# tut6(comment and escape sequence)

```
print("hello")
# single line comment
"""multi line
comment
"""

print("hello avi")
print("hello avi2")
# Now every print statement is starting in new line to end it in same line use
 end="(character with which you want to end like comma,space,fullstop)"
print("hello avi",end=", ")
print("hello avi2")

print("hello avi",end="*****")
print("hello avi2")

print("hello avi","hello avi2",)        #it will automatically give space.
#Escape Sequence - "\n,\t"  to print escpae sequence write \\ like "\\n ,\\t "
```

# tut7 (variables)

```
var1="hello world"
var2 =4
var3 =36.7
var4 = "Avi"
print(type(var1))
print(type(var2))
print(type(var3))

#print(var1 + var2)  error
#print(var1 + var3)  error
print(var2+ var3)
print(var1+var4)
print(type(var2+ var3))


#Type casting int(variable_name)         int(),float(),str()
var5 = "4"
var6 = "12"
print(var5+var6)
print(int(var5)+int(var6))
print(str(var2)+str(var3))

#utilities  10*(any_string) print it 10 times, n*(any string) print it n times
```

```
#how to take input in python input is taken by default as string
print("Enter no.")
a = input()
print("You entered ",a)
#alternate method
a = input("enter again")
print("You entered ",a)
```

# tut8 (string slicing)

```
mystr ="Avi is good boy"
print(mystr) #print complete string
print(mystr[2]) #print of that index.
print(len(mystr)) #print the length
print(mystr[0:10]) #print from including starting index and upto last index(ex
cluding)
print(mystr[0:10:2]) #print with escaping one characters if instead of 2 we wr
ite n it will skip n-1 character
print(mystr[::-1]) #first reverse the string then print from starting to last
print(mystr[::-
2]) #first reverse the string then print from starting to last skiping 1 chara
cter
print(mystr[0:])  #print from starting index to last
print(mystr[::]) #print from starting to last

print(mystr.isalnum()); #check whether it is alpha numeric or not
print(mystr.isalpha()); #check whether it is alpha or not here false b/c conta
ins space
print(mystr.endswith("boy")) #check whether it ends with given word/letter or
not
print(mystr.count("o")) #counts no of repetition
print(mystr.capitalize()) #capitalise first letter
print(mystr.find("is")) #gives the starting index
print(mystr.lower()) #convert in lowercase
print(mystr.upper()) #convert in uppercase
print(mystr.replace("good","very good")) # replace
```

# tut9 (list,tuple and list func.)

```
grocery =["harpic","vim bar","dio","bhindi","lollly pop", 45]
print(grocery) #print complete list
print(grocery[3]) #print at that index assume as array
numbers =[5,5,5,8,3,7,4]
numbers.sort() #sort
numbers.reverse() #reverse
numbers.append(9) #append
numbers.insert(1,61) #insert 61 at index 1
numbers.remove(5)
numbers.pop() #remove last element
print(numbers.count(6)) #count how many times it is appeared in list
#slicing
#slicing returns new list but not changes intial list
print(numbers[:]) # it will print the list with index starting before colon(by
 default 0) and just before index mentioned after colon(by default last index)
#extended slicing
print(numbers[::2]) # print the list skipping 1 element if n then skipping n-
1 letter if -1 then reverse list
print(len(numbers))  #find length
print(max(numbers)) #find maximum in list
print(min(numbers)) #find minimum in list

"""List are mutable while tuple is immutable means tuple can not be changed,
 tuples are in parenthesis while list is in square bracket """
tuple_example =(4,6,5)
print(tuple_example)
"""to make a tuple of single element put a comma after the element like (1,)""
"

"""simple program to swap two numbers"""
a=1
b=2
a,b = b,a
print(a,b)

###################### LIST COMPREHENSION #########################
"""
A list comprehension generally consist of these parts :
   Output expression,
   input sequence,
   a variable representing member of input sequence and
   an optional predicate part.

For example : list for square of odd no

lst  =  [x ** 2  for x in range (1, 11)   if  x % 2 == 1]

here, x ** 2 is output expression,
      range (1, 11)  is input sequence,
      x is variable and
      if x % 2 == 1 is predicate part.
"""
```

# tut10 (Dictionary)

```
#Dictionary is key value pair it is written in {}
```

```
d1 ={"Avi":"Avishek","Abh":"Abhay","Rau":"Raushan"}
print(type(d1))
print(d1["Avi"]) #it will print the value of corresponding to that key
# we can also keep dictionary inside dictionary
d2 ={"Avi":{"Name":"Avishek","MOB":7479734685},"Abh":"Abhay","Rau":"Raushan"}
print(d2["Avi"]["Name"])
d2["Ankit"] = "Junk Food" # add items in dict
print([d2["Ankit"]])
d2["Ankit"] = "New Junk Food"
print([d2["Ankit"]])
del d2["Ankit"] # it will delete this key and its pair
d3 = d2  # it means now d3 will point d2 , on changing in d3 it will change on
 d2
d3 = d2.copy() #it will return copy of d2, now d2 and d3 will be independent

print(d2.keys())  #print keys
print(d2.items()) #print items
```

## tut11 (Set)

```
s = set()
print(type(s))
s_fron_list = set([1,2,3,4])  # same set can be created using list instead of
passing list you can also pass the name of list declared before
print((s_fron_list))
s.add(1)  # it will add it in set but set contains unique values only
s.add(1)  # adding it again will not change any thing in set but in list you c
an add repeatitively
print(s)
s1 = s.union({4,2,3})   #return union of s and given set
print( s,s1)
s1 = s.intersection((1,3)) # return union of s and given set
print( s,s1)
print(s.isdisjoint(s1)) #it will tell whether s ar s1 is disjoint or not
s_fron_list.remove(4)   # removes the passed element
#similarly len(s),max(s),min(s) will gives length and maximum, minimum value
```

## tut12 and 13(if else)

```
a = 6
b= 56
c = int(input("Enter no\n"))

if c>b:
    print("Greater")
elif c==b:
    print("Equal")
```

```
else:
    print("Lesser")


list1 = [5,7,3]
if 5 in list1:
    print("Yes")
if 15 not in list1:  # here "in" and "not in" is keyword
    print("NO")

#short hand for if else
c = int(input("Enter no\n"))
if c>b : print("Greater")
c = int(input("Enter no again\n"))
print("Greater") if c>b else print("Smaller")
```

