacted due to the changes made in the original
```

```
Out[985]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Address': 'Helsinki'}
```

## Loop through a Dictionary

```
In [986]: mydict1 = {'Name':'Asif' , 'ID': 12345 , 'DOB': 1991 , 'Address' : 'Helsinki' , 'Job': 'Analyst'}
mydict1
```

```
Out[986]: {'Name': 'Asif',
           'ID': 12345,
           'DOB': 1991,
           'Address': 'Helsinki',
           'Job': 'Analyst'}
```

```
In [987]: for i in mydict1:
           print(i , ':' , mydict1[i]) # Key & value pair
```

```
Name : Asif
ID : 12345
```

DOB : 1991  
 Address : Hilsinki  
 Job : Analyst

[988]: `for i in mydict1:  
 print(mydict1[i]) # Dictionary items`

Asif  
 12345  
 1991  
 Hilsinki  
 Analyst

## Dictionary Membership

In [989]: `mydict1 = {'Name':'Asif' , 'ID': 12345 , 'DOB': 1991 , 'Job': 'Analyst'}`  
`mydict1`

Out[989]: `{'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Job': 'Analyst'}`

In [990]: `'Name' in mydict1 # Test if a key is in a dictionary or not.`

Out[990]: `True`

In [991]: `'Asif' in mydict1 # Membership test can be only done for keys.`

Out[991]: `False`

In [992]: `'ID' in mydict1`

Out[992]: `True`

In [993]: `'Address' in mydict1`

Out[993]: `False`

## All / Any

The `all()` method returns:

- **True** - If all all keys of the dictionary are true
- **False** - If any key of the dictionary is false

The `any()` function returns True if any key of the dictionary is True. If not, any() returns False.

In [995]: `mydict1 = {'Name':'Asif' , 'ID': 12345 , 'DOB': 1991 , 'Job': 'Analyst'}`  
`mydict1`

Out[995]: `{'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Job': 'Analyst'}`

In

In [996]: `all(mydict1) # Will Return false as one value is false (Value 0)`

Out[996]: True

Usman Ghias

In

```
[997]: any(mydict1) # Will Return True as we have items in the dictionary with True val
```

Out[997]: True

```
In [998]: mydict1[0] = 'test1'  
mydict1
```

```
Out[998]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Job': 'Analyst', 0: 'test1'}
```

```
In [999]: all(mydict1) # Returns false as one value is false
```

Out[999]: False

```
In [1000]: any(mydict1) # Will Return True as we have items in the dictionary with True val
```

Out[1000]: True

## Dictionary Comprehension

```
In [323]: double = {i:i*2 for i in range(10)} #double each value using dict comprehension
double
```

```
Out[323]: {0: 0, 1: 2, 2: 4, 3: 6, 4: 8, 5: 10, 6: 12, 7: 14, 8: 16, 9: 18}
```

```
In [327]: square = {i:i**2 for i in range(10)}
square
```

```
Out[327]: {0: 0, 1: 1, 2: 4, 3: 9, 4: 16, 5: 25, 6: 36, 7: 49, 8: 64, 9: 81}
```

{key:value for var in iterable}

```
{i : i**2 for i in range(10)}
```

```
In [329]: key = ['one' , 'two' , 'three' , 'four' , 'five']  
value = [1,2,3,4,5]
```

```
mydict = {k:v for (k,v) in zip(key,value)} # using dict comprehension to create d  
mydict
```

```
Out[329]: {'one': 1, 'two': 2, 'three': 3, 'four': 4, 'five': 5}
```

In

```
[332]: mydict1 = {'a':10 , 'b':20 , 'c':30 , 'd':40 , 'e':50} mydict1 = {k:v/10 for (k,v) in mydict1.items()} # Divide all values in a dictionary mydict1
```

```
Out[332]: {'a': 1.0, 'b': 2.0, 'c': 3.0, 'd': 4.0, 'e': 5.0}
```

```
In [334]: str1 = "Natural Language Processing"
```

```
mydict2 = {k:v for (k,v) in enumerate(str1)} # Store enumerated values in a dictionary mydict2
```

```
Out[334]: {0: 'N',  
 1: 'a',  
 2: 't',  
 3: 'u',  
 4: 'r',  
 5: 'a',  
 6: 'l',  
 7: ' ',  
 8: 'L',  
 9: 'a',  
 10: 'n',  
 11: 'g',  
 12: 'u',  
 13: 'a',  
 14: 'g',  
 15: 'e',  
 16: ' ',  
 17: 'P',  
 18: 'r',  
 19: 'o',  
 20: 'c',  
 21: 'e',  
 22: 's',  
 23: 's',  
 24: 'i',  
 25: 'n',  
 26: 'g'}
```

```
[337]: str1 = "abcdefghijklmnopqrstuvwxyz"  
mydict3 = {i:i.upper() for i in str1} # Lower to Upper Case  
mydict3
```

```
Out[337]: {'a': 'A',  
 'b': 'B',  
 'c': 'C',  
 'd': 'D',  
 'e': 'E',  
 'f': 'F',  
 'g': 'G',  
 'h': 'H',  
 'i': 'I',  
 'j': 'J',  
 'k': 'K',  
 'l': 'L',  
 'm': 'M',  
 'n': 'N',  
 'o': 'O',  
 'p': 'P',  
 'q': 'Q',  
 'r': 'R',  
 's': 'S',  
 't': 'T',  
 'u': 'U',  
 'v': 'V',  
 'w': 'W',  
 'x': 'X',  
 'y': 'Y',  
 'z': 'Z'}
```

In

```
'j': 'J',
'k': 'K',
'l': 'L',
'm': 'M',
'n': 'N',
'o': 'O',
'p': 'P',
'q': 'Q',
'r': 'R',
's': 'S',
't': 'T',
'u': 'U',
'v': 'V',
'w': 'W',
'x': 'X',
'y': 'Y',
'z': 'Z'}
```

## Word Frequency using dictionary

```
In [61]: mystr4 = "one two three four one two two three five five six seven six seven one
```

```
In [64]: mylist = mystr4.split() # Split String into substrings  
mylist
```

```
Out[64]: ['one',  
          'two',  
          'three',  
          'four',  
          'one',  
          'two',  
          'two',  
          'three',  
          'five',  
          'five',  
          'six',  
          'seven',  
          'six',  
          'seven',  
          'one',  
          'one',  
          'one',  
          'ten',  
          'eight',  
          'ten',  
          'nine',  
          'eleven',  
          'ten',  
          'ten',  
          'nine']
```

```
In [63]: mylist1 = set(mylist) # Unique values in a List  
mylist1 = list (mylist1)  
mylist1
```

```
Out[63]: ['nine',  
          'one',  
          'eight',  
          'two',  
          'seven',  
          'ten',  
          'four',  
          'five',  
          'three',  
          'eleven',  
          'six']
```

In

```
[60]: # Calculate frequent of each word
count1 = [0] * len(mylist1)
mydict5 = dict()
for i in range(len(mylist1)):
    for j in range(len(mylist)):
        if mylist1[i] == mylist[j]:
            count1[i] += 1
    mydict5[mylist1[i]] = count1[i]
print(mydict5)

{'nine': 2, 'one': 5, 'eight': 1, 'two': 3, 'seven': 2, 'ten': 4, 'four': 1, 'five': 2, 'three': 2, 'eleven': 1, 'six': 2}
```

## Operators

- Operators are special symbols in Python which are used to perform operations on variables/values.

### Arithmetic Operators

In

```
[81]: a = 5
b = 2

x = 'Asif'
y = 'Bhat'

# Addition
c = a + b
print('Addition of {} and {} will give :- {}'.format(a,b,c))

#Concatenate string using plus operator
z = x+y
print ('Concatenate string \'x\' and \'y\' using \'+'\ operaotr :- {}'.format(z))

# Subtraction
c = a - b
print('Subtracting {} from {} will give :- {}'.format(b,a,c))

# Multiplication
c = a * b
print('Multiplying {} and {} will give :- {}'.format(a,b,c))

# Division
c = a / b
print('Dividing {} by {} will give :- {}'.format(a,b,c))

# Modulo of both number
c = a % b
print('Modulo of {} , {} will give :- {}'.format(a,b,c))

# Power
c = a ** b
print('{} raised to the power {} will give :- {}'.format(a,b,c))

# Division(floor)
c = a // b
print('Floor division of {} by {} will give :- {}'.format(a,b,c))
```

Addition of 5 and 2 will give :- 7

Concatenate string 'x' and 'y' using '+' operaotr :- AsifBhat

Subtracting 2 from 5 will give :- 3

Multiplying 5 and 2 will give :- 10

Dividing 5 by 2 will give :- 2.5

Modulo of 5 , 2 will give :- 1

5 raised to the power 2 will give :- 25

In

```
Floor division of 5 by 2 will give :- 2
```

Usman Ghias

## Comparison Operators

Comparison operators are used to compare values.

```
In [84]: x = 20
y = 30

print('Is x greater than y :- ',x>y)
print('\nIs x less than y :- ',x<y)
print('\nIs x equal to y :- ',x==y)
print('\nIs x not equal to y :- ',x!=y)
print('\nIs x greater than or equal to y :- ',x>=y)

print('\nIs x less than or equal to y :- ',x<=y)
Is x greater than y :- False
Is x less than y :- True
Is x equal to y :- False
Is x not equal to y :- True
Is x greater than or equal to y :- False
Is x less than or equal to y :- True
```

```
In [87]: a = 'Asif'
b = 'Bhat'
c = 'Asif'

a == b , a ==c , a != b # Comparison operators on string
```

```
Out[87]: (False, True, True)
```

## Logical Operators

```
In [92]: x = True
y =
False
print('Logical AND operation :- ',x and y) # True if both values are true
print('Logical OR operation :- ',x or y) # True if either of the values is true
print('NOT operation :- ',not x ) # True if operand is false

Logical AND operation :- False
Logical OR operation :- True
```

NOT operation :- False **Bitwise****operators** Bitwise operators act on

bits and performs bit by bit operation.

```
In [98]: x = 18 # binary form 10010
y = 6 # binary form 00110

print('Bitwise AND operation - {}'.format(x&y))
print('Bitwise OR operation - {}'.format(x|y))
print('Bitwise XOR operation - {}'.format(x^y))
print('Bitwise NOT operation - {}'.format(~x))
print('Bitwise right shift operation - {}'.format(x>>2))
print('Bitwise left shift operation - {}'.format(x<<2))

Bitwise AND operation - 2
Bitwise OR operation - 22
Bitwise XOR operation - 20
Bitwise NOT operation - -19
Bitwise right shift operation - 4
Bitwise left shift operation - 72
```

## Assignment Operators

```
In [120]: x = 10

        print('Initialize x with value 10 (x=10) :- ',x)

x+=20 # x = x+20
print ('Add 20 to x :- ',x)

x-=20 # x = x-20
print ('subtract 20 from x :- ',x)

x/=10 # x = x/10
print ('Divide x by 10 :- ',x)

x*=10 # x = x*10
print ('Multiply x by 10 :- ',x)

x = int(x)

x**=2 # x = x*10
print ('x raised to the power 2 :- ',x)

x%=2
print ('Modulo Division :- ',x)

x//=3
print ('Floor Division :- ',x)

x&=2
print('Bitwise AND :- ',x)

x|=2
print('Bitwise OR :- ',x)

x^=2
print('Bitwise XOR :- ',x)

x = 10

x<<=2
```

```

print('Bitwise left shift operation',x)

x>>=2
print('Bitwise right shift operation',x)
Initialize x with value 10 (x=10) :- 10
Add 20 to x :- 30
subtract 20 from x :- 10
Divide x by 10 :- 1.0 Multiply
x by 10 :- 10.0 x raised to
the power 2 :- 100
Modulo Division :- 0
Floor Division :- 6
Bitwise AND :- 2 Bitwise
OR :- 2
Bitwise XOR :- 0
Bitwise left shift operation 40
Bitwise right shift operation 10

```

## Membership Operators

Membership Operators are used to test whether a value / variable is present in a sequence.

