# Python Programming

## MODULE - II

**Agenda:**

- Modules: Modules and Files
- Namespaces
- Importing Modules,
- Importing Module Attributes,
- Module Built-in Functions,
- Packages,
- Other Features of Modules
- Files: File Objects,
- File Built-in Function,
- File Built-in Methods,
- File Built-in Attributes,
- Standard Files,
- Command-line Arguments,
- File System,
- File Execution,
- Persistent Storage Modules.
- Exceptions: Exceptions in Python,
- Detecting and Handling Exceptions,
- Context Management,
- Exceptions as Strings,
- Raising Exceptions,
- Assertions,
- Standard Exceptions,
- Creating Exceptions,
- Why Exceptions,
- Why Exceptions at All?
- Exceptions and the sys Module.

## *Modules*

- Like many other programming languages, Python supports modularity. That is, you can break large code into smaller and more manageable pieces. And through modularity, Python supports code reuse.
- We can import modules in Python into your programs and reuse the code therein as many times as you want.
- Modules provide us with a way to share reusable functions.

*A module is simply a "Python file" which contains code we can reuse in multiple Python programs. A module may contain functions, classes, lists, etc.*

- Modules in Python can be of two types:
    1. Built-in Modules.
    2. User-defined Modules.

## *1. Built in Modules in Python*

- One of the many superpowers of Python is that it comes with a "rich standard library". This rich standard library contains lots of built-in modules. Hence, it provides a lot of reusable code.
- In Python, modules are accessed by using the import statement
- When our current file is needed to use the code which is already existed in other files then we can import that file (module).
- When Python imports a module called module1 for example, the interpreter will first search for a built-in module called module1. If a built-in module is not found, the Python interpreter will then search for a file named module1.py in a list of directories that it receives from the sys.path variable.
- We can import module in three different ways:
    1. *import <module_name>*
    2. *from <module_name> import <method_name>*
    3. *from <module_name> import **

**1.import <module_name>:**

- This way of importing module will import all methods which are in that specified module.

  **Eg: import math**
- Here this import statement will import all methods which are available in math module. We may use all methods or may use required methods as per business requirement.

**2.From <module_name> import <method_name>:**

- This import statement will import a particular method from that module which is specified in the import statement.
- We can't use other methods which are available in that module as we specified particular method name in the import statement.
- The main advantage of this is we can access members directly without using module name.

**Eg:from <module_name>import <*>**
**from math import factorial**
**from math import***

## *Finding members of module by using dir() function:*

- Python provides inbuilt function dir() to list out all members of current module or a Specified module.
- **dir()** ===>To list out all members of current module
- **dir(moduleName)**==>To list out all members of specified module

**1.Eg:**

```
>>> dir()
['__annotations__', '__builtins__', '__doc__', '__loader__', '__name__', '__package__', '__spec__']
```

**2.Eg:**

```
>>> import math
>>> dir(math)
['__doc__', '__loader__', '__name__', '__package__', '__spec__', 'acos', 'acosh', 'asin', 'asinh', 'atan', 'atan2', 'atanh', 'ceil', 'comb', 'copysign', 'cos', 'cosh', 'degrees', 'dist', 'e', 'erf', 'erfc', 'exp', 'expm1', 'fabs', 'factorial', 'floor', 'fmod', 'frexp', 'fsum', 'gamma', 'gcd', 'hypot', 'inf', 'isclose', 'isfinite', 'isinf', 'isnan', 'isqrt', 'lcm', 'ldexp', 'lgamma', 'log', 'log10', 'log1p', 'log2', 'modf', 'nan', 'nextafter', 'perm', 'pi', 'pow', 'prod', 'radians', 'remainder', 'sin', 'sinh', 'sqrt', 'tan', 'tanh', 'tau', 'trunc', 'ulp']
```

## *Some of Standard modules*

- **Math module**
- **Calendar module**

## *Working with math module:*

- Python provides inbuilt module math.
- This module defines several functions which can be used for mathematical operations.
- Some main important functions are

1. sqrt(x)
2. ceil(x)
3. floor(x)
4. fabs(x)
5. log(x)
6. sin(x)
7. tan(x)
8.factorial(x)

....