## tut16 17( for and while loop)

```
list1 = ["avi","kvi","ashi","aksd","klajdkf","sdfkld"]
list2 = [["akldj",1],["klaj",2],["klaj",3]]
dict1 = dict(list2)
for item in list1:
    print(item)
for item,numb in list2:
    print(item,"has scored rank",numb,"\n",end="*")
print("printing dictionary ",dict1)
#to iterate in dictionary
for item,numb in dict1.items():
    print(item,"has scored rank",numb)

#practise
prac = ["avi",4,12,"akd",6.5]
for item in  prac:
    if(str(item).isnumeric() and item>6):
        print(item)
    else:
        print("It is not allowed")

"""range function it will take three argument max,
first is starting, second is terminating and third is increment value
if you pass one value then by default starting value =0, increment value = 1,t
erminating value = passed value
if you pass 2 value (a,b) a= starting value ,b= terminating value,increment va
lue=1(bydefault)
"""
for item in range(0,6,2):
    print(item,end=" fOr ")
print("")
```

```
i=0
while(i<=5):
    print(i,end=" w ")
    i += 1
```

## tut 18 (break, continue)

```
i=0
while(i<=10):
    if(i==4 or i==8):
        i += 1
        continue
    print(i, end=" ")
    i += 1
i=0
print("")
while(i<=10):
    if(i==8):
        i += 1
        break
    print(i, end=" ")
    i += 1
```

## tut21(Operators)

```
"""Arithmetic,Comparision,Identity,Membership,Bitwise
#Arithmetic
+  addition
-  subtraction
*  multiplication
/  divide
// divide but gives integer GIF
** exponetial
% modulu for remainder

#Assignment Operator
x +=7  means x = x+7

#Comparison Operator
== equality
!= not equal
>,< greater,lesser
>=,<= greater than,less than

#Logical Operator
a = True
b = False
"and" and
"or"  or
```

```
#Identity operator
"is" (a is b) check whether a is b
"is not" (a is not b) check whether a is not b

#Membership Operator
list = [3,3,2,45,24,8,6,7,15,76]
"in" print(45 in list) it will print whether 45 is in list or not
"not in"

#Bitwise Operator
& binary and
| binary or


"""
```

# tut 22 ( function and docstring)

```
# user define function
#first line inside a function as a multi line comment is called docstring whic
h should contain some details related to that function
#to check the docstring of function f1() write "print(f1.__doc__)"
def function(a, b):
    """this is a function to add two number"""
    print("Hello inside function", a + b)
def function2(a,b):
    """this to find average"""
    average = (a+b)/2
    print(average)
    return average

print(function(7, 10))
print(function2(4,8)) # first execute the function then print the return value
print(function2.__doc__) #print the docstring
print(function2.__code__)
print(function.__doc__)
```

# tut23 (exception handling)

```
# Here try and except is used

a = input("enter a\n")
b = input("enter b\n")
try:
    print("sum",int(a)+int(b))
except Exception as e:
    print("something is wrong",e) #Exception is the error msg
```

# File handling( reading)

```
"""
FILE IO BASICS
"r" - open file for reading
"w" - open file for writing , erase the previous content and write ,create new
 file if not exist
"x" - creates file if not exist (exclusive creation)
"b" - open for binary mode
"t" - text mode  (it is default mode)
"a" - add more content (append) write in last of file
"+" - both read and write


"""
#f = open("avi.txt")                            #syntax of file opening
f = open("avi.txt","r")                     #second argument is file opening mode
by default it "r" mode
# content = f.read()                             #if we not mention any no. insid
e read() it will read whole file
# print(content)

#content = f.read(3)         #here it will read first 3 character and then cal
ling it again it will read after that character
                            # and if we put very large no such that there is n
ot that much character then it will read upto last only
#print(content)

#content = f.read(3)          #here it will read 3 character after that which
was already read
#print(content)
""" to read file line by line or letter by letter we have to iterate the file"
""
# for line in content:                #it will read letter by letter here we h
ave to use content
#     print(line,end=(" "))
# for line in f:                         # read line by line
#     print(line,end="")                 # here no need to use content = f.read()
 b/c if we use it will read file upto end and nothing will left to read

# print(f.readline())    # it will also read line
# print(f.readline())    #when it is called again it will read after that

print(f.readlines())    #it will store the line in list
```

```
f.close()                                   #syntax of file closing and it is
good practise to close the file
```

## file handling( writing and appending)

```
# f = open("avi2.txt","w") # erase and write
# f = open("avi2.txt","a")  # append
f = open("avi2.txt","r+")   # handle read and write
print(f.read())
f.write("Thank you")
# a = f.write("Writing in a file again") #it will returns no. of character wri
tten


f.close()
```

| Sr.No. | Modes & Description |
|---|---|
| 1 | **r**<br>Opens a file for reading only. The file pointer is placed at the beginning of the file. This is the default mode. |
| 2 | **rb**<br>Opens a file for reading only in binary format. The file pointer is placed at the beginning of the file. This is t default mode. |
| 3 | **r+**<br>Opens a file for both reading and writing. The file pointer placed at the beginning of the file. |
| 4 | **rb+**<br>Opens a file for both reading and writing in binary format. The file pointer placed at the beginning of the file. |
| 5 | **w**<br>Opens a file for writing only. Overwrites the file if the file exists. If the file does not exist, creates a new file writing. |

| | |
|---|---|
| 6 | **wb**<br><br>Opens a file for writing only in binary format. Overwrites the file if the file exists. If the file does not exist, creates<br>new file for writing. |
| 7 | **w+**<br><br>Opens a file for both writing and reading. Overwrites the existing file if the file exists. If the file does not exi<br>creates a new file for reading and writing. |
| 8 | **wb+**<br><br>Opens a file for both writing and reading in binary format. Overwrites the existing file if the file exists. If the file do<br>not exist, creates a new file for reading and writing. |
| 9 | **a**<br><br>Opens a file for appending. The file pointer is at the end of the file if the file exists. That is, the file is in the appe<br>mode. If the file does not exist, it creates a new file for writing. |
| 10 | **ab**<br><br>Opens a file for appending in binary format. The file pointer is at the end of the file if the file exists. That is, the f<br>is in the append mode. If the file does not exist, it creates a new file for writing. |
| 11 | **a+**<br><br>Opens a file for both appending and reading. The file pointer is at the end of the file if the file exists. The file ope<br>in the append mode. If the file does not exist, it creates a new file for reading and writing. |
| 12 | **ab+**<br><br>Opens a file for both appending and reading in binary format. The file pointer is at the end of the file if the file exis<br>The file opens in the append mode. If the file does not exist, it creates a new file for reading and writing. |

## tell and seek

tell – returns the position of pointer in terms of character

seek- it changes the position of pointer to given position

```
f = open("avi.txt")
f.seek(11)
print(f.tell())
print(f.readline())
# print(f.tell())
```

```
print(f.readline())
# print(f.tell())
f.close()
```

## using with block

it is same as f = open and f.close()

```
with open("avi.txt") as f:  #inside open you can also pass opening mode
    a = f.readlines()
    print(a)
```

inside this with block you can do your work related to file and on coming outside  of this block it automatically close the file.