```

In [122]: mystr = 'Asif Ali Bhat'

'Asif' in mystr , 'John' in mystr

Out[122]: (True, False)

In [123]: mystr = 'Asif Ali Bhat'

'Asif' not in mystr , 'John' not in mystr

Out[123]: (False, True)

```

## Functions

- A function is a block of organized code written to carry out a specified task.
- Functions help break our program into smaller and modular chunks for better readability.
- Information can be passed into a function as arguments.
- Parameters are specified after the function name inside the parentheses.
- We can add as many parameters as we want. Parameters must be separated with a comma.
- A function may or may not return data.
- In Python a function is defined using the **def** keyword

## Parameter VS Argument

- A parameter is the variable listed inside the parentheses in the function definition.
- An argument is the value that is sent to the function when it is called.

## Three types of functions in Python:-

### Three types of functions in Python:

- **Built-in function** :- Python predefined functions that are readily available for use like `min()` , `max()` , `sum()` , `print()` etc.
- **User-Defined Functions**:- Function that we define ourselves to perform a specific task.
- **Anonymous functions** : Function that is defined without a name. Anonymous functions are also called as lambda functions. They are not declared with the `def` keyword.

### Syntax

```
def FunctionName( parameters ):  
    """ Function DocString """  
    statement(s)  
    return [expression]
```

### Modularity

```
def CollectData():
    """Function to collect data"""
    statement(s)
```

```
def CleanData():
    """Function to clean data"""
    statement(s)
```

```
def ProcessData():
    """Function to process data"""
    statement(s)
```

```
def ExploreData():
    """Function to Explore data"""
    statement(s)
```

```
def VisualizaData():
    """Function to visualize data"""
    statement(s)
```

```
# Main Program
CollectData()
CleanData()
ProcessData()
ExploreData()
VisualizaData()
```

```
In [582]: def myfunc():
    print("Hello Python Lovers")

myfunc()
```

## Hello Python Lovers

```
In [585]: def details(name,userid,country): # Function to print User details
    print('Name :- ', name)      print('User ID is :- ', userid)
    print('Country :- ',country)

    details('Asif' , 'asif123' , 'India')

Name :- Asif
User ID is :- asif123
Country :- India
```

```
In [586]: def square (n): #function to find square of a number
    n= n*n
    return n

    square (10)

Out[586]: 100
```

```
In [39]: def even_odd (num): #Even odd test
    """ This function will check whether a number is even or odd"""
    if num % 2 ==0:
        print (num, ' is even number')
    else:
        print (num, ' is odd number')

    even_odd(3)
    even_odd(4)
    print(even_odd.__doc__) # Print function documentation string

3 is odd number
4 is even number
    This function will check whether a number is even or odd
```

```
In [590]: def fullname (firstname , middlename , lastname): #Concatenate Strings
    fullname = "{} {} {}".format(firstname,middlename,lastname)
    print (fullname)

    fullname('Asif' , 'Ali' , 'Bhat')

Asif Ali Bhat
```

```
In [591]: def fullname (firstname , middlename , lastname): #Concatenate Strings
    fullname = "{} {} {}".format(firstname,middlename,lastname)
    print (fullname)

    fullname(lastname = 'Bhat' , middlename='Ali' , firstname='Asif') # Keyword Argument

Asif Ali Bhat
```

```
In [592]: fullname ('Asif') # This will throw error as function is expecting 3 arguments.
```

```
-----
TypeError                                         Traceback (most recent call last)
<ipython-input-592-d194f8b98253> in <module>
      1 fullname ('Asif')
```

```
TypeError: fullname() missing 2 required positional arguments: 'middlename' and 'lastname'
```

```
In [596]: def myfunc(city = 'Mumbai'):
    print('Most Populous City :- ', city)

myfunc() # When a function is called without an argument it will use default
# value

Most Populous City :- Mumbai
```

```
In [26]: var1 = 100 # Variable with Global scope.

def myfunc():
    print(var1) # Value 100 will be displayed due to global scope of var1

myfunc()
print(var1)

100
100
```

In

```
[27]: def myfunc1():
    var2 = 10 # Variable with Local scope
    print(var2)

def myfunc2():
    print(var2) # This will throw error because var2 has a local scope. Var2 is o

myfunc1()
myfunc2()

10

-----
NameError: name 'var2' is not defined
Traceback (most recent call last)
<ipython-input-27-6a1c34e80ca2> in <module>
    8
    9 myfunc1() --->
10 myfunc2()

<ipython-input-27-6a1c34e80ca2> in myfunc2()
    5
    6 def myfunc2():
----> 7     print(var2) # Value 100 will be displayed due to global scope of va
r1
    8
    9 myfunc1()

NameError: name 'var2' is not defined
```

In [29]: `var1 = 100 # Variable with Global scope.`

```
def myfunc():
    var1 = 99 # Local scope
    print(var1)
```

```
myfunc()
print(var1) # The original value of var1 (100) will be retained due to global sco
99
100
```

In [33]: `list1 = [11,22,33,44,55]`

```
def myfunc(list1):
    del list1[0]

print("List1" before calling the function:- ',list1)
myfunc(list1) # Pass by reference (Any change in the parameter within the functi
print("List1" after calling the function:- ',list1)

"List1" before calling the function:- [11, 22, 33, 44, 55]
```

```
In [34]: list1 = [11,22,33,44,55]

def myfunc(list1):
    list1.append(100)

print("List1" before calling the function:- ',list1)
myfunc(list1) # Pass by reference (Any change in the parameter within the function)
print("List1" after calling the function:- ',list1)

"List1" after calling the function:- [22, 33, 44, 55]
"List1" before calling the function:- [11, 22, 33, 44, 55]
"List1" after calling the function:- [11, 22, 33, 44, 55, 100]
```

```
In [46]: list1 = [11,22,33,44,55]
def
myfunc(list1):
    list1 = [10,100,1000,10000] # Link of 'list1' with previous object is broken

print("List1" before calling the function:- ',list1)
myfunc(list1) # Pass by reference (Any change in the parameter within the function)
print("List1" after calling the function:- ',list1)

"List1" before calling the function:- [11, 22, 33, 44, 55]
"List1" after calling the function:- [11, 22, 33, 44, 55]
```

```
In [45]: def swap(a,b):
    temp = a
    a = b      # Link of 'a' with previous object is broken now as new object is
    b = temp    # Link of 'b' with previous object is broken now as new object is

    a = 10
    b = 20
    swap(a,b)
a,b
```

Out[45]: (10, 20)

```
In [601]: def factorial(num): # Calculate factorial of a number using recursive function
    if num <=1 :
        return 1
    else:
        return num * factorial(num-1)

factorial(4)
```

Out[601]: 24

In

```
In [618]: def add(num): # Sum of first n natural numbers
    if num == 0:
        return 0
    else:
        return num + add(num-1)

add(5) # Sum of first five natural numbers (1,2,3,4,5)
```

Out[618]: 15

```
[12]: def fiboacci(num):
    if num <= 1:
        return num
    if num == 2:
        return 1
    else:
        return(fiboacci(num-1) + fiboacci(num-2))

nums = int(input("How many fibonacci numbers you want to generate -"))

for i in range(nums):
    print(fiboacci(i)) # Generate Fibonacci series
```

How many fibonacci numbers you want to generate -10

```
0
1
1
2
3
5
8
13
21
34
```

## args & kwargs

### \*args

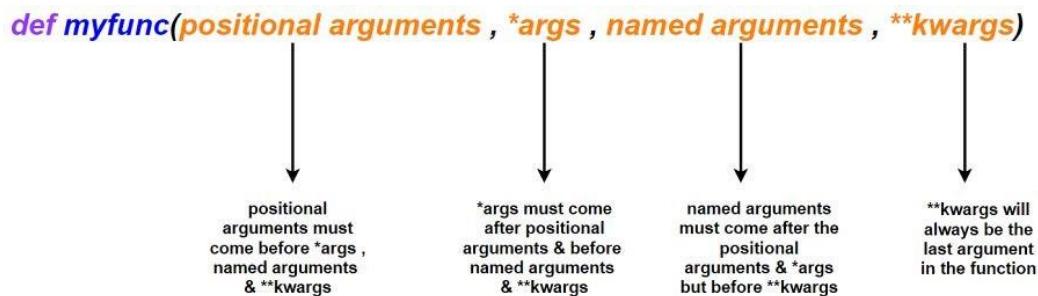
- When we are not sure about the number of arguments being passed to a function then we can use \*args as function parameter.
- \*args allow us to pass the variable number of **Non Keyword Arguments** to function.
- We can simply use an asterisk \* before the parameter name to pass variable length arguments.
- The arguments are always passed as a tuple.
- We can rename it to anything as long as it is preceded by a single asterisk (\*). It's best practice to keep naming it args to make it immediately recognizable.

In

**\*\*kwargs**

- \*\*kwargs allows us to pass the variable number of **Keyword Arguments** to the function.
- We can simply use an double asterisk \*\* before the parameter name to pass variable length arguments.
- The arguments are passed as a dictionary.
- We can rename it to anything as long as it is preceded by a double asterisk (\*\*). It's best practice to keep naming it kwargs to make it immediately recognizable.

Usman Ghias



**Example :-** `def TicketDetails(RequestId, CustomerName, *args, status=0, **kwargs)`

```
In [578]: def add(a,b,c):
           return a+b+c

print(add(10,20,30)) # Sum of two numbers
60
```

```
In [577]: print(add(1,2,3,4)) '''This will throw below error as this function will only tak
If we want to make argument list dynamic then *args wil come in picture'''

File "<ipython-input-577-565d47b69332>", line 2
  If we want to make argument list dynamic then *args wil come in picture'''^
SyntaxError: invalid syntax
```

```
In [566]: def some_args(arg_1, arg_2, arg_3):
           print("arg_1:", arg_1)
           print("arg_2:", arg_2)
           print("arg_3:", arg_3)

my_list = [2, 3]
some_args(1, *my_list)
```

```
arg_1: 1
arg_2: 2
arg_3: 3
```

```
[524]: def add1(*args):
           return sum(args)

print(add1(1,2,3))
print(add1(1,2,3,4)) # *args will take dynamic argument List. So add() function w
print(add1(1,2,3,4,5))
print(add1(1,2,3,4,5,6))
print(add1(1,2,3,4,5,6,7))
```

```
6
10
15
21
```

In

28

```
In [561]: list1 = [1,2,3,4,5,6,7]
tuple1 = (1,2,3,4,5,6,7)

add1(*list1) , add1(*tuple1) #tuple & List items will be passed as argument list
```

```
Out[561]: (28, 28)
```

```
In [562]: list1 = [1,2,3,4,5,6,7]
list2 = [1,2,3,4,5,6,7]
list3 = [1,2,3,4,5,6,7]
list4 = [1,2,3,4,5,6,7]

add1(*list1 , *list2 , *list3 , *list4 ) #All four Lists are unpacked and each in
```

```
Out[562]: 112
```

```
In [511]: def UserDetails(*args):
print(args)

UserDetails('Asif' , 7412 , 41102 , 33 , 'India' , 'Hindi')

''' For the above example we have no idea about the parameters passed e.g 7412 ,
In such cases we can take help of Keyworded arguments (**kwargs) '''

('Asif', 7412, 41102, 33, 'India', 'Hindi')
```

```
In [517]: def UserDetails(**kwargs):
print(kwargs)

UserDetails(Name='Asif' , ID=7412 , Pincode=41102 , Age= 33 , Country= 'India' ,
{'Name': 'Asif', 'ID': 7412, 'Pincode': 41102, 'Age': 33, 'Country': 'India',
'Language': 'Hindi'}
```

```
[519]: def UserDetails(**kwargs):
for key, val
in kwargs.items():
{} .format(key, val))

UserDetails(Name='Asif' , ID=7412 , Pincode=41102 , Age= 33 , Country= 'India' ,
Name :- Asif
ID :- 7412
Pincode :- 41102 Age
:- 33
Country :- India
Language :- Hindi
```

```
In [523]: mydict = {'Name': 'Asif', 'ID': 7412, 'Pincode': 41102, 'Age': 33, 'Country': 'In
```