**Eg:**

```
>>> from math import*
>>> print(sqrt(5))
2.23606797749979
>>> print(ceil(15.25))
16
>>> print(floor(15.25))
15
>>> print(fabs(-15.6))
15.6
>>> print(fabs(15.6))
15.6
>>> print(log(10.5))
2.3513752571634776
>>> print(sin(1))
0.8414709848078965
>>> print(tan(0))
0.0
>>> print(factorial(5))
120
```

## *Working with Calendar module:*

- Python defines an inbuilt module calendar which handles operations related to calendar.

- Calendar module allows output calendars like the program and provides additional useful functions related to the calendar.

**calendar.day_name:**An array that represents the days of the week in the current locale.

**1. Displaying all week names one by one**

```
import calendar
for i in calendar.day_name:
 print(i)

output:
Monday
Tuesday
Wednesday
Thursday
Friday
Saturday
Sunday
```

**calendar.month_name:**

An array that represents the months of the year in the current locale. This follows normal convention of January being month number 1, so it has a length of 13 and month_name[0] is the empty string.

```
>>> import calendar
>>> for i in calendar.month_name:
        print(i)
January
February
March
April
May
June
July
August
September
October
November
December
```

**calendar.monthrange(year, month):** Returns weekday of first day of the month and number of days in month, for the specified year and month.

```
>>> import calendar
>>> print(calendar.monthrange(2021,6))
```

```
(1, 30)
>>> print(calendar.monthrange(2021,7))
(3, 31)
>>> print(calendar.monthrange(2022,1))
(5, 31)
>>> print(calendar.monthrange(2021,1))
(4, 31)
```

**calendar.isleap(year):** Returns True if year is a leap year, otherwise False.

```
>>> import calendar
>>> print(calendar.isleap(2020))
True
>>> print(calendar.isleap(2021))
False
```

**calendar.leapdays(y1, y2):** Returns the number of leap years in the range from y1 to y2 (exclusive), where y1 and y2 are years.

```
>>> import calendar
>>> print(calendar.leapdays(2000,2020))
5
```

**calendar.weekday(year, month, day):** Returns the day of the week (0 is Monday) for year (1970–…), month (1–12), day (1–31)

```
>>> import calendar
>>> print(calendar.weekday(2020,5,1))
4
>>> print(calendar.weekday(2021,5,1))
5
```

**calendar.weekheader(n):** Return a header containing abbreviated weekday names. n specifies the width in characters for one weekday

```
>>> import calendar
>>> print(calendar.weekheader(1))
M T W T F S S
>>> print(calendar.weekheader(3))
Mon Tue Wed Thu Fri Sat Sun
>>> print(calendar.weekheader(10))
 Monday   Tuesday  Wednesday  Thursday   Friday   Saturday   Sunday
```

**calendar. calendar(year, w, l, c):**Returns a 3-column calendar for an entire year as a multi-line string using the formatyear() of the TextCalendar class.

This function shows the year, width of characters, no. of lines per week and column separations.

**>>> import calendar**
**>>> print(calendar.calendar(2021))**
**Output:prints 2021 full calendar**

## 1. *User defined Modules.*

- Another superpower of Python is that it lets you take things in your own hands.
- A python module can be defined as a python program file which contains a python code including python functions, class, or variables. In other words, we can say that our python code file saved with the extension (.py) is treated as the module. We may have a runnable code inside the python module.
- Modules in Python provides us the flexibility to organize the code in a logical way.
- To use the functionality of one module into another, we must have to import the specific module.