## Scope, global variable and keyword

```
#first part

l = 10 #Globlal
def function1(n):
     #l = 5           #it is local scope

    # print(l)
    """here it will first search for local variable and if it will not in loca
l scope it will search in global
     we can not change global variable directly it will give error"""
    global l            # need to write this statement to change the the value
of global variable
    l = l + 10
    print(n,l,"I have printed")


function1("This is me")
print(l)


#second part
x=89
def avi():
    x =20
    def avi2():
        global x      # on writing this it will go directly to global scope to
find
        x=88        # here on writing it will directly go to global scope(note
 x = 20 is not in global scope it is also inside a fn) and if there is any var
iable it will change its value or
```

```
        # if not create it in global scope and assign it value
    print("befor calling avi2()",x)         # here it will print 20 because it
 accessing its local variable
    avi2()
    print("befor calling avi()",x)      # here it will print 20 again because
it that fn changed in global scope but avi() fn has x in its local scope so it
 will execute this one.
avi()
print(x)  #it will print 88 because that fn has changed your value
```

# lambda or anonymus function

it is a one liner function without any name

```
# Lambda functions or anonymous functions
# def add(a, b):
#     return a+b
#
# # minus = lambda x, y: x-y   #both this minus or minus fn defined below do same
#
# def minus(x, y):
#     return x-y
#
# print(minus(9, 4))


a =[[1, 14], [5, 6], [8,23]]
a.sort(key=lambda x:x[1])
print(a)
```

sort or sorted function can receive two arguments “ key = none “ and “reverse = False” none and false is by default if we not pass if we make reverse = true it will sort in descending order

and key if we pass any function name then it pass each element of that list or tuple in function and then sort according to the returned value of function

and instead of passing a fn you can also write lambda function

# using modules

to install a module open windows powershell and run it as administrator then write “pip install flask” to install flask for other write its name

```
import random
import datetime
import playsound
import platform
import math
import builtins
import calendar

print(datetime.datetime.now())
print("Here is the calendar",calendar.month(2020,2))
print(platform.system())
print(math.sqrt(25))
print(builtins.bin(8))
playsound.playsound('Tera zikr.mp3')

random_num = random.randint(0,5)
print(random_num)
print(random.random())  # 0 to 1
lst = ["channel1","channel2","channel3","channel4","channel5","channel6","chan
nel7"]
print(random.choice(lst))
```

# F-string and string formatting

F string is similar to template literal of ES6 of javascript

```
me = "Avi"
a1 =3
# a = "this is %s %s"%(me, a1)
# a = "This is {1} {0}"
# b = a.format(me, a1)
# print(b)
a = f"this is {me} {a1} {math.cos(65)}"   # this is f string
# time
print(a)
```

```
a = input("Enter you name\n")
b = "18"
str = "Hello {0} you have to wait {1} minutes to meet with Mr. Abhishek Pratap
 Singh"
print("Hello %s you have to wait %s minutes to meet with Mr. Abhishek Pratap S
ingh"%(a,b))
print(str.format(a,b))
print(f"Hello {a} you have to wait {b} minutes to meet with Mr. Abhishek Prata
p Singh")
```

# *args and **kwargs

args means arguments

kwargs means keyworded (named or like key, pair) arguments

*keyworded arguments doesn’t matter order in which they passed in function, in python it knows the name of variable name defined( search keyworded arguments in python on google for more info)*

The special syntax **args* in function definitions in python is used to pass a variable number of arguments to a function. It is used to pass a non-keyworded, variable-length argument list.

The special syntax ***kwargs* in function definitions in python is used to pass a keyworded, variable-length argument list. We use the name *kwargs* with the double star. The reason is because the double star allows us to pass through keyword arguments (and any number of them).

```
# def function_name_print(a, b, c, d, e):
#     print(a, b, c, d, e)

def funargs(normal, *argsrohan, **kwargsbala):
    print(normal)
    for item in argsrohan:
        print(item)
    print("\nNow I would Like to introduce some of our heroes")
    for key, value in kwargsbala.items():
        print(f"{key} is a {value}")



# function_name_print("Harry", "Rohan", "Skillf", "Hammad", "Shivam")

har = ["Harry", "Rohan", "Skillf", "Hammad",
       "Shivam", "The programmer"]
normal = "I am a normal Argument and the students are:"
kw = {"Rohan":"Monitor", "Harry":"Fitness Instructor",
      "The Programmer": "Coordinator", "Shivam":"Cook"}
funargs(normal, *har, **kw)
```

```
#in function *args and ** kwargs are optional even
# if you write it in function and not pass then also  it is ok
# means they can accept 0 items inside it
```

```
def fun(normal_variable,*myargs,**mykwargs):
    print("This is normal variable",normal_variable)
    print("Now these are args variable")
    for item in myargs:
        print(item,end="   ")
    print("Now these are kwargs with keyworded variable")
    for key,value in mykwargs.items():
        print(f"{key} is related with {value} using key value pair.")

fun("Avishek",*["Avi","Abhay","Raushan","Varun"],**{"Avi":"7479","Abhay":"8540
","Raus":"****"})
```

# Time module

```
import time
initial = time.time()

k = 0
while(k<3):
    print("This is me")
    # time.sleep(2)                    # it stops the program for n no. of se
conds n is number that is passed
    k+=1
print("While loop ran in", time.time() - initial, "Seconds")

initial2 =time.time()
for i in range(3):
    print("This is me")
print("For loop ran in", time.time() - initial2, "Seconds")


localtime = time.asctime(time.localtime(time.time()))
print(localtime)
print(time.time())       # it gives total ticks/seconds from epoch
print(time.localtime(time.time()))      #it converts ticks into tuple of year
month day hour min sec
print(time.asctime(time.localtime(time.time())))        # it converts it into
human readable format
```

# Virtual environment

A virtual environment is a tool that helps to keep dependencies required by different projects separate by creating isolated python virtual environments for them. This is one of the most important tools that most of the Python developers use.

**Why do we need a virtual environment?**

- Imagine a scenario where you are working on two web based python projects and one of them uses a Django 1.9 and the other uses Django 1.10 and so on. In such situations virtual environment can be really useful to maintain dependencies of both the projects.

- Imagine another scenario you have create a program using some functions of current versions of pandas or sklearn libraries and then after some year that libray got updated and that function is removed and when you use the same program it will not behave normally. So we can also keep a copy of current versions of libraries and some other tools also in virtual environment which are used by our program.

Virtual Environment should be used whenever you work on any Python based project. It is generally good to have one new virtual environment for every Python based project you work on. So the dependencies of every project are isolated from the system and each other.