```
UserDetails(**mydict)
```

```
Name :- Asif
```

In

```
ID :- 7412
Pincode :- 41102 Age
:- 33
Country :- India
Language :- Hindi
```

```
In [553]: def UserDetails(licenseNo, *args, phoneNo=0, **kwargs): # Using all four arguments
    print('License No :- ', licenseNo) j=' ' for i in args: j = j+i
    print('Full Name :- ', j) print('Phone Number:- ', phoneNo) for key, val in
    kwargs.items(): print("{} :- {}".format(key, val))

    name = ['Asif', ' ', 'Ali', ' ', 'Bhat']
    mydict = {'Name': 'Asif', 'ID': 7412, 'Pincode': 41102, 'Age': 33, 'Country':
    'In'
    UserDetails('BHT145', *name, phoneNo=1234567890, **mydict)

License No :- BHT145
Full Name :- Asif Ali Bhat
Phone Number:- 1234567890
Name :- Asif
ID :- 7412
Pincode :- 41102 Age
:- 33
Country :- India
Language :- Hindi
```

```
In [554]: def UserDetails(licenseNo, *args, phoneNo=0, **kwargs): # Using all four arguments
    print('Nothing')
[557]: def UserDetails(licenseNo, **kwargs, *args): # This will fail. *args MUST come before **kwargs
    print('Nothing')

    File "<ipython-input-557-dcd3c92277bc>", line 1
        def UserDetails(licenseNo, **kwargs, *args): # This will fail. *args MUST
        come before **kwargs in the argument list
        ^
    SyntaxError: invalid syntax
```

```
In [564]: #The below function will fail. Default argument/positional argument (LicenseNo) MUST come before *args
def UserDetails(ID = 1, licenseNo, *args): print('Nothing')

    File "<ipython-input-564-8a3e722c7ed7>", line 2
        def UserDetails(ID = 1, licenseNo, *args):
        ^
    SyntaxError: non-default argument follows default argument
```

In

# Lambda, Filter, Map and Reduce

## Lambda

- A lambda function is an anonymous function (function without a name).
- Lambda functions can have any number of arguments but only one expression. The expression is evaluated and returned.
- We use lambda functions when we require a nameless function for a short period of time.

### Syntax:-

***lambda argument(s) : expression***

***lambda num1 , num2 : num1 + num2***

## Filter

- It is used to filter the iterables/sequence as per the conditions.
- Filter function filters the original iterable and passes the items that returns True for the function provided to filter.

- It is normally used with Lambda functions to filter list, tuple, or sets. `filter()`

method takes two parameters:

- **function** - function tests if elements of an iterable returns true or false
- **iterable** - Sequence which needs to be filtered, could be sets, lists, tuples, or any iterators

Syntax:

***filter ( function , iterable )***

***filter ( lambda n: n%2 == 1 , list1 )***

## Map

- The `map()` function applies a given function to each item of an iterable (list, tuple etc.) and returns a list of the results.

`map()` function takes two Parameters :

- **function** : The function to execute for each item of given iterable.
- **iterable** : It is a iterable which is to be mapped.

**Returns** : Returns a list of the results after applying the given function to each item of a given iterable (list, tuple etc.)

Syntax:

***map ( function , iterable )***

***map ( lambda num : num\*2 , list1 )***

## Reduce

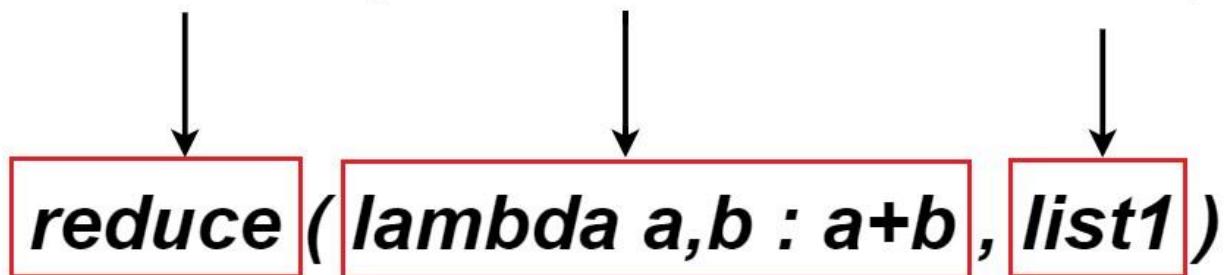
- The reduce() function is defined in the **functools** python module. The reduce() function receives two arguments, a function and an iterable. However, it doesn't return another iterable, instead it returns a single value.

### Working:

- 1) Apply a function to the first two items in an iterable and generate a partial result.
- 2) The function is then called again with the result obtained in **step 1** and the next value in the sequence. This process keeps on repeating until there are items in the sequence.
- 3) The final returned result is returned and printed on console.

### Syntax:

**reduce ( function , iterable )**


  
**reduce ( lambda a,b : a+b , list1 )**

In [392]: `addition = lambda a : a + 10 # This Lambda function adds value 10 to an argument` `print(addition(5))`

15

In [393]: `product = lambda a, b : a * b #This Lambda function takes two arguments (a,b) and` `print(product(5, 6))`

30

In [394]: `addition = lambda a, b, c : a + b + c #This Lambda function takes three argument` `print(addition(5, 6, 2))`

13

In [364]: `res = (lambda *args: sum(args)) # This Lambda function can take any number of arguments` `res(10,20) , res(10,20,30,40) , res(10,20,30,40,50,60,70)`

Out[364]: (30, 100, 280)

In [370]: `res1 = (lambda **kwargs: sum(kwargs.values())) # This Lambda function can take any number of keyword arguments` `res1(a = 10 , b= 20 , c = 30) , res1(a = 10 , b= 20 , c = 30, d = 40 , e = 50)`

Out[370]: (60, 150)

In [386]: `res1 = (lambda **kwargs: sum(kwargs.values())) # This Lambda function can take any number of keyword arguments` `res1(a = 10 , b= 20 , c = 30) , res1(a = 10 , b= 20 , c = 30, d = 40 , e = 50)`

Out[386]: (60, 150)

```
In [446]: # User defined function to find product of numbers
def product(nums):
    total = 1
    for i in nums:
        total *= i
    return total

# This Lambda function can take any number of arguments and return their
# product. res1 = (lambda **kwargs: product(kwargs.values()))
res1(a = 10, b= 20, c = 30), res1(a = 10, b= 20, c = 30, d = 40, e = 50)
```

```
Out[446]: (6000, 12000000)
```

```
In [447]: def myfunc(n):
    return lambda a : a + n

add10 = myfunc(10)
add20 = myfunc(20)
add30 = myfunc(30)

print(add10(5))
print(add20(5))
print(add30(5))

15
25
35
```

```
In [437]: list1 = [1,2,3,4,5,6,7,8,9]

def odd(n):
    if n%2 ==1: return True
    else: return False

odd_num = list(filter(odd,list1)) # This Filter function filters list1 and passes
odd_num
```

```
Out[437]: [1, 3, 5, 7, 9]
```

```
In [438]: list1 = [1,2,3,4,5,6,7,8,9]
# The below Filter function filters "list1" and passes all odd numbers using
# Lamb odd_num = list(filter(lambda n: n%2 ==1 ,list1)) odd_num
```

```
Out[438]: [1, 3, 5, 7, 9]
```

In

```
[439]: def twice(n):
         return n*2

doubles = list(map(twice,odd_num)) # The map function will apply user defined "twice" function to each item in odd_num list
```

```
Out[439]: [2, 6, 10, 14, 18]
```

```
In [440]: doubles = list(map(lambda n:n*2,odd_num)) # This map function will double all items in odd_num list
```

```
Out[440]: [2, 6, 10, 14, 18]
```

```
In [441]: from functools import reduce
```

```
def add(a,b):
    return a+b
```

```
sum_all = reduce(add,doubles) # This reduce function will perform sum of all items in doubles list
```

```
Out[441]: 50
```

```
In [442]: #The below reduce() function will perform sum of all items in the list using Lambda function
sum_all = reduce(lambda a,b : a+b,doubles) sum_all
```

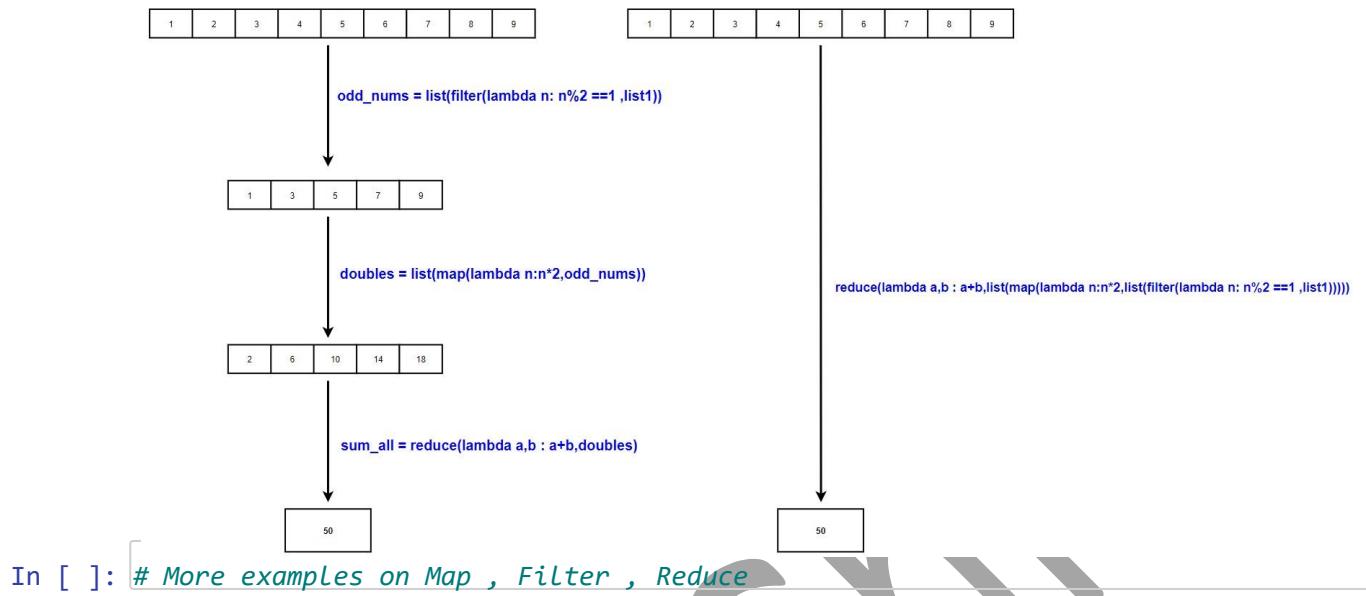
```
Out[442]: 50
```

```
In [448]: # Putting all together
```

```
sum_all = reduce(lambda a,b : a+b,list(map(lambda n:n*2,list(filter(lambda n: n%2==1,odd_num)))))
```

```
Out[448]: 50
```

## Lambda , Filter , Map & Reduce



In

```
In [497]: list1 = [1,2,3,4,5,6,7,8,9,10]
even = list(filter(lambda n: n%2 ==0 ,list1)) # Filter even numbers from the List
odd = list(filter(lambda n: n%2 !=0 ,list1)) # Filter odd numbers from the List

print('-----')
print(even)
print(odd)
print('-----')

list2 = ['one' , 'TWO' , 'three' , 'FOUR']

upper = list(filter(lambda x: x.isupper() , list2)) # filter uppercase strings from the List
lower = list(filter(lambda x: x.islower() , list2)) # filter Lowercase strings from the List

print(upper)
print(lower)
print('-----')

list3 = ['one' , 'two2' , 'three3','88' , '99' , '102']

numeric = list(filter(lambda x:x.isnumeric(), list3)) # filter numbers from the List
alpha = list(filter(lambda x:x.isalpha(), list3)) # filter character strings from the List
alphanum = list(filter(lambda x:x.isalnum(), list3)) # filter numbers & character strings from the List

print(alpha)
print(numeric)
print(alphanum)
print('-----')

#Vowel Test
```

-----  
[2, 4, 6, 8, 10]  
[1, 3, 5, 7, 9] -----  
['TWO', 'FOUR']  
['one', 'three']  
-----  
['one']  
['88', '99', '102']  
['one', 'two2', 'three3', '88', '99', '102']  
-----