**Creating a Module:**

Shown below is a Python script containing the definition of sum() function. It is saved as calc.py.

```
#calc.py
def sum(x, y):
   return x + y
def sub(x, y):
   return x - y
def mul(x, y):
   return x * y
def di(x, y):
   return x / y
```

**Importing a Module**

We can now import this module and execute the any functions which are there in calac.py module in the Python shell.

```
>>> import calc
>>> print(calc.sum(4,5))
9
>>> print(calc.sub(4,5))
-1
>>> print(calc.mul(4,5))
20
```

```
>>> from calc import *
>>> print(sum(4,5))
9
>>> print(sub(4,5))
-1
>>> print(mul(4,5))
20
```

- Every module, either built-in or custom made, is an object of a module class. Verify the type of different modules using the built-in type() function, as shown below.

```
>>> import calc
>>> type(calc)
<class 'module'>
>>> import math
>>> type(math)
<class 'module'>
```

**Renaming the Imported Module**

Use the as keyword to rename the imported module as shown below.-

```
>>> import calc as c
>>> import math as raj
>>> import calc as c
>>> import math as raj
>>> print(c.sum(4,5))
9
>>> print(raj.factorial(5))
120
```

## *Namespaces*

- Generally speaking, a **namespace** is a naming system for making names unique to avoid ambiguity.
- Everybody knows a namespacing system from daily life, i.e. the naming of people in firstname and familiy name (surname).
- A namespace is a simple system to control the names in a program. It ensures that names are unique and won't lead to any conflict.
- Some namespaces in Python:
    1. Local Namespace
    2. Global Namespace

3. Built-in Namespace

## *Local Namespace:*

The Variables which are defined in the function are a local scope of the variable. These variables are defined in the function body.

## *Global Namespace*

The Variable which can be read from anywhere in the program is known as a global scope. These variables can be accessed inside and outside the function. When we want to use the same variable in the rest of the program, we declare it as global.

**Eg:**

```
n=0#global namesapce
def f1():
   n=1#local namespace
   print("local variable n=",n)
f1()
print("Global variable n=",n)
```

**OutPut:**

```
local variable n= 1
Global variable n= 0
```

## *Built-in Scope*

- If a Variable is not defined in local,or global scope, then python looks for it in the built-in scope.
- In the Following Example, 1 from math module pi is imported, and the value of pi is not defined in global, local and enclosed.
- Python then looks for the pi value in the built-in scope and prints the value. Hence the name which is already present in the built-in scope should not be used as an identifier.

**Eg:**

```
# Built-in Scope
from math import pi
# pi = 'Not defined in
global pi'
def f1():
   print('Not defined in f1()
pi')
def f2():
   print('Not defined in f2()
pi')
f1()
f2()
print('pi is Built-in
scope',pi)
```

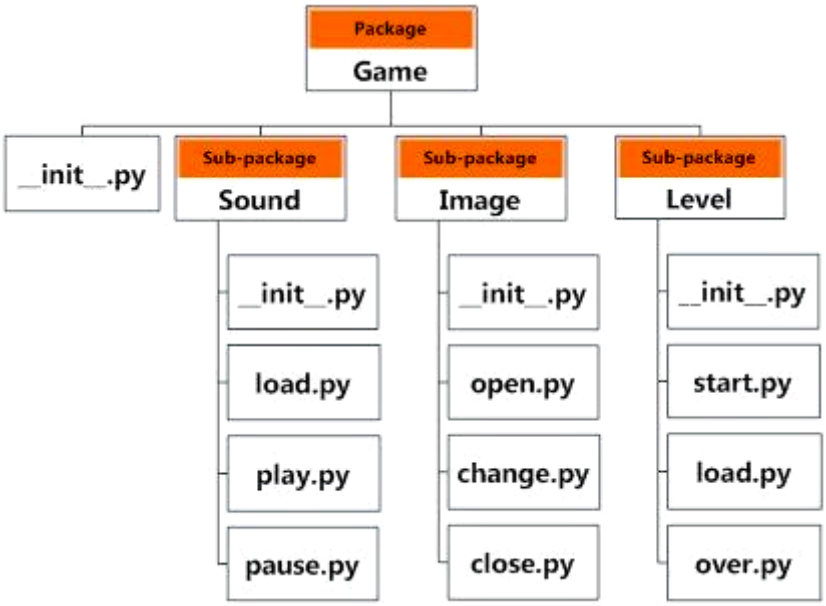
**OutPut:**

```
Not defined in f1() pi
Not defined in f2() pi
pi is Built-in scope
3.141592653589793
```