**How does a virtual environment work?**

We use a module named **virtualenv** which is a tool to create isolated Python environments. virtualenv creates a folder which contains all the necessary executables to use the packages that a Python project would need.

**Installing virtualenv**

- Open a folder(where you want to create virtual environment) then press shift and right click >Open powershell window here
- After opening it
  ```
  pip install virtualenv
  ```
- Then
  ```
  virtualenv my_name
  ```
- It has created a new virtual environment and it is  independent like a new born baby. And you can also check there is folder of `my_name` in the selected folder.
- And if you want to create a virtual environment that is not like new born baby or it should contain all site packages of your system interpreter then use command **virtualenv --system-site-packages my_name2**
- You can activate it by ***opening that folder > Scripts > activate.bat***.
  Or from windows powershell ***.\my_name\Scripts\activate***
- Now your virtual environment has been created. Once the virtual environment is activated, the name of your virtual environment will appear on left side of terminal. This will let you know that the virtual environment is currently active.
- Now you can install your packages using command **pip install its_name**.
- To install a particular version suppose to install Django 1.9 use command
  ```
  pip install Django==1.9
  ```

- However if want to share our program with its dependent package , generally we don't share it with whole packages due to its large size. So we keep a record of packages that is used by our program in our **requirements.txt** file.
- To create the requirements.txt file we use command **pip freeze > requirements.txt**

- Or to install the packages of someone else program keep that requirements.txt file in that folder and use command **pip install -r .\requirements.txt**
- Once you are done with the work, you can deactivate the virtual environment by command **deactivate.**

**How to execute your program in new virtual environment already created(in pycharm) ?**

- Open pycharm>File>Open
- Choose your virtual environment folder and select/open in pycharm.
- Now you can create any program and simply execute as you do normally.

# Enumerators

Enumerate() method adds a counter to an iterable and returns it in a form of enumerate object. This enumerate object can then be used directly in for loops or be converted into a list of tuples using list() method.

```
l1 =["item1","item2","item3","item4","item5","item6","item7","item8"]
for index,item in enumerate(l1):
    print(f"{item} is on index number {index+1}")
```

# How import works And if __name__== '__main__'

When we write import means we are putting the codes of that file in our file we can also import our own file.

**__name__** is a built-in variable which evaluates to the name of the current module.  Thus it can be used to check whether the current script is being run on its own or being imported somewhere else by combining it with if statement.

If the script is executed in its file then name is main but when imported in some file and executed then its name is its file name .

Sometimes we define some very useful function and do some work in a file and if we import that file then it is again executed there, which is not required we need only those defined function for some other operations. In such case we use **if __name__ =='__main__'** because when it is imported in some other file then it's name will be different and the condition becomes false and if it is executed in same file then only condition will be true and it's code will be executed

File1

```
import file2                        # we can also import files written by us
import file3
import sys
print(sys.path)                    # this tells the hierarchical order of places
where the interpreter searches for any imported
                            # file or package so if it is found in first one then
it import that ones not in other
                            #so it is a very good practice to never keep the name
of a file same as any library like
                            # flask, or pandas or sklearn.

print(file2.a)
file2.printjoke("This is me")
file3.add(10, 5)
print(file3.printhar(", Basanti in kutton k saamne mat naachna"))
```

File2

```
a = 7
def printjoke(str):
    print(f"this function is a joke {str}")

if __name__ == '__main__':
    print("inside file2")
```

File 3

```
def printhar(string):
    return f"Ye string harry ko de de thakur {string}"


def add(num1, num2):
    return num1 + num2 + 5


print("and the name is", __name__)

if __name__ == '__main__':
    print(printhar("Harry1"))
    o = add(4, 6)
    print(o)
```

# Join function

It joins the list or tuple or …

```
lst = ["john", "cena", "Randy", "orton", "Sheamus", "khali", "jinder mahal"]

for item in lst:
    print(item, "and", end=" ")
print("others are wwe superstars")
print()
print(" and ".join(lst), " and others are wwe superstars")
```

here both print statements will do the same thing

# Map, filter and reduce

**Map** – it applies a function over all the elements of a list.

To apply same function over all elements of list we can use for loop or map function

Syntax- **map(function_name, list_name)**

First argument is function name without braces and other is list name. Or instead of that we can also pass lambda function.

It returns a object then we have to type cast in list.

```python
def square(x):
    return x*x


def cube(x):
    return x*x*x


numbers = ["3", "34", "64", "420"]
numbers = list(map(int, numbers))
numbers[2] = numbers[2] + 1
print(numbers[2])
num = [2, 3, 5, 6, 76, 3]
sq = list(map(lambda x: x*x, num))  # here map will give each element of num list to fn which will return its square
print(sq)

func = [square, cube]       # list of function
for i in range(6):
    val = list(map(lambda x: x(i), func))    # here map will give each function from func list to lambda function and here lambda fn is also recieving a fn and returning f(i)

    print(val)
```

**Filter** – It filters a list means it return a object of sublist  with elements such that for which that function returns true

```python
def is_greater_5(num):
    return num>5


lst = [1,2,3,4,5,6,7,8,9]
print(list(filter(is_greater_5, lst)))
```

**Reduce** - The **reduce(fun,seq)** function is used to apply a particular function passed in its argument to all of the list elements mentioned in the sequence passed along.This function is defined in “functools” module.

**Working :**

- At first step, first two elements of sequence are picked and the result is obtained.
- Next step is to apply the same function to the previously attained result and the number just succeeding the second element and the result is again stored.
- This process continues till no more elements are left in the container.
- The final returned result is returned and printed on console.

```python
from functools import reduce

lis = [1, 3, 5, 6, 2]

# using reduce to compute sum of list
print("The sum of the list elements is : ", end="")
print(reduce(lambda a,b : a+b,lis))

# using reduce to compute maximum element from list
print("The maximum element of the list is : ", end="")
print(reduce(lambda a, b : a if a > b else b, lis))
```

## Decorators

A decorator is a design pattern in Python that allows a user to add new functionality to an existing object without modifying its structure. Decorators are usually called before the definition of a function you want to decorate.

It takes a function as an argument and we can do something inside a decorator and with that function. To add a decorator use the @ symbol and name of that decorator before the definition of that symbol.

```python
def dec1(func1):
    def nowexec():
        print("Executing now")
        func1()
        print("Executed")
    return nowexec


@dec1
def who_is_harry():
    print("Harry is a good boy")


# who_is_harry = dec1(who_is_harry)


who_is_harry()
```

## Object Oriented Programming

## Class

Like C/C++ same type of class is here,

Here we can add some properties ( function or variables ) to a particular object without changing in template of class.

```python
class Employee:
    no_of_leaves = 8


avi = Employee()
abhi = Employee()

avi.name = "Avishek"
abhi.name = "Abhishek"

print(avi.name)
print(avi.no_of_leaves)
print(abhi.no_of_leaves)
print(Employee.no_of_leaves)

avi.no_of_leaves = 5
print("After changing")
print(avi.no_of_leaves)
print(abhi.no_of_leaves)
print(Employee.no_of_leaves)
```

Output

```
Avishek

8

8

8

After changing

5

8

8
```

To get the details of class or object "**its_name.__dict__**"

## Self and __init__()(constructor)

Constructor initialise the object.