```
[501]: list1 = [1,2,3,4]
list2 = [5,6,7,8]

def double(x):
    return x+x

def add(x,y):
    return x+y

def square(x):
    return x*x

print('-----')

print(list(map(double, list1))) # Double each number using map & User defined fun
print(list(map(add, list1, list2))) # add two items using map & User defined fun
print(list(map(square, list1))) #Square numbers using map & User defined function

print('-----')

print(list(map(lambda x: x + x, list1))) # Double each number using map & Lambda
print(list(map(lambda x, y: x + y, list1, list2))) # add two items using map & L
print(list(map(lambda x: x*x, list1))) #Square numbers using map & Lambda

print('-----')
```

```
-----
[2, 4, 6, 8]
[6, 8, 10, 12]
[1, 4, 9, 16]
-----
```

```
[2, 4, 6, 8]
[6, 8, 10, 12]
[1, 4, 9, 16]
```

In

```
[459]: list2 = [1,2,3,4]

product = reduce(operator.mul, list2) # Product of all numbers in a List

add = reduce(operator.add, list2) # Add all numbers in the List

concat_str = reduce(operator.add, ['Python', ' ', 'Rocks']) # Concatenate strings

prod = reduce(operator.mul, ['Hello ', 3]) # Repeat a string multiple times

min_num = reduce(lambda a, b: a if a < b else b, list2) # Minimum number in the List

max_num = reduce(lambda a, b: a if a > b else b, list2) # Maximum number in the List

print(product)

print(add)

print(concat_str)

print(prod)

print(min_num)

print(max_num)
```

```
24
10
Python Rocks
Hello Hello Hello
1
4
```

In [461]:

```
def min_func(a, b):
    return a if a < b else b

def max_func(a, b):
    return a if a > b else b

min_num = reduce(min_func, list2) # Minimum number in the List using reduce () &

max_num = reduce(max_func, list2) # Maximum number in the List using reduce () &

min_num , max_num
```

Out[461]: (1, 4)

```
[474]: print('-----') print(reduce(lambda a, b: bool(a and b), [0, 0, 1, 0, 0])) # Returns True if all
print(reduce(lambda a, b: bool(a and b), [2, 3, 1, 5, 6])) # Returns True if all
print(reduce(lambda a, b: bool(a and b), [8, 9, 1, 0, 9])) # Returns True if all
print('-----')

print(reduce(lambda a, b: bool(a or b), [0, 0, 0, 0, 0])) # Returns True if any
print(reduce(lambda a, b: bool(a or b), [2, 3, 1, 5, 6])) # Returns True if any
print(reduce(lambda a, b: bool(a or b), [8, 9, 1, 0, 9])) # Returns True if any
print('-----')

-----
False True
False
-----
False
True
True
-----
```

## Classes & Objects

- A Class is an object constructor or a "blueprint" for creating objects.
- Objects are nothing but an encapsulation of variables and functions into a single entity.
- Objects get their variables and functions from classes.
- To create a class we use the keyword **class**.
- The first string inside the class is called docstring which gives the brief description about the class.
- All classes have a function called `init()` which is always executed when the class is being initiated.
- We can use `init()` function to assign values to object properties or other operations that are necessary to perform when the object is being created
- The **self** parameter is a reference to the current instance of the class and is used to access class variables.
- **self** must be the first parameter of any function in the class
- The **super()** builtin function returns a temporary object of the superclass that allows us to
  - access methods of the base class.
- **super()** allows us to avoid using the base class name explicitly and to enable multiple inheritance.

### Syntax

In

```
class myclass:  
    "DocString"  
    def __init__(self, var1, var2)  
        self.var1 = var1  
        self.var2 = var2  
    .  
    .  
    .  
    def myfunc1(self):  
        print(self.var1)  
        print(self.var2)  
  
    def myfunc2(self)  
    .  
    .  
    .
```

```
In [49]: # Create a class with property "var1"
class myclass:
    var1 = 10

obj1 = myclass() # Create an object of class "myClass()"
print(obj1.var1)
```

10

usman ghiyas

```
In [70]: # Create an employee class
class Employee:
    def __init__(self, name, empid): # __init__() function is used to assign values
        self.name = name
        self.empid = empid
    def greet(self): # Class Method
        print("Thanks for joining ABC Company {}".format(self.name))

emp1 = Employee("Asif", 34163) # Create an employee object

print('Name :- ',emp1.name)
print('Employee ID :- ',emp1.empid)
emp1.greet()
```

Name :- Asif  
 Employee ID :- 34163  
 Thanks for joining ABC Company Asif!!

```
In [71]: emp1.name = 'Basit' # Modify Object Properties
emp1.name
```

```
Out[71]: 'Basit'
```

```
In [72]: del emp1.empid # Delete Object Properties
emp1.empid
```

```
-----
AttributeError                                         Traceback (most recent call last)
<ipython-input-72-b111c8b828fc> in <module>
      1 del emp1.empid # Delete Object Properties
----> 2 emp1.empid

AttributeError: 'Employee' object has no attribute 'empid'
```

```
In [73]: del emp1 # Delete the object
emp1
```

```
-----
NameError                                         Traceback (most recent call last)
<ipython-input-73-db2cb77ec9fb> in <module>
      1 del emp1 # Delete the object
----> 2 emp1

NameError: name 'emp1' is not defined
```

```
In [75]: emp2 = Employee("Michael", 34162) # Create an employee object
```

```
print('Name :- ',emp2.name)
print('Employee ID :- ',emp2.empid)
emp2.greet()
```

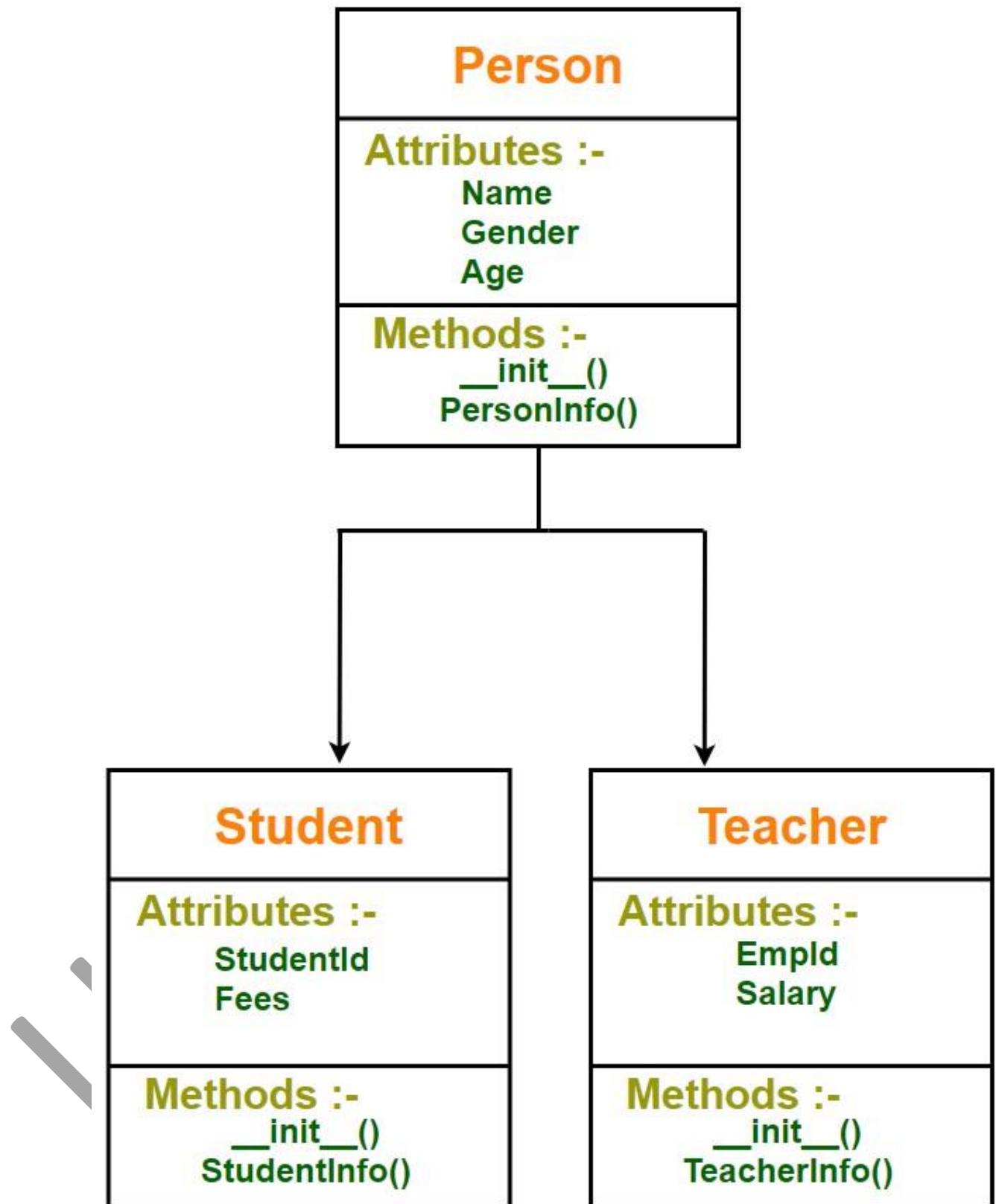
Name :- Michael  
 Employee ID :- 34162  
 Thanks for joining ABC Company Michael!!

```
In [77]: emp2.country = 'India' #instance variable can be created manually
emp2.country
```

```
Out[77]: 'India'
```

## Inheritance

- Inheritance is a powerful feature in object oriented programming.
- Inheritance provides code reusability in the program because we can use an existing class (Super Class/ Parent Class / Base Class) to create a new class (Sub Class / Child Class / Derived Class) instead of creating it from scratch.
- The child class inherits data definitions and methods from the parent class which facilitates the reuse of features already available. The child class can add few more definitions or redefine a base class method.
- Inheritance comes into picture when a new class possesses the 'IS A' relationship with an existing class. E.g Student is a person. Hence person is the base class and student is derived class.



In [163]:

```
class person: # Parent Class
    def __init__(self, name , age , gender):
        self.name = name
        self.age = age
        self.gender = gender

    def PersonInfo(self):
        print('Name :- {}'.format(self.name))
        print('Age :- {}'.format(self.age))
        print('Gender :- {}'.format(self.gender))

class student(person): # Child Class
    def __init__(self, name, age, gender, studentid, fees):
        person.__init__(self, name, age, gender)
        self.studentid = studentid
        self.fees = fees

    def StudentInfo(self):
        print('Student ID :- {}'.format(self.studentid))
        print('Fees :- {}'.format(self.fees))

class teacher(person): # Child Class
    def __init__(self, name, age, gender, empid, salary):
        person.__init__(self, name, age, gender)
        self.empid = empid
        self.salary = salary

    def TeacherInfo(self):
        print('Employee ID :- {}'.format(self.empid))
        print('Salary :- {}'.format(self.salary))

stud1 = student('Asif' , 24 , 'Male' , 123 , 1200)
print('Student Details')
print('-----')
stud1.PersonInfo()    # PersonInfo() method presnt in Parent Class will be accessed
stud1.StudentInfo()
print()

teacher1 = teacher('Basit' , 36 , 'Male' , 456 , 80000)
print('Employee Details')
print('-----')
teacher1.PersonInfo()    # PersonInfo() method presnt in Parent Class will be accessed
teacher1.TeacherInfo()
```

Student Details

-----

Name :- Asif

```
Age :- 24
Gender :- Male
Student ID :- 123
Fees :- 1200
```

Employee Details

```
-----
Name :- Basit
Age :- 36
Gender :- Male
Employee ID :- 456
Salary :- 80000
```

```
In [4]: class person: # Parent Class
    def __init__(self, name , age , gender):
        self.name = name
        self.age = age
        self.gender = gender

    def PersonInfo(self):
        print('Name :- {}'.format(self.name))
        print('Age :- {}'.format(self.age))
        print('Gender :- {}'.format(self.gender))

class student(person): # Child Class
    def __init__(self, name, age, gender, studentid, fees):
        person.__init__(self, name, age, gender)
        self.studentid = studentid
        self.fees = fees

    def StudentInfo(self):
        print('Student ID :- {}'.format(self.studentid))
        print('Fees :- {}'.format(self.fees))

stud1 = student('Asif' , 24 , 'Male' , 123 , 1200)
print('Student Details')
print('-----')
stud1.PersonInfo()      # PersonInfo() method presnt in Parent Class will be accessed
stud1.StudentInfo()
print()
```

Student Details