## *Packages in Python*

- A Package is nothing but a collection of modules. It is also imported into programs.
- In Package, several modules are present, which you can import in your code.
- Packages are a way of structuring many packages and modules which helps in a well-organized hierarchy of data set, making the directories and modules easy to access.
- Just like there are different drives and folders in an OS to help us store files, similarly packages help us in storing other sub-packages and modules, so that it can be used by the user when necessary.
- Similarly, as a directory can contain subdirectories and files, a Python package can have sub-packages and modules.
- A directory must contain a file named **__init__.py** in order for Python to consider it as a package. This file can be left empty but we generally place the initialization code for that package in this file.
- Any folder or directory contains **__init__.py** file,is considered as a Python package.This file can be empty.
- As we discussed, a package may hold other Python packages and modules. But what distinguishes a package from a regular directory? Well, a Python package must have an **__init__.py** file in the directory.
- You may leave it empty, or you may store initialization code in it. But if your directory does not have an **__init__.py** file, it isn't a package; it is just a directory with a bunch of Python scripts. Leaving **__init__.py** empty is indeed good practice.

**Example:** Suppose we are developing a game. One possible organization of packages and modules could be as shown in the figure below.




The Following Steps to be follow.

**Step1:** Create a folder or package

**Step2:** Inside the Folder create a sub folder or package

**Step3:** Inside the package we have to create _init_.py which indicate its a package

**Step4:** After that we can create some modules based on requirement

**Step5:** After that we have to create main module in package folder by importing the created modules in sub package.

**Eg 1:**

```
F:\>
 |-test.py
 |-python_package
 |-First.py
 |-Second.py
 |-__init__.py
```

**test.py**

```
----------
from python_package import First,second
First.f1()
second.f2()
```

**First.py**

```
---------
def f1():
   print("This is First function")
```

**Second.py**

**----------**

```
def f2():
   print("This is Second Function")
```

**OutPut:**

**This is First function**
**This is Second Function**

## *Files Handling in Python*

- Python File Handling Before we move into the topic "Python File Handling", let us try to understand why we need files?
- So far, we have been receiving the input data from the console and writing the output data back to the console.
- The console only displays a limited amount of data. Hence we don't have any issues if the input or output is small. What if the output or input is too large?
- We use files when we have large data as input or output.
- A file is nothing but a named location on disk which stores data.
- Files are also used to store data permanently since it stores data on non-volatile memory.
- Most modern file systems are composed of three main parts:
    1. **Header:** metadata about the contents of the file (file name, size, type, and so on)
    2. **Data:** contents of the file as written by the creator or editor
    3. **End of file (EOF):** special character that indicates the end of the file

### *Types of Files in Python*

- Text File
- Binary File

### *1. Text File*

- Text file store the data in the form of characters.
- Text file are used to store characters or strings.
- Usually we can use text files to store character data
  **eg: abc.txt**

### *2. Binary File*

- Binary file store entire data in the form of bytes.
- Binary file can be used to store text, image, audio and video.

- Usually we can use binary files to store binary data like images,video files, audio files etc.

## *File operation on Text Files:*

In Python, we can perform the following file operations:

- Open a file
- Read or write a file
- Close a file

## *Opening a File:*

- Before performing any operations like read or write on a file, the first thing we need to do is open a file.
- Python provides an in-built function open() to open a file.
- The open function accepts two parameters: the name of the file and the access mode.
- The access mode specifies what operation we are going to perform on a file whether it is read or write.
- The open() function in turn returns a file object/handle, with which we can perform file operations based on the access mode.

**Syntax: file_object=open(filename, access_mode)**

- The allowed modes in Python are

- **r :** open an existing file for read operation. The file pointer is positioned at the beginning of the file. If the specified file does not exist then we will get FileNotFoundError. This is default mode.

- **w :** open an existing file for write operation. If the file already contains some data then it will be overridden. If the specified file is not already available then this mode will create that file.

- **a :** open an existing file for append operation. It won't override existing data. If the specified file is not already available then this mode will create a new file.