When nothing in passed as argument inside the methods (functions) then there is "self" has to be passed, self is calling object and inside the function we access it by using dot operator with self.

__init_() is constructor which takes “self” argument which is used to acess its members.

```python
class Employee:
    no_of_leaves = 8

    def __init__(self, aname, asalary, arole):
        # this is a constructor and will be called when
        # object is created and we have to pass these arguments
        # at the time creating object.
        self.name = aname
        self.salary = asalary
        self.role = arole

    def printdetails(self):
        return f"Name is {self.name} and role is {self.role}"
    # here self is is the object from which it is called


avi = Employee("Avishek", "Not fixed", "Programmer")
abhi = Employee("Abhishek", "Not fixed", "Programmer")
# avi.name = "Avishek"
# avi.role = "Teacher"
# abhi.role = "Student"
# abhi.name = "Abhishek"

print(avi.printdetails())
print(abhi.printdetails())
```

# Methods

First of all we need to know what is difference between function and methods ?

Functions defined inside a class is called methods and basic difference is “A method **can operate on the data (instance variables) that is contained by the corresponding class**”.

### STATIC METHODS

A static method in python must be created by decorating it with **@staticmethod** in order to let python now that the method should be static. The main characteristics of a static method is that they can be called without instantiating the class. This methods are self contained, meaning that they cannot access any other attribute or call any other method within that class.

You could use a static method when you have a class but you do not need an specific instance in order to access that method. For example if you have a class called Math and you have a method called factorial (calculates the factorial of a number). You probably won’t need an specific instance to call that method so you could use a static method. **It can be used without creating any instance or object or class but other two (class, instance) can not be**.

### CLASS METHOD

Methods which have to be created with the decorator **@classmethod**, this methods share a characteristic with the static methods and that is that they can be called without having an instance of the class. The difference relies on the capability to access other methods and class attributes but no instance attributes .

- A class method is a method which is bound to the class and not the object of the class.
- They have the access to the state of the class as it takes a class parameter that points to the class and not the object instance.
- It can modify a class state that would apply across all the instances of the class. For example it can modify a class variable that will be applicable to all the instances.

**“cls” keyword is used to access class variables and It is same for all the objects of that class**

## Instance Methods

**Simply defined functions inside a class (no keywords are required ) are instance methods.**

This method can only be called if the class has been instantiated. Once an object of that class has been created the instance method can be called and can access all the attributes of that class through the reserved word self. An instance method is capable of creating, getting and setting new instance attributes and calling other instance, class and static methods **. “self” keyword is used to access the class variables and it is different for different objects of same class.**

-------------------------------------------------------------------------------------------------------------------------

**Check diff between cls and self**

The **difference between** the keywords **self** and **cls** reside only on the method type, on one hand if the created method is an instance method then the reserved word **self** have to be used, on the other hand if the method is a class method is a class method then the keyword **cls** must be used.

```python
class Employee:
    no_of_leaves = 8


    def __init__(self, aname, asalary, arole):

        self.name = aname
        self.salary = asalary
        self.role = arole

    def printdetails(self):
        return f"Name is {self.name} and role is {self.role}"

    @classmethod
    def change_leaves(cls,new_leaves):
        cls.no_of_leaves = new_leaves

avi = Employee("Avishek", "Not fixed", "Programmer")
abhi = Employee("Abhishek", "Not fixed", "Programmer")
avi.change_leaves(100)
```

```
print(avi.no_of_leaves)
```

## Class method as a alternative constructor

We can also use class method as constructor. It can be better explained by following example.

```
class Employee:
    no_of_leaves = 8

    def __init__(self, aname, asalary, arole):
        self.name = aname
        self.salary = asalary
        self.role = arole

    def printdetails(self):
        return f"The Name is {self.name}. Salary is {self.salary} and role is 
{self.role}"

    @classmethod
    def change_leaves(cls, newleaves):
        cls.no_of_leaves = newleaves

    @classmethod
    def from_dash(cls, string):
        # params = string.split("-")
        # print(params)
        # return cls(params[0], params[1], params[2])
        return cls(*string.split("-"))



harry = Employee("Harry", 255, "Instructor")
rohan = Employee("Rohan", 455, "Student")
karan = Employee.from_dash("Karan-480-Student")

print(karan.no_of_leaves)
# rohan.change_leaves(34)
#
# print(harry.no_of_leaves)
```

# Single level inheritance

Source code:

```
class Employee:
    no_of_leaves = 8

    def __init__(self, aname, asalary, arole):
        self.name = aname
        self.salary = asalary
        self.role = arole

    def printdetails(self):
        return f"The Name is {self.name}. Salary is {self.salary} and role is
{self.role}"

    @classmethod
    def change_leaves(cls, newleaves):
        cls.no_of_leaves = newleaves

    @classmethod
    def from_dash(cls, string):
        return cls(*string.split("-"))

    @staticmethod
    def printgood(string):
        print("This is good " + string)


class Programmer(Employee):
    no_of_holiday = 56
    def __init__(self, aname, asalary, arole, languages):
        self.name = aname
        self.salary = asalary
        self.role = arole
        self.languages = languages



    def printprog(self):
        return f"The Programmer's Name is {self.name}. Salary is {self.salary} and
role is {self.role}.The languages are {self.languages}"
```

```python



harry = Employee("Harry", 255, "Instructor")
rohan = Employee("Rohan", 455, "Student")

shubham = Programmer("Shubham", 555, "Programmer", ["python"])
karan = Programmer("Karan", 777, "Programmer", ["python", "Cpp"])
print(karan.no_of_holiday)
```

# Multiple Inheritance

Source Code:

```python
class Employee:
    no_of_leaves = 8
    var = 8

    def __init__(self, aname, asalary, arole):
        self.name = aname
        self.salary = asalary
        self.role = arole

    def printdetails(self):
        return f"The Name is {self.name}. Salary is {self.salary} and role is
{self.role}"

    @classmethod
    def change_leaves(cls, newleaves):
        cls.no_of_leaves = newleaves

    @classmethod
    def from_dash(cls, string):
        return cls(*string.split("-"))

    @staticmethod
    def printgood(string):
        print("This is good " + string)

class Player:
    var = 9
    no_of_games = 4
    def __init__(self, name, game):
        self.name = name
        self.game =game

    def printdetails(self):
        return f"The Name is {self.name}. Game is {self.game}"

class CoolProgramer(Player, Employee):

    language = "C++"
    def printlanguage(self):
        print(self.language)

harry = Employee("Harry", 255, "Instructor")
rohan = Employee("Rohan", 455, "Student")

shubham = Player("Shubham", ["Cricket"])
karan = CoolProgramer("Karan",["Cricket"])
# det = karan.printdetails()
# karan.printlanguage()
# print(det)
print(karan.var)
```

**Order of class matters**, if we are using any variable or function that is available in both then it will first search first class passed and if it is there it will use that one.