```
-----
Name :- Asif
Age :- 24
Gender :- Male
Student ID :- 123
Fees :- 1200
```

In [182]: *# super() builtin function allows us to access methods of the base class.*

```
class person: # Parent Class
    def __init__(self, name, age, gender):
        self.name = name
        self.age = age
        self.gender = gender

    def PersonInfo(self):
        print('Name :- {}'.format(self.name))
        print('Age :- {}'.format(self.age))
        print('Gender :- {}'.format(self.gender))

class student(person): # Child Class
    def __init__(self, name, age, gender, studentid, fees):
        super().__init__(name, age, gender)
        self.studentid = studentid
        self.fees = fees

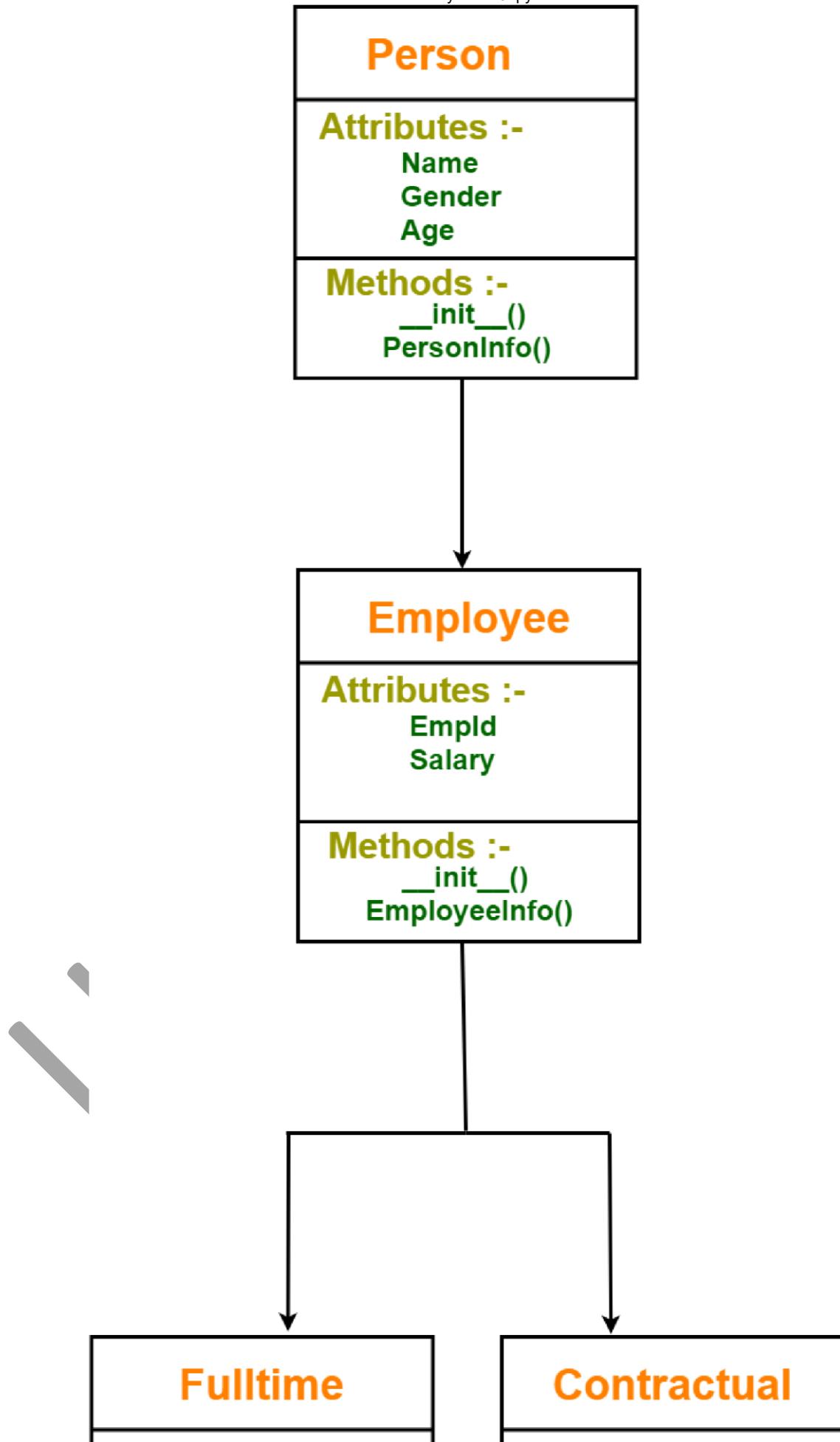
    def StudentInfo(self):
        super().PersonInfo()
        print('Student ID :- {}'.format(self.studentid))
        print('Fees :- {}'.format(self.fees))

stud = student('Asif', 24, 'Male', 123, 1200)
print('Student Details')
print('-----')
stud.StudentInfo()
```

Name :- Asif  
 Age :- 24  
 Gender :- Male  
 Student ID :- 123  
 Fees :- 1200

## Multi-level Inheritance

- In this type of inheritance, a class can inherit from a child class or derived class.
- Multilevel Inheritance can be of any depth in python



**Attributes :-**

**WorkExperience**

**Methods :-**

**\_\_init\_\_()**

**FulltimeInfo()**

**Attributes :-**

**ContractExpiry**

**Methods :-**

**\_\_init\_\_()**

**ContractInfo()**

UsmanGhias

In [196]:

```
class person: # Parent Class
    def __init__(self, name , age , gender):
        self.name = name
        self.age = age
        self.gender = gender

    def PersonInfo(self):
        print('Name :- {}'.format(self.name))
        print('Age :- {}'.format(self.age))
        print('Gender :- {}'.format(self.gender))

class employee(person): # Child Class
    def __init__(self, name, age, gender, empid, salary):
        person.__init__(self, name, age, gender)
        self.empid = empid
        self.salary = salary

    def employeeInfo(self):
        print('Employee ID :- {}'.format(self.empid))
        print('Salary :- {}'.format(self.salary))

class fulltime(employee): # Grand Child Class
    def __init__(self, name, age, gender, empid, salary, WorkExperience):
        employee.__init__(self, name, age, gender, empid, salary)
        self.WorkExperience = WorkExperience

    def FulltimeInfo(self):
        print('Work Experience :- {}'.format(self.WorkExperience))

class contractual(employee): # Grand Child Class
    def __init__(self, name, age, gender, empid, salary, ContractExpiry):
        employee.__init__(self, name, age, gender, empid, salary)
        self.ContractExpiry = ContractExpiry

    def ContractInfo(self):
        print('Contract Expiry :- {}'.format(self.ContractExpiry))

print('Contractual Employee Details')
print('*****')
contract1 = contractual('Basit' , 36 , 'Male' , 456 , 80000,'21-12-2021')
contract1.PersonInfo()
contract1.employeeInfo()
contract1.ContractInfo()

print('\n \n')
```

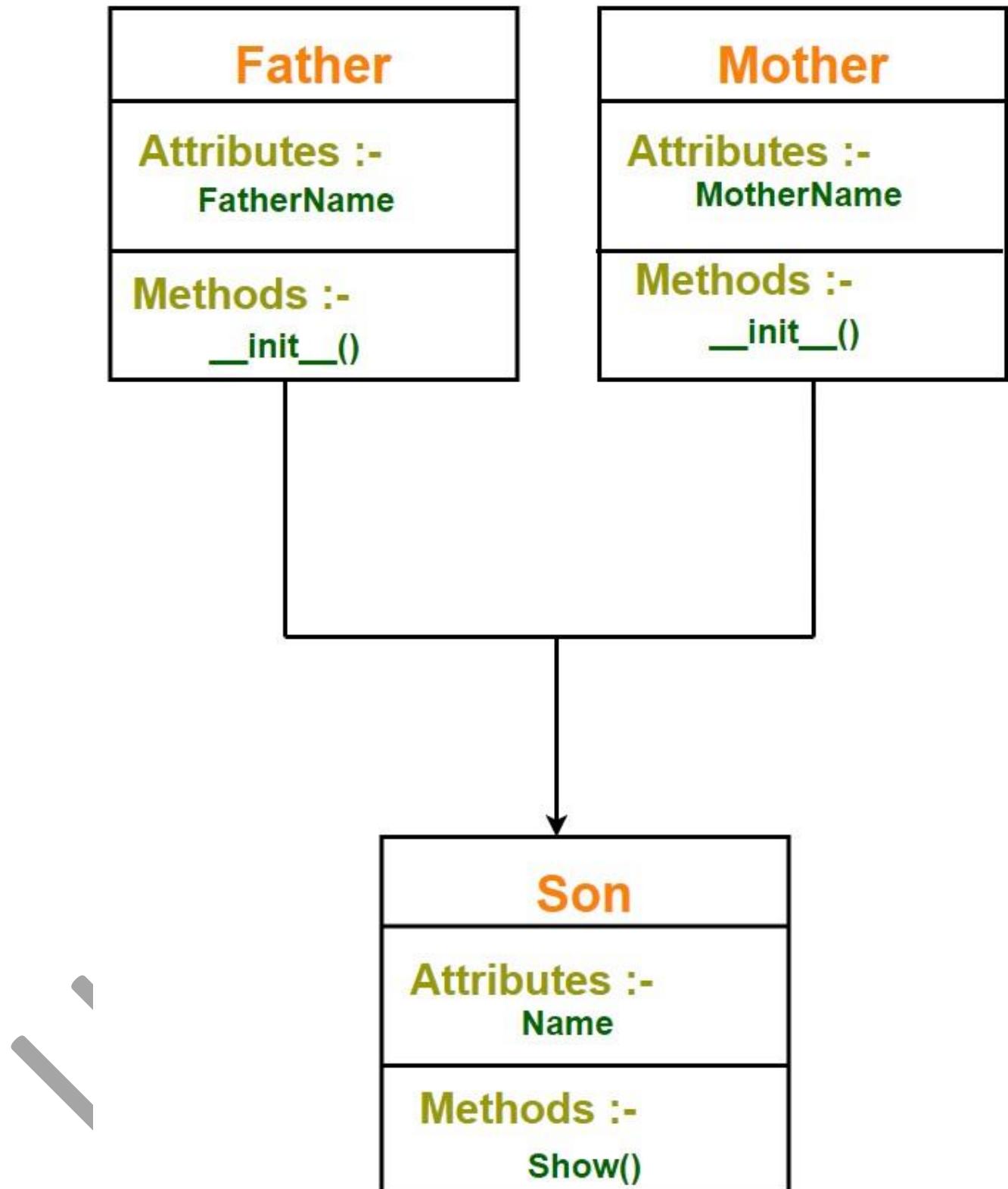
```
print('Fulltime Employee Details')
print('*****')
fulltim1= fulltime('Asif' , 22 , 'Male' , 567 , 70000, 12)
fulltim1.PersonInfo() fulltim1.employeeInfo()
fulltim1.FulltimeInfo()

Contractual Employee Details
*****
Name :- Basit
Age :- 36
Gender :- Male
Employee ID :- 456
Salary :- 80000
Contract Expiry :- 21-12-2021
```

```
Fulltime Employee Details
*****
Name :- Asif
Age :- 22
Gender :- Male
Employee ID :- 567
Salary :- 70000 Work
Experience :- 12
```

## Multiple Inheritance

- Multiple inheritance is a feature in which a class (derived class) can inherit attributes and methods from more than one parent class.
- The derived class inherits all the features of the base case.