- **r+ :** To read and write data into the file. The previous data in the file will not be deleted. The file pointer is placed at the beginning of the file.

- **w+ :** To write and read data. It will override existing data.

- **a+ :** To append and read data from the file.It wont override existing data.

- **x :** To open a file in exclusive creation mode for write operation. If the file already exists then we will get FileExistsError.

❖ All the above modes are applicable for text files. If the above modes suffixed with 'b' then these represents for binary files.

- **rb,wb,ab,r+b,w+b,a+b,xb**

**Ex:**

1. **file_object=open("test.txt") # when file is in the current directory**
2. **file_object=open("C:/User/Desktop/test.txt") # specify full path when file is in different directory**

## *Closing a File:*

After completing our operations on the file,it is highly recommended to close the file. For this we have to use close() function. f.close()

## *Writing data to text files:*

We can write character data to the text files by using the following 2 methods.

- write(str)
- writelines(list of lines)

**Eg:1**

```
1) f=open("abcd.txt",'w')
2) f.write("MREC \n")
3) f.write("CSE \n")
4) f.write("DS\n")
5)f.write("Dept\")
6) f.close()
abcd.txt:
MREC
CSE
DS
DEPT
```

**Eg 2:**

```
1) f=open("abcd.txt",'a')
2) list=["\nAI&ML\n","IOT\n","RAJ"]
3) f.writelines(list)
4) f.close()

abcd.txt:
MREC
CSE
DS
DEPT
AI&ML
IOT
RAJ
```

## *Reading Character Data from text files:*

- We can read character data from text file by using the following read methods.

**read()→** To read total data from the file
**read(n) →** To read 'n' characters from the file
**readline()→**To read only one line
**readlines()→** To read all lines into a list

Eg 1: To read total data from the file

```
f=open("abc.txt",'r')
data=f.read()
print(data)
f.close()
```

**Output**

```
MREC
CSE
DS
DEPT
AI&ML
IOT
RAJ
```

Eg 2: To read only first 10 characters:

```
f=open("abc.txt",'r')
data=f.read(10)
print(data)
f.close()
```

**Output**

```
MREC
CSE
DS
```

Eg 3: To read data line by line:

```
f=open("abc.txt",'r')
line1=f.readline()
print(line1,end='')
line2=f.readline()
print(line2,end='')
line3=f.readline()
print(line3,end='')
f.close()
```

**Output**

```
MREC
 CSE
 DS
```

Eg 4: To read all lines into list:

```
f=open("abc.txt",'r')
lines=f.readlines()
for line in lines:
print(line,end='')
f.close()
```

**Output**

```
MREC
CSE
DS
DEPTS
AI&ML
IOT
RAJ
```

## *The seek() and tell() methods:*

### *tell():*

- We can use tell() method to return current position of the cursor(file pointer) from beginning of the file.
- The position(index) of first character in files is zero just like string index.

**Eg:**

```
f=open('F:/abcd.txt','r')
print(f.tell())
print(f.read(2))
print(f.tell())
print(f.read(2))
f.close()
```

**Output:**

```
0
MR
2
EC
```

### *seek():*

- We can use seek() method to move cursor(file pointer) to specified location.
- **Syntax:f.seek(offset)**

**Eg:**

```
f=open('F:/abcd.txt','r')
print(f.tell())
print(f.read(2))
print(f.tell())
print(f.read(2))
f.seek(0)
print(f.read(4))
f.seek(4)
print(f.read())
f.close()
```

**output:**

```
0
MR
2
EC
MREC
```

## File Built in Attributes and Built in Methods

- Once we opened a file and we got file object, we can get various details related to that file by using its properties or attributes and methods on it.
- The Following are some of the attributes.
- **name -->** Name of opened file
- **mode -->**Mode in which the file is opened
- **closed -->**Returns boolean value indicates that file is closed or not

**Eg:**

```
>>>
f=open("C:/Users/rajas/AppData/Local/Programs/Python/Python39/m2.py",'r')
>>> f.name
'C:/Users/rajas/AppData/Local/Programs/Python/Python39/m2.py'
>>> f.mode
'r'
>>> f.closed
False
```