## Multilevel Inheritance

Source Code:

```python
class Dad:
    basketball =6

class Son(Dad):
    dance =1
    basketball = 9
    def isdance(self):
        return f"Yes I dance {self.dance} no of times"

class Grandson(Son):
    dance =6
    guitar = 1

    def isdance(self):
        return f"Jackson yeah!" \
            f"Yes I dance very awesomely {self.dance} no of times"

darry = Dad()
larry = Son()
harry = Grandson()

# print(darry.guitar)
```

In multilevel inheritance if we are using any variable or function which is also present in more than one of its ancesstors then it will use which comes first from that level to grand level.

## Public, protected and private

Syntax:

No special syntax for  public

_name = for protected

__name = for private

But in python it does restrict accessibility like c++ only these syntax are to keep in mind that these are different access specifier.

Source Code:

```python
class Employee:
    no_of_leaves = 8
    var = 8
    _protec = 9
    __pr = 98

    def __init__(self, aname, asalary, arole):
        self.name = aname
        self.salary = asalary
        self.role = arole

    def printdetails(self):
        return f"The Name is {self.name}. Salary is {self.salary} and role is 
{self.role}"
```

```
    @classmethod
    def change_leaves(cls, newleaves):
        cls.no_of_leaves = newleaves

    @classmethod
    def from_dash(cls, string):
        return cls(*string.split("-"))

    @staticmethod
    def printgood(string):
        print("This is good " + string)

emp = Employee("harry", 343, "Programmer")
print(emp._Employee__pr)
```

But in private python do **name mangling** means to access you have to write in this format.

## Polymorphism

polymorphism means that a call to a member function will cause a different function to be executed depending on the type of object that invokes the function.

## Super() and Overriding

When we create an object( or instance) of a class and call any variable or method then first it search for **instance variable or method** in that class and if it is not found then it search for instance variable or method in its parent class from where it is derived and **if there is no any instance variable or method is present then it search for class variable or method** in that class and if it is not found then in its parent class from where it is inherited.

And if none of instance/class variable or method of that name is present then it gives error.

### Overriding

When we override any method in its child class then that method (present in parent class) is completely neglected in program. Like in below ex if we override the constructor then first is neglected and calling *special* varialble will throw *error*.

```
class A:
    classvar1 = "I m a class var in class A"
    def __init__(self):
        self.var1 = "I ma inside class A a constructor"
        self.classvar1 = "Instance var in class A"
        self.special = "special variable"
```

```python
class B(A):
    classvar1 =  "I m a class var in class B"
    def __init__(self):

        self.var1 = "I ma inside class B a constructor"
        self.classvar1 = "Instance var in class B"


a = A()
b = B()
print(b.classvar1)
print(b.special)
```

So to execute constructor of both class we have to use **super()** , `super()` provides the access to those methods of the super-class (parent class) which have been overridden in a sub-class (child class) that inherits from it.

But if we write super() and use constructor of parent(super) class in starting of constructor of child class then first it will execute the super() class constructor but if in last of constructor of child class then it will be executed in last. See ex

Case 1:

```python
class A:
    classvar1 = "I m a class var in class A"
    def __init__(self):
        self.var1 = "I ma inside class A a constructor"
        self.classvar1 = "Instance var in class A"
        self.special = "special variable"

class B(A):
    classvar1 =  "I m a class var in class B"
    def __init__(self):
        super().__init__()
        self.var1 = "I ma inside class B a constructor"
        self.classvar1 = "Instance var in class B"


a = A()
b = B()
print(b.classvar1)
print(b.special)
```

Output:

```
Instance var in class B

special variable
```

Here first super class constructor executed which made b.classvar1 = “Instance var in class A” because it is written first inside the constructor of B and then after its constructor executed due to which it changed to b.classvar1 = “Instance var in class B” because of the line

```python
self.classvar1 = "Instance var in class B"
```

in its constructor because it is written after the super() means it executed after the constructor of parent class is executed so it changed the value of b.classvar1.

**Case 2:**

```
class A:
    classvar1 = "I m a class var in class A"
    def __init__(self):
        self.var1 = "I ma inside class A a constructor"
        self.classvar1 = "Instance var in class A"
        self.special = "special variable"

class B(A):
    classvar1 =  "I m a class var in class B"
    def __init__(self):
        self.var1 = "I ma inside class B a constructor"
        self.classvar1 = "Instance var in class B"
        super().__init__()


a = A()
b = B()
print(b.classvar1)
print(b.special)
```

Output:

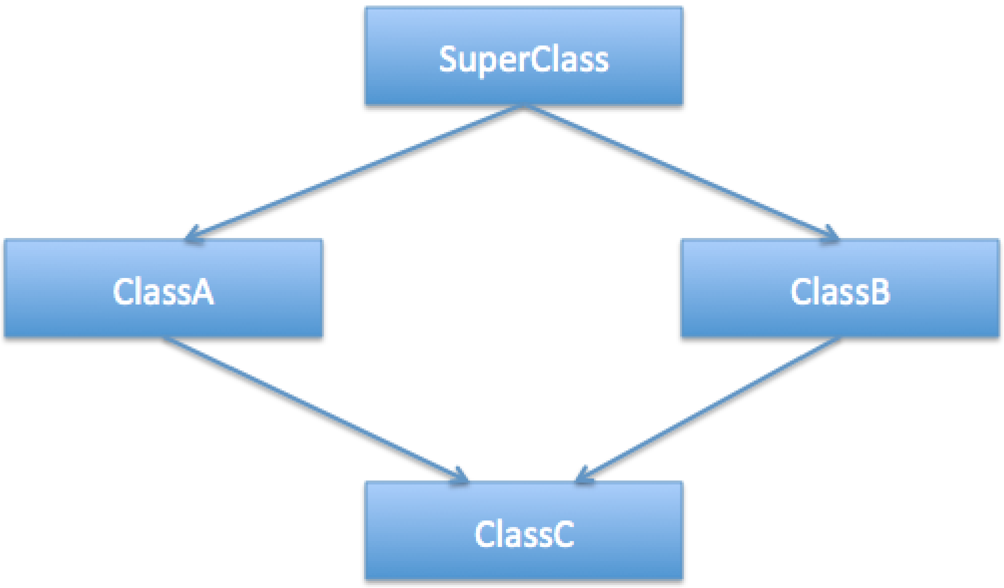
```
Instance var in class A

special variable
```

Here first constructor of class B executes in which its 2nd line made b.classvar1 = “Instance var in class B” and then it called constructor of parent (super) class using super() and then 2nd line of constructor of A made b.classvar1 = “Instance var in class A” so final result in case 2 is b.classvar1 = “Instance var in class A”.