```
In [120]: # Super Class
class Father:
    def __init__(self):
        self.fathername = str()

# Super Class
class Mother:
    def __init__(self):
        self.mothername = str()

# Sub Class
class Son(Father, Mother):
    name = str()
    def show(self):
        print('My Name :- ',self.name)
        print("Father :", self.fathername)
        print("Mother :", self.mothername)

s1 = Son()
s1.name = 'Bill'
s1.fathername = "John"
s1.mothername = "Kristen"
s1.show()
```

```
My Name :- Bill
Father : John
Mother : Kristen
```

```
In [215]: class Date:
    def __init__(self,date):
        self.date = date

class Time:
    def __init__(self,time):
        self.time = time

class timestamp(CurrentDate,CurrentTime):
    def __init__(self,date,time):
        CurrentDate.__init__(self,date)
        CurrentTime.__init__(self,time)
        DateTime = self.date + ' ' + self.time
        print(DateTime)

datetime1 = timestamp( '2020-08-09', '23:48:55')
```

```
2020-08-09 23:48:55
```

## Method Overriding

- Overriding is a very important part of object oriented programming because it makes inheritance exploit its full power.

- Overriding is the ability of a class (Sub Class / Child Class / Derived Class) to change the implementation of a method provided by one of its parent classes.
- When a method in a subclass has the same name, same parameter and same return type as a method in its super-class, then the method in the subclass is said to override the method in the super-class.
- The version of a method that is executed will be determined by the object that is used to invoke it.
- If an object of a parent class is used to invoke the method, then the version in the parent class will be executed, but if an object of the subclass is used to invoke the method, then the version in the child class will be executed.

```
In [173]: class person: # Parent Class
    def __init__(self, name, age, gender):
        self.name = name
        self.age = age
        self.gender = gender

    def greet(self):
        print("Hello Person")
```

```
class student(person): # Child Class
    def __init__(self, name, age, gender, studentid, fees):
        person.__init__(self, name, age, gender)
        self.studentid = studentid
        self.fees = fees

    def greet(self):
        print("Hello Student")

stud = student('Gabriel', 56, 'Male', 45, 345678)
stud.greet() # greet() method defined in subclass will be triggered as "stud" is
person1 = person('Gabriel', 56, 'Male')
person1.greet() # greet() method defined in superclass will be triggered because
```

Hello Student  
Hello Person

## Container

- Containers are data structures that hold data values.
- They support membership tests which means we can check whether a value exists in the container or not.
- Generally containers provide a way to access the contained objects and to iterate over them.
- Examples of containers include tuple, list, set, dict, str

ap es o co ta e s c u de t u p e, st, set, d ct, st

```
In [124]: list1 = ['asif' , 'john' , 'Michael' , 'Basit']

'asif' in list1 # Membership check using 'in' operator
```

```
Out[124]: True
```

```
In [128]: assert 'john' in list1 # If the condition returns true the program does nothing
```

```
In [127]: assert 'john1' in list1 # If the condition returns false, Assert will stop the pr
```

```
-----
AssertionError                                         Traceback (most recent call last)
<ipython-input-127-f7bcea8c4682> in <module>
      1 assert 'john1' in list1 AssertionError:
```

```
In [130]: mydict = {'Name':'Asif' , 'ID': 12345 , 'DOB': 1991 , 'Address' : 'Helsinki'}
mydict
```

```
Out[130]: {'Name': 'Asif', 'ID': 12345, 'DOB': 1991, 'Address': 'Helsinki'}
```

```
In [131]: 'Asif' in mydict # Dictionary membership will always check the keys
```

```
Out[131]: False
```

```
In [132]: 'Name' in mydict # Dictionary membership will always check the keys
```

```
Out[132]: True
```

```
In [133]: 'DOB' in mydict
```

```
Out[133]: True
```

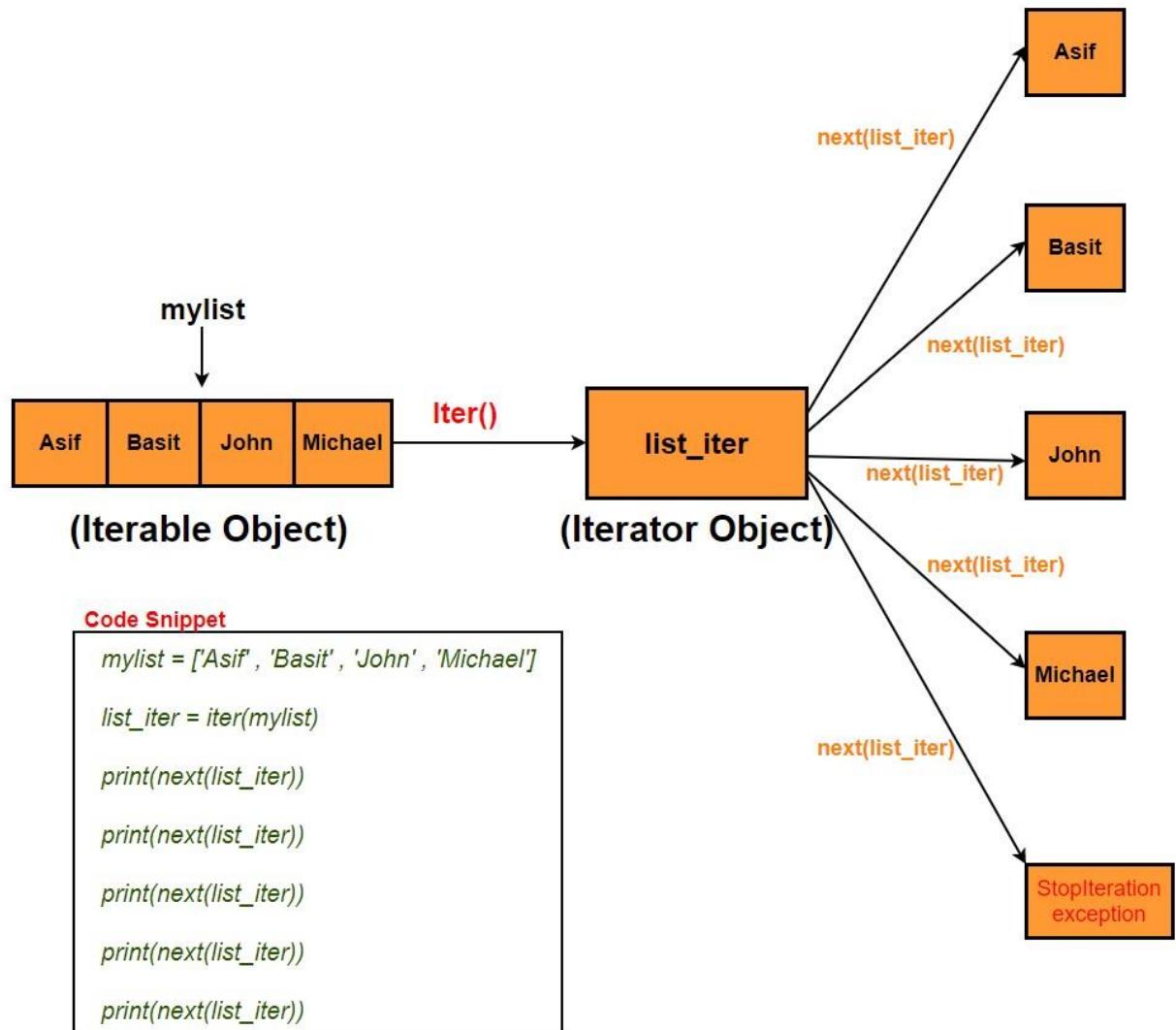
```
In [134]: mystr = 'asifbhat'

'as' in mystr # Check if substring is present
```

```
Out[134]: True
```

## Iterable & Iterator

- An **iterable** is an object that can be iterated upon. It can return an iterator object with the purpose of traversing through all the elements of an iterable.
- An iterable object implements `__iter__()` which is expected to return an iterator object. The iterator object uses the `__next__()` method. Every time `next()` is called next element in the iterator stream is returned. When there are no more elements available **StopIteration exception** is encountered. So any object that has a `__next__()` method is called an **iterator**.
- Python lists, tuples, dictionaries and sets are all examples of iterable objects.



In

```
[236]: mylist = ['Asif' , 'Basit' , 'John' , 'Michael'] list_iter =  
        iter(mylist) # Create an iterator object using iter()  
        print(next(list_iter)) # return first element in the iterator  
        stream print(next(list_iter)) # return next element in the iterator  
        stream print(next(list_iter)) print(next(list_iter))  
        print(next(list_iter))
```

```
Asif  
Basit  
John  
Michael
```

```
-----  
StopIteration
```

```
Traceback (most recent call last)
```

```
<ipython-input-236-a2095e242a65> in <module>  
5 print(next(list_iter))  
6 print(next(list_iter))  
----> 7 print(next(list_iter))
```

```
StopIteration:
```

```
In [238]: mylist = ['Asif' , 'Basit' , 'John' , 'Michael'] list_iter = iter(mylist)  
# Create an iterator object using iter() print(list_iter.__next__()) #  
# return first element in the iterator stream print(list_iter.__next__()) #  
# return next element in the iterator stream print(list_iter.__next__())  
print(list_iter.__next__())
```

```
Asif  
Basit  
John  
Michael
```

```
In [247]: mylist = ['Asif' , 'Basit' , 'John' , 'Michael'] list_iter =  
        iter(mylist) # Create an iterator object using iter() for i in  
        list_iter: print(i)
```

```
Asif  
Basit  
John  
Michael
```

```
In [241]: # Looping Through an Iterable (list) using for Loop
```

```
mylist = ['Asif' , 'Basit' , 'John' , 'Michael']  
  
for i in mylist:  
    print(i)
```

```
Asif  
Basit  
John  
Michael
```

In

```
[242]: # Looping Through an Iterable (tuple) using for Loop

mytuple = ('Asif' , 'Basit' , 'John' , 'Michael')

for i in mytuple:
    print(i)
```

```
Asif
Basit
John Michael
```

```
In [243]: # Looping Through an Iterable (string) using for Loop
```

```
mystr = "Hello Python"

for i in mystr:
    print(i)
```

```
H
e
l
l
o
P
y
t
h
o
n
```

```
[255]: # This iterator produces all natural numbers from 1 to 10.
```

```
class myiter:
    def __init__(self):
        self.num = 0

    def __iter__(self):
        self.num = 1
        return self

    def __next__(self):
        if self.num <= 10:
            val = self.num
            self.num += 1
            return val
        else:
            raise StopIteration

mynum = myiter()
iter1 = iter(mynum)
for i in iter1:
    print(i)
```

```
1
2
3
```

In

```
4
5
6
7
8
9
10
[256]: # This iterator will produce odd numbers
class myiter:
    def __init__(self):
        self.num = 0

    def __iter__(self):
        self.num = 1
        return self

    def __next__(self):
        if self.num <= 20 :
            val = self.num
            self.num += 2
            return val
        else:
            raise StopIteration

myodd = myiter()
iter1 = iter(myodd)
for i in iter1:
    print(i)
```

```
1
3
5
7
9
11
13
15
17
19
```

In

```
[257]: # This iterator will produce fibonacci numbers

class myfibonacci:
    def __init__(self):
        self.prev = 0
        self.cur = 0

    def __iter__(self):
        self.prev = 0
        self.cur = 1
        return self

    def __next__(self):
        if self.cur <= 50:
            val = self.cur
            self.cur += self.prev
            self.prev = val
            return val
        else:
            raise StopIteration

myfibo = myfibonacci()
iter1 = iter(myfibo)
for i in iter1:
    print(i)
```

```
1
1
2
3
5
8
13
21
34
```

## Generator

- Python generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.
- It is a special type of function which returns an iterator object.
- In a generator function, a **yield** statement is used rather than a **return** statement.
- The generator function cannot include the **return** keyword. If we include it then it will terminate the execution of the function.
- The difference between **yield** and **return** is that once **yield** returns a value the function is paused and the control is transferred to the caller. Local variables and their states are

In

remembered between successive calls. In case of the return statement value is returned and the execution of the function is terminated.

- Methods like `iter()` and `next()` are implemented automatically in generator function.

Usman Ghilas

- Simple generators can be easily created using **generator expressions**. Generator expressions create anonymous generator functions like lambda.
- The syntax for generator expression is similar to that of a list comprehension but the only difference is square brackets are replaced with round parentheses. Also list comprehension produces the entire list while the generator expression produces one item at a time which is more memory efficient than list comprehension.

In [258]: *# Simple generator function that will generate numbers from 1 to 5.*