# Diamond Shape Problem

This is a inheritance map and we have to understand how and which run on doing diamond shape inheritance.

```
class A:

    def met(self):

        print("This is a method from class A")


class B(A):

    def met(self):

        print("This is a method from class B")


class C(A):

    def met(self):
        print("This is a method from class C")

class D(C, B):
    def met(self):
        print("This is a method from class D")


a = A()
b = B()
c = C()
d = D()

d.met()
```



## Operator Overloading and Dunder methods

In python it is very easy to do overloading.

```
class Employee:
    no_of_leaves = 8

    def __init__(self, aname, asalary, arole):
        self.name = aname
        self.salary = asalary
        self.role = arole

    def printdetails(self):
        return f"The Name is {self.name}. Salary is {self.salary} and role is
{self.role}"

    @classmethod
    def change_leaves(cls, newleaves):
        cls.no_of_leaves = newleaves

    def __add__(self, other):
        return self.salary + other.salary

    def __truediv__(self, other):
        return self.salary / other.salary

    def __repr__(self):
        return f"Employee('{self.name}', {self.salary}, '{self.role}')"

    def __str__(self):
        return f"The Name is {self.name}. Salary is {self.salary} and role is
{self.role}"

emp1 =Employee("Harry", 345, "Programmer")
# emp2 =Employee("Rohan", 55, "Cleaner")
print(str(emp1))
```

## Python __str__()

This method returns the string representation of the object. This method is called when print() or `str()` function is invoked on an object.

This method must return the String object. If we don't implement __str__() function for a class, then built-in object implementation is used that actually calls __repr__() function.

## Python __repr__()

Python __repr__() function returns the object representation. It could be any valid python expression such as tuple, dictionary, string etc.

This method is called when `repr()` function is invoked on the object, in that case, __repr__() function must return a String otherwise error will be thrown.

If we write "print(function_name)" then first it will prefer to print " str method" and if it is not available and repr method is available then it will print "repr method". But if we write str(function_name) then it will print str method and if repr(function name) then repr method.

| Operation | Syntax | Function |
|---|---|---|
| Addition | `a + b` | `add(a, b)` |
| Concatenation | `seq1 + seq2` | `concat(seq1, seq2)` |
| Containment Test | `obj in seq` | `contains(seq, obj)` |
| Division | `a / b` | `truediv(a, b)` |
| Division | `a // b` | `floordiv(a, b)` |
| Bitwise And | `a & b` | `and_(a, b)` |
| Bitwise Exclusive Or | `a ^ b` | `xor(a, b)` |
| Bitwise Inversion | `~ a` | `invert(a)` |
| Bitwise Or | `a \| b` | `or_(a, b)` |
| Exponentiation | `a ** b` | `pow(a, b)` |
| Identity | `a is b` | `is_(a, b)` |
| Identity | `a is not b` | `is_not(a, b)` |
| Indexed Assignment | `obj[k] = v` | `setitem(obj, k, v)` |
| Indexed Deletion | `del obj[k]` | `delitem(obj, k)` |
| Indexing | `obj[k]` | `getitem(obj, k)` |
| Left Shift | `a << b` | `lshift(a, b)` |

| Operation | Syntax | Function |
|---|---|---|
| Modulo | `a % b` | `mod(a, b)` |
| Multiplication | `a * b` | `mul(a, b)` |
| Matrix Multiplication | `a @ b` | `matmul(a, b)` |
| Negation (Arithmetic) | `- a` | `neg(a)` |
| Negation (Logical) | `not a` | `not_(a)` |
| Positive | `+ a` | `pos(a)` |
| Right Shift | `a >> b` | `rshift(a, b)` |
| Slice Assignment | `seq[i:j] = values` | `setitem(seq, slice(i, j), values)` |
| Slice Deletion | `del seq[i:j]` | `delitem(seq, slice(i, j))` |
| Slicing | `seq[i:j]` | `getitem(seq, slice(i, j))` |
| String Formatting | `s % obj` | `mod(s, obj)` |
| Subtraction | `a - b` | `sub(a, b)` |
| Truth Test | `obj` | `truth(obj)` |
| Ordering | `a < b` | `lt(a, b)` |
| Ordering | `a <= b` | `le(a, b)` |
| Equality | `a == b` | `eq(a, b)` |
| Difference | `a != b` | `ne(a, b)` |
| Ordering | `a >= b` | `ge(a, b)` |
| Ordering | `a > b` | `gt(a, b)` |

Here for “a+b” function is add(a,b)

If we write

```
    def __add__(self, other):
        return self.salary + other.salary
```

then add will be overloaded for other type

Example:

```
class avishek:
    def __init__(self, name,salary, role):
        self.name = name
        self.salary = salary
        self.role = role
        print("You are inside cosntructor")
    def __abs__(self, other):
        return f"abs of {other}"
    def __floordiv__(self, other):
        return self.salary//other
    def __repr__(self):
        return f"Object : ('{self.name}',{self.salary},'{self.role}'"
    def __add__(self, a):
        return avishek(f"{str(a).lower()+'  '+ self.name }",750,"second
programmer")


a = avishek("Avi", 75, "Programmer")
print(a.__abs__("Nothing"))
print((a + "kdfj") +"check")
print(a//10)
```

Here I overloaded add "+" with one operand of avishek type and other of str type and it will also return of avishek type addition of these two will return of type avishek  and which is  further added with another string.

# Abstract class or @abstrcat method

An abstract class can be considered as a blueprint for other classes, allows you to create a set of methods that must be created within any child classes built from your abstract class. A class which contains one or abstract methods is called an abstract class. An abstract method is a method that has declaration but not has any implementation. Abstract classes are not able to instantiated and it needs subclasses to provide implementations for those abstract methods which are defined in abstract classes. While we are designing large functional units we use an abstract class. When we want to provide a common implemented functionality for all implementations of a component, we use an abstract class. Abstract classes allow partially to implement classes when it completely implements all methods in a class, then it is called interface.

**Why use Abstract Base Classes :**
Abstract classes allow you to provide default functionality for the subclasses. Compared to interfaces abstract classes can have an implementation. By defining an abstract base class, you can define a common Application Program Interface(API) for a set of subclasses. This capability is especially useful in situations where a third-party is going to provide implementations, such as with plugins in an application, but can also help you when working on a large team or with a large code-base where keeping all classes in your head at the same time is difficult or not possible.

**How Abstract Base classes work :**

In python by default, it is not able to provide abstract classes, but python comes up with a module which provides the base for defining Abstract Base classes(ABC) and that module name is ABC. ***ABC*** works by marking methods of the base class as abstract and then registering concrete classes as implementations of the abstract base. A method becomes an abstract by decorated it with a keyword @abstractmethod.

```
#for python version < 3.x
# from abc import ABCMeta, abstractmethod
#for python version 3.x
from abc import ABC, abstractmethod

class Shape(ABC):
    @abstractmethod
    def printarea(self):
        return 0

class Rectangle(Shape):
    type = "Rectangle"
    sides = 4
    def __init__(self):
        self.length = 6
        self.breadth = 7

    def printarea(self):
        return self.length * self.breadth

rect1 = Rectangle()
print(rect1.printarea())
```

We can not create object of abstract class it will throw error.

It is only used for blueprint.

## Setters and property decorators

Getters, setters and property decorator are used to achieve encapsulation. Also, Private variables in python are not actually hidden fields like in other object oriented languages. Getters and Setters in python are often used when:

- We use getters & setters to add validation logic around getting and setting a value.
- To avoid direct access of a class field i.e. private variables cannot be accessed directly or modified by external user.

Consider below example we have a class employee having fname, lname, and email which is formed using fname and lname at the time of initialisation. But what if we change the fname or lname later email will not change automatically because it was set at time of initialisation. But sometimes we need such that it also change automatically.

```python
class Employee:
    def __init__(self, fname, lname):
        self.fname = fname
        self.lname = lname
        self.email = f"{fname}.{lname}@gmail.com"

    def explain(self):
        return f"This employee is {self.fname} {self.lname}"


hindustani_supporter = Employee("Hindustani","Supporter")

print(hindustani_supporter.explain())

print(hindustani_supporter.email)
hindustani_supporter.fname = "US"
print(hindustani_supporter.email)
```

So to do that we can remove email as a variable and define it as function like as shown below but now we have to use small brackets because now it is fn.

```python
class Employee:
    def __init__(self, fname, lname):
        self.fname = fname
        self.lname = lname
        # self.email = f"{fname}.{lname}@gmail.com"

    def email(self):
        return f"{self.fname}.{self.lname}@gmail.com"



hindustani_supporter = Employee("Hindustani","Supporter")

print(hindustani_supporter.email())
hindustani_supporter.fname = "US"
print(hindustani_supporter.email())
```

But we are neglecting the concept of encapsulation so we have to define it as property using **@property**

```python
class Employee:
    def __init__(self, fname, lname):
        self.fname = fname
        self.lname = lname
        # self.email = f"{fname}.{lname}@gmail.com"

    @property
    def email(self):
        return f"{self.fname}.{self.lname}@gmail.com"
```

```
hindustani_supporter = Employee("Hindustani","Supporter")

print(hindustani_supporter.email)
hindustani_supporter.fname = "US"
print(hindustani_supporter.email)
```

This was something called getters.

But what when we want to change the fname or lname when email is changed to ( or to set/access the private members with some condition)

```
@email.setter
def email(self,string):
    print("Setting now....")
    names = string.split("@")[0]
    self.fname = names.split(".")[0]
    self.lname = names.split(".")[1]
    # self.fname, self.lname = names.split(".") #single line instead of two
```

And you can set email like

```
hindustani_supporter.email = "abc.def@gmail.com"
```

And to delete this email method we have to use **delete** but in object oriented programming generally we don't delete we set it None.

```
@email.deleter
def email(self):
    self.fname = None
    self.lname = None
```

But setting it only None gives None.None@gmail.com when we print email so in property (getter) we have to change something

```
@property
def email(self):
    if self.fname==None or self.lname==None :
        return "Email is not, you can set it using setter"
    return f"{self.fname}.{self.lname}@gmail.com"
```

We can also use it to access private variable

```
class Geeks:
     def __init__(self):
          self._age = 0

     # using property decorator
     # a getter function
     @property
     def age(self):
         print("getter method called")
         return self._age

     # a setter function
     @age.setter
     def age(self, a):
         if(a < 18):
            raise ValueError("Sorry you age is below eligibility criteria")
```

```
        print("setter method called")
        self._age = a

mark = Geeks()

mark.age = 19

print(mark.age)
```

## Object Introspection

Introspection is the ability to determine the type of an object at runtime. It is one of Python's strengths. Everything in Python is an object and we can examine those objects.

### `dir`

In this section we will learn about `dir` and how it facilitates us in introspection.

It is one of the most important functions for introspection. It returns a list of attributes and methods belonging to an object. Here is an example:

```
my_list = [1, 2, 3]
dir(my_list)
# Output: ['__add__', '__class__', '__contains__', '__delattr__', '__delitem__',
# '__delslice__', '__doc__', '__eq__', '__format__', '__ge__', '__getattribute__',
# '__getitem__', '__getslice__', '__gt__', '__hash__', '__iadd__', '__imul__',
# '__init__', '__iter__', '__le__', '__len__', '__lt__', '__mul__', '__ne__',
# '__new__', '__reduce__', '__reduce_ex__', '__repr__', '__reversed__', '__rmul__',
# '__setattr__', '__setitem__', '__setslice__', '__sizeof__', '__str__',
# '__subclasshook__', 'append', 'count', 'extend', 'index', 'insert', 'pop',
# 'remove', 'reverse', 'sort']
```

Our introspection gave us the names of all the methods of a list. This can be handy when you are not able to recall a method name. If we run `dir()` without any argument then it returns all names in the current scope.

### `type` and `id`

The `type` function returns the type of an object. For example:

```
print(type(''))
# Output: <type 'str'>

print(type([]))
# Output: <type 'list'>

print(type({}))
# Output: <type 'dict'>

print(type(dict))
# Output: <type 'type'>
```

```
print(type(3))
# Output: <type 'int'>
```

`id` returns the unique ids of various objects. For instance:

```
name = "Yasoob"
print(id(name))
# Output: 139972439030304
```

## `inspect` module

The inspect module also provides several useful functions to get information about live objects. For example you can check the members of an object by running:

```
import inspect
print(inspect.getmembers(str))
# Output: [('__add__', <slot wrapper '__add__' of ... ...
```

Introspection of previously defined Employee class

```
skillf = Employee("Avi","Singh")
print(skillf.email)
print(type(skillf))
print(type("mystring"))
o = "mystring"
print(dir(o))
print(dir(skillf))
print(id("mystring"))
print(id("mystring"))
import inspect
print(inspect.getmembers(skillf))
```