```
def mygen():
    n = 1
    yield n

    n += 1
    yield n

mygen1 = mygen()

print(next(mygen1))
print(next(mygen1))
print(next(mygen1))
print(next(mygen1))
print(next(mygen1)) #Function will terminate here as all 5 values have been returned
print(next(mygen1)) # As function is already terminated, StopIteration is raised
```

```
1
2
3
4
5
```

---

```
StopIteration
<ipython-input-258-4c1c399db6dd> in <module>
24 print(next(mygen1))
25 print(next(mygen1))
--> 26 print(next(mygen1))
```

Traceback (most recent call last)

**StopIteration:**

In

```
[272]: # Simple generator function that will generate natural numbers from 1 to 20.
def mygen():
    for i in range(1,20):
        yield i

mygen1 = mygen()

for i in mygen1:
    print(i)
```

```
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
```

In [274]: num = list(mygen()) # Store all values generated by generator function in a List  
num

Out[274]: [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19]

```
[275]: # Simple generator function that will generate even numbers from 1 to 20.
def mygen():
    for i in range(1,20):
        if i%2 == 0:
            yield i
```

```
mygen1 = mygen()

for i in mygen1:
    print(i)
```

```
2
4
6
```

In

```
8  
10  
12  
14  
16  
18
```

In [276]: *# This Generator function will generate ten numbers of fibonacci series.*

```
def myfibo():  
    num1 , num2 = 0,1  
    count = 0  
    while count < 10:  
        yield num1  
        num1,num2 = num2,num1+num2  
        count+=1  
  
fibo = myfibo()  
  
for i in fibo:  
    print(i)
```

```
0  
1  
1  
2  
3  
5  
8  
13  
21  
34
```

In [277]: *list1 = list(myfibo()) # Store the fibonacci series in a List*

Out[277]: [0, 1, 1, 2, 3, 5, 8, 13, 21, 34]

[283]: *list2 = [i\*\*2 for i in range(10)] # List comprehension*

Out[283]: [0, 1, 4, 9, 16, 25, 36, 49, 64, 81]

In [280]: *gen2 = (i\*\*2 for i in range(10)) # Generator expression*

Out[280]: <generator object <genexpr> at 0x000001EF4B639848>

In

```
In [282]: print(next(gen2))
print(next(gen2))
print(next(gen2))
print(next(gen2))
print(next(gen2))
```

```
1
4
9
16
25
```

```
In [288]: gen2 = (i for i in range(40) if i%2 == 0) # Generator expression to generate even
gen2

for i in gen2:
    print(i)
```

```
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
34
36
38
```

## Decorator

**Decorator** is very powerful and useful tool in Python as it allows us to wrap another function in order to extend the behavior of wrapped function without permanently modifying it.

In Decorators functions are taken as the argument into another function and then called inside the wrapper function.

### Advantages -

- Logging & debugging
- Access control and authentication

```
In [2]: def subtract(num1 , num2):  
    res = num1 - num2  
    print('Result is :- ', res)
```

```
subtract(2,4)
```

```
Result is :-  2  
Result is :- -2
```

```
subtract(4,2)
```

```
In [6]: ''' We now want subtract() function to always subtract lower number from higher one  
So when we pass (2,4) it should perform 4-2 not 2-4. To achieve this we will
```

```
def sub_decorator(func):  
    def wrapper(num1,num2):  
        if num1 < num2:  
            num1,num2 = num2,num1  
            return func(num1,num2)  
    return wrapper  
  
sub = sub_decorator(subtract)  
  
sub(2,4)
```

```
Result is :-  2
```

```
In [20]: @sub_decorator  # we can use @ syntax for decorating a function in one step  
def subtract(num1 , num2):  
    res = num1 - num2  
    print('Result is :- ', res)  
subtract(2,4)
```

```
Result is :-  2
```

```
In [60]: def InstallLinux():
    print('Linux installation has started \n')

def InstallWindows():
    print('Windows installation has started \n')

def InstallMac():
    print('Mac installation has started \n')

InstallLinux()
InstallWindows()
InstallMac()

print()

''' Now suppose if we want to print message :- "Please accept terms & conditions"
then easy way will be to create one decorator function which will present thi

def InstallDecorator(func):
    def wrapper():
        print('Please accept terms & conditions')
        return func()
    return wrapper()

@InstallDecorator    # we can use @ syntax for decorating a function in one step
def InstallLinux():
    print('Linux installation has started \n')

@InstallDecorator
def InstallWindows():
    print('Windows installation has started \n')

@InstallDecorator
def InstallMac():
    print('Mac installation has started \n')
```

Linux installation has started

Windows installation has started

Mac installation has started

Please accept terms & conditions  
Linux installation has started

Please accept terms & conditions  
Windows installation has started

Please accept terms & conditions

In

Mac installation has started

```
[69]: # Apply multiple decorator on a single function

def InstallDecorator1(func):
    def wrapper():
        print('Please accept terms & conditions...\n')
        func()
    return wrapper

def InstallDecorator2(func):
    def wrapper():
        print('Please enter correct license key...\n')
        return func()
    return wrapper

def InstallDecorator3(func):
    def wrapper():
        print('Please enter partitioning choice...\n')
        return func()
    return wrapper

@InstallDecorator1
@InstallDecorator2
@InstallDecorator3
def InstallLinux():
    print('Linux installation has started \n')

InstallLinux()
```

Please accept terms &amp; conditions...

Please enter correct license key...

Please enter partitioning choice...

Linux installation has started

## File Management

Python has several built-in modules and functions for creating, reading, updating and deleting files.

## Order of File Operation



### Open File

```
In [69]: fileobj = open('test1.txt') # Open file in read/text mode
```

```
In [70]: fileobj = open('test1.txt', 'r') # Open file in read mode
```

```
In [71]: fileobj = open('test1.txt', 'w') # Open file in write mode
```

```
In [72]: fileobj = open('test1.txt', 'a') # Open file in append mode
```

### Close File

```
In [73]: fileobj.close()
```

### Read File

```
In [84]: fileobj = open('test1.txt')
```

```
In [85]: fileobj.read() #Read whole file
```

Out[85]: 'Python generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.\nIt is a special type of function which returns an iterator object.\nIn a generator function, a `yield` statement is used rather than a `return` statement.\nThe generator function cannot include the `return` keyword. If we include it then it will terminate the execution of the function.\nThe difference between `yield` and `return` is that once `yield` returns a value the function is paused and the control is transferred to the caller. Local variables and their states are remembered between successive calls. In case of the `return` statement value is returned and the execution of the function is terminated.\nMethods like `__iter__()` and `__next__()` are implemented automatically in generator function.\nSimple generators can be easily created using generator expressions. Generator expressions create anonymous generator functions like `lambda`. The syntax for generator expression is similar to that of a list comprehension but the only difference is square brackets are replaced with round parentheses. Also list comprehension produces the entire list while the generator expression produces one item at a time which is more memory efficient than list comprehension.'

```
In [86]: fileobj.read() #File cursor is already at the end of the file so it won't be able
```

```
Out[86]: ''
```

In

```
[87]: fileobj.seek(0) # Bring file cursor to initial position.  
fileobj.read()
```

Out[87]: 'Python generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.\nIt is a special type of function which returns an iterator object.\nIn a generator function, a yield statement is used rather than a return statement.\nThe generator function cannot include the return keyword. If we include it then it will terminate the execution of the function.\nThe difference between yield and return is that once yield returns a value the function is paused and the control is transferred to the caller.Local variables and their states are remembered between successive calls. In case of the return statement value is returned and the execution of the function is terminated.\nMethods like `__iter__()` and `__next__()` are implemented automatically in generator function.\nSimple generators can be easily created using generator expressions. Generator expressions create anonymous generator functions like `lambda`.The syntax for generator expression is similar to that of a list comprehension but the only difference is square brackets are replaced with round parentheses. Also list comprehension produces the entire list while the generator expression produces one item at a time which is more memory efficient than list comprehension.'

In [88]: `fileobj.seek(7) # place file cursor at Loc 7`  
`fileobj.read()`

Out[88]: 'generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.\nIt is a special type of function which returns an iterator object.\nIn a generator function, a yield statement is used rather than a return statement.\nThe generator function cannot include the return keyword. If we include it then it will terminate the execution of the function.\nThe difference between yield and return is that once yield returns a value the function is paused and the control is transferred to the caller.Local variables and their states are remembered between successive calls. In case of the return statement value is returned and the execution of the function is terminated.\nMethods like `__iter__()` and `__next__()` are implemented automatically in generator function.\nSimple generators can be easily created using generator expressions. Generator expressions create anonymous generator functions like `lambda`.The syntax for generator expression is similar to that of a list comprehension but the only difference is square brackets are replaced with round parentheses. Also list comprehension produces the entire list while the generator expression produces one item at a time which is more memory efficient than list comprehension.'

In [89]: `fileobj.seek(0)`  
`fileobj.read(16) # Return the first 16 characters of the file`

Out[89]: 'Python generator'

In [90]: `fileobj.tell() # Get the file cursor position`

Out[90]: 16

```
In [91]: fileobj.seek(0)

print(fileobj.readline()) # Read first line of a file.

print(fileobj.readline()) # Read second line of a file.

print(fileobj.readline()) # Read third line of a file.
```

Python generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.

It is a special type of function which returns an iterator object.

In a generator function, a yield statement is used rather than a return statement.

```
nt. fileobj.readlines() # Read all lines of a file.
```

```
In [92]: fileobj.seek(0)
```

```
Out[92]: ['Python generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.\n',
 'It is a special type of function which returns an iterator object.\n',
 'In a generator function, a yield statement is used rather than a return statement.\n',
 'The generator function cannot include the return keyword. If we include it then it will terminate the execution of the function.\n',
 'The difference between yield and return is that once yield returns a value the function is paused and the control is transferred to the caller. Local variables and their states are remembered between successive calls. In case of the return statement value is returned and the execution of the function is terminated.\n',
 'Methods like __iter__() and __next__() are implemented automatically in generator function.\n',
 'Simple generators can be easily created using generator expressions. Generator expressions create anonymous generator functions like lambda.\n',
 'The syntax for generator expression is similar to that of a list comprehension but the only difference is square brackets are replaced with round parentheses. Also list comprehension produces the entire list while the generator expression produces one item at a time which is more memory efficient than list comprehension.']")

```

In

```
[93]: # Read first 5 lines of a file using readline()
fileobj.seek(0)

count = 0
for i in range(5):
    if (count < 5):
        print(fileobj.readline())
    else:
        break
    count+=1
```

Python generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.

It is a special type of function which returns an iterator object.

In a generator function, a `yield` statement is used rather than a `return` statement.

The generator function cannot include the `return` keyword. If we include it then it will terminate the execution of the function.

The difference between `yield` and `return` is that once `yield` returns a value the function is paused and the control is transferred to the caller. Local variables and their states are remembered between successive calls. In case of the `return` statement value is returned and the execution of the function is terminated.

In

```
[94]: # Read first 5 lines of a file using readlines()
fileobj.seek(0)

count = 0
for i in fileobj.readlines():
    if (count < 5):
        print(i)
    else:
        break
    count+=1
```

Python generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.

It is a special type of function which returns an iterator object.

In a generator function, a `yield` statement is used rather than a `return` statement.

The generator function cannot include the `return` keyword. If we include it then it will terminate the execution of the function.

The difference between `yield` and `return` is that once `yield` returns a value the function is paused and the control is transferred to the caller. Local variables and their states are remembered between successive calls. In case of the `return` statement value is returned and the execution of the function is terminated.

## Write File

```
[95]: fileobj = open('test1.txt', 'a')

fileobj.write('THIS IS THE NEW CONTENT APPENDED IN THE FILE') # Append content to

fileobj.close()

fileobj = open('test1.txt')

fileobj.read()
```

In

Out[95]: 'Python generators are easy way of creating iterators. It generates values one at a time from a given sequence instead of returning the entire sequence at once.\nIt is a special type of function which returns an iterator object.\nIn a generator function, a yield statement is used rather than a return statement.\nThe generator function cannot include the return keyword. If we include it then it will terminate the execution of the function.\nThe difference between yield and return is that once yield returns a value the function is paused and the control is transferred to the caller. Local variables and their states are remembered between successive calls. In case of the return statement value is returned and the execution of the function is terminated.\nMethods like `__iter__` and `__next__` are implemented automatically in generator function.\nSimple generators can be easily created using generator expressions. Generator expressions create anonymous generator functions like `lambda`. The syntax for generator expression is similar to that of a list comprehension but the only difference is square brackets are replaced with round parentheses. Also list comprehension produces the entire list while the generator expression produces one item at a time which is more memory efficient than list comprehension.THIS IS THE NEW CONTENT APPENDED IN THE FILE'

In [96]:

```
fileobj = open("test1.txt", "w")
fileobj.write("NEW CONTENT ADDED IN THE FILE. PREVIOUS CONTENT HAS BEEN OVERWRITTEN")
fileobj.close()
fileobj = open('test1.txt')
fileobj.read()
```

Out[96]: 'NEW CONTENT ADDED IN THE FILE. PREVIOUS CONTENT HAS BEEN OVERWRITTEN'

```
In [114]: fileobj = open("test2.txt", "w") # Create a new file

fileobj.write("First Line\n")
fileobj.write("Second Line\n")
fileobj.write("Third Line\n")
fileobj.write("Fourth Line\n")
fileobj.write("Fifth Line\n")
fileobj.close()

fileobj = open('test2.txt')

fileobj.readlines()
```

```
Out[114]: ['First Line\n',
 'Second Line\n',
 'Third Line\n',
 'Fourth Line\n',
 'Fifth Line\n']
```

## Delete file

```
In [115]: os.remove("test3.txt") # Delete file
```

```
In [116]: os.remove("test3.txt")
```

```
-----
FileNotFoundError                                     Traceback (most recent call last)
<ipython-input-116-fecc9f240170> in <module>
      1 os.remove("test3.txt")
FileNotFoundError: [WinError 2] The system cannot find the file specified: 'test3.txt'
```

```
In [117]: os.rmdir('folder1/') # Delete folder
```

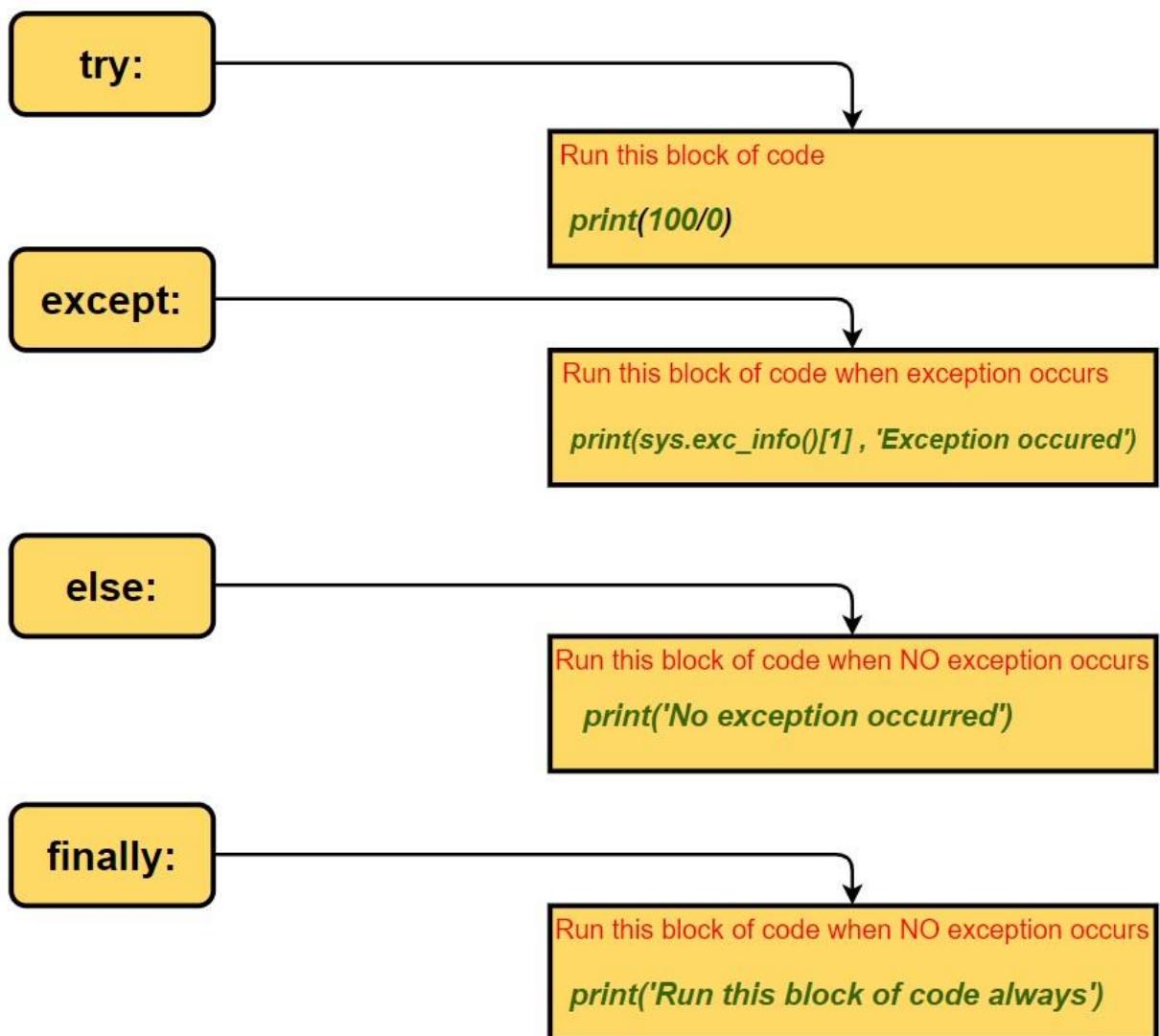
```
In [118]: os.rmdir('folder1/')
```

```
-----
FileNotFoundError                                     Traceback (most recent call last)
<ipython-input-118-e9e89c9edbf0> in <module>
      1 os.rmdir('folder1/')
FileNotFoundError: [WinError 2] The system cannot find the file specified: 'folder1/'
```

# Error & Exception Handling

- Python has many built-in exceptions (ArithmeticError, ZeroDivisionError, EOFError, IndexError, KeyError, SyntaxError, IndentationError, FileNotFoundError etc) that are raised when your program encounters an error.

- When the exception occurs Python interpreter stops the current process and passes it to the calling process until it is handled. If exception is not handled the program will crash.
- Exceptions in python can be handled using a **try** statement. The **try** block lets you test a block of code for errors.
- The block of code which can raise an exception is placed inside the try clause. The code that will handle the exceptions is written in the **except** clause.
- The **finally** code block will execute regardless of the result of the try and except blocks.
- We can also use the **else** keyword to define a block of code to be executed if no exceptions were raised.
- Python also allows us to create our own exceptions that can be raised from the program using the **raise** keyword and caught using the **except** clause. We can define what kind of error to raise, and the text to print to the user.



## Code Snippet:-

```

try:
    print(100/0)

except:
    print(sys.exc_info()[1] , 'Exception occurred')

else:
    print('No exception occurred')

finally:
    print('Run this block of code always')

```

## Output :-

Division by zero Exception occurred  
Run this block of code always

In [130]:

```

try:
    print(100/0) # ZeroDivisionError will be encountered here. So the control wil

except:
    print(sys.exc_info()[1] , 'Exception occurred') # This statement will be execut

else:
    print('No exception occurred') # This will be skipped as code block inside tr

finally:
    print('Run this block of code always') # This will be always executed

```

division by zero Exception occurred  
Run this block of code always

In [134]:

```

try:
    print(x) # NameError exception will be encountered as variable x is not defi

except:
    print('Variable x is not defined')

```

Variable x is not defined

```
In [137]: try:  
    os.remove("test3.txt") # FileNotFoundError will be encountered as "test3.txt"  
  
except:                      # Below statement will be executed as exception occur  
    print("BELOW EXCEPTION OCCURED")  
    print(sys.exc_info()[1])  
  
else:  
    print('\nNo exception occurred')  
  
finally:  
    print('\nRun this block of code always')  
BELOW EXCEPTION OCCURED  
[WinError 2] The system cannot find the file specified: 'test3.txt'  
  
Run this block of code always
```

```
In [141]: # Handling specific exceptions  
try:  
    x = int(input('Enter first number :- '))  
    y = int(input('Enter first number :- ')) # If input entered is non-zero then  
    print(x/y)  
    os.remove("test3.txt")  
  
except NameError:  
    print('NameError exception occurred')  
  
except FileNotFoundError:  
    print('FileNotFoundError exception occurred')  
  
except ZeroDivisionError:  
    print('ZeroDivisionError exception occurred')  
  
Enter first number :- 12  
Enter first number :- 13  
0.9230769230769231 FileNotFoundError  
exception occurred
```

In

```
[142]: # Handling specific exceptions
try:
    x = int(input('Enter first number :- '))
    y = int(input('Enter first number :- ')) # If the input entered is zero the
    print(x/y)
    os.remove("test3.txt")

except NameError:
    print('NameError exception occurred')

except FileNotFoundError:
    print('FileNotFoundError exception occurred')

except ZeroDivisionError:
    print('ZeroDivisionError exception occurred')

Enter first number :- 10
Enter first number :- 0
ZeroDivisionError exception occurred
```

In [144]:

```
try:
    x = int(input('Enter first number :- '))
    if x > 50:
        raise ValueError(x) # If value of x is greater than 50 ValueError exception
except:
    print(sys.exc_info()[0])

Enter first number :- 100
<class 'ValueError'>
```

## Built-in Exceptions

In [149]:

```
# OverflowError - This exception is raised when the result of a numeric calculation
# exceeds the range of a numeric type

try:
    import math
    print(math.exp(1000))
except OverflowError:
    print (sys.exc_info())
else:
    print ("Success, no error!")

(<class 'OverflowError'>, OverflowError('math range error'), <traceback object
at 0x000002B2B12EFB88>)
```

In [150]: *# ZeroDivisionError - This exception is raised when the second operator in a division is zero.*

```
try:
    x = int(input('Enter first number :- '))
    y = int(input('Enter first number :- '))
    print(x/y)

except ZeroDivisionError:
    print('ZeroDivisionError exception occurred')
```

Enter first number :- 100  
Enter first number :- 0

ZeroDivisionError exception occurred

In [152]: *# NameError - This exception is raised when a variable does not exist.*

```
try:
    print(x1)

except NameError:
    print('NameError exception occurred')
```

NameError exception occurred

In [155]: *# AssertionError - This exception is raised when an assert statement fails.*

```
try:
    a = 50
    b = "Asif"
    assert a == b
except AssertionError:
    print ("Assertion Exception Raised.")
```

Assertion Exception Raised.

In

```
In [157]: # ModuleNotFoundError - This exception is raised when an imported module does not

try:
    import MyModule

except ModuleNotFoundError:
    print ("ModuleNotFoundError Exception Raised.")

ModuleNotFoundError Exception Raised.
```

```
In [160]: # KeyError - This exception is raised when key does not exist in a dictionary

try:
    mydict = {1:'Asif', 2:'Basit', 3:'Michael'}
    print (mydict[4])

except KeyError:
    print ("KeyError Exception Raised.")

KeyError Exception Raised.
```

```
In [165]: # TypeError - This exception is raised when two different datatypes are combined

try:
    a = 50
    b = "Asif"
    c = a/b
except TypeError:
    print ("TypeError Exception Raised.")

TypeError Exception Raised.
```

```
In [171]: # AttributeError: - This exception is raised when attribute reference or assignment

try:
    a = 10
    b = a.upper()
    print(b)
except AttributeError:
    print ("AttributeError Exception Raised.")

AttributeError Exception Raised.
```

```
In [ ]: try:
    x = input('Enter first number :- ')

except:
    print('ZeroDivisionError exception occurred')
```

```
In [162]: # IndexError - This exception is raised when an index of a sequence does not exist

try:
    mylist = [1,2,3,4,5,6]
    print (mylist[10])

except IndexError:
    print ("IndexError Exception Raised.")
```

IndexError Exception Raised.

**END**

Usman Ghias