## File Built in Methods

Python has the following set of methods available for the file object.

| Method | Description |
|---|---|
| close() | Closes the file |
| fileno() | Returns a number that represents the stream, from the operating system's perspective |
| flush() | Flushes the internal buffer |
| isatty() | Returns whether the file stream is interactive or not |
| read() | Returns the file content |
| readable() | Returns whether the file stream can be read or not |
| readline() | Returns one line from the file |
| readlines() | Returns a list of lines from the file |
| seek() | Change the file position |
| seekable() | Returns whether the file allows us to change the file position |
| tell() | Returns the current file position |
| truncate() | Resizes the file to a specified size |
| writable() | Returns whether the file can be written to or not |
| write() | Writes the specified string to the file |
| writelines() | Writes a list of strings to the file |

## File close() Method

- Close a file after it has been opened:

```
f = open("raj.txt", "r")
print(f.read())
f.close()
```

## File fileno() Method

- Return the file descriptor of the stream:

```
f = open("raj.txt", "r")
print(f.fileno())
```

## File flush() Method

- The flush() method cleans out the internal buffer.
- You can clear the buffer when writing to a file:

```
f = open("myfile.txt", "a")
f.write("Now the file has one more line!")
f.flush()
f.write("…and another one!")
```

## File isatty() Method

- The isatty() method returns True if the file stream is interactive, example: connected to a terminal device.

```
f = open("raj.txt", "r")
print(f.isatty())
```

## File read() Method

- The read() method returns the specified number of bytes from the file. Default is -1 which means the whole file.

```
f = open("raj.txt", "r")
print(f.read())
```

## File readable() Method

- The readable() method returns True if the file is readable, False if not.

```
f = open("raj.txt", "r")
print(f.readable())
```

## File readline() Method

- The readline() method returns one line from the file.
- You can also specified how many bytes from the line to return, by using the size parameter.

```
f = open("demofile.txt", "r")
print(f.readline())
```

## File readlines() Method

- The readlines() method returns a list containing each line in the file as a list item.

```
f = open("raj.txt", "r")
print(f.readlines())

f = open("raj.txt", "r")
print(f.readline())
```

## File seek() Method

- The seek() method sets the current file position in a file stream.
- The seek() method also returns the new postion.

```
f = open("raj.txt", "r")
f.seek(4)
print(f.readline())
```

## File seekable() Method

- The seekable() method returns True if the file is seekable, False if not.
- A file is seekable if it allows access to the file stream, like the seek() method.

```
f = open("raj.txt", "r")
print(f.seekable())
```

## File tell() Method

- The tell() method returns the current file position in a file stream.

```
f = open("raj.txt", "r")
print(f.tell())
```

## File truncate() Method

- The truncate() method resizes the file to the given number of bytes.
- If the size is not specified, the current position will be used.

```
f = open("demofile2.txt", "a")
f.truncate(20)
f.close()
```

```
#open and read the file after the truncate:
f = open("demofile2.txt", "r")
print(f.read())
```

## *File writable() Method*

- The writable() method returns True if the file is writable, False if not.
- A file is writable if it is opened using "a" for append or "w" for write.

```
f = open("raj.txt", "a")
print(f.writable())
```

## *File write() Method*

- The write() method writes a specified text to the file.
- Where the specified text will be inserted depends on the file mode and stream position.
- "a": The text will be inserted at the current file stream position, default at the end of the file.
- "w": The file will be emptied before the text will be inserted at the current file stream position, default 0.

```
f = open("demofile2.txt", "a")
f.write("See you soon!")
f.close()

#open and read the file after the appending:
f = open("demofile2.txt", "r")
print(f.read())
```

## *File writelines() Method*

- The writelines() method writes the items of a list to the file.
- Where the texts will be inserted depends on the file mode and stream position.
- "a": The texts will be inserted at the current file stream position, default at the end of the file.
- "w": The file will be emptied before the texts will be inserted at the current file stream position, default 0.

```
f = open("raj.txt", "a")
f.writelines(["See you soon!", "Over and out."])
f.close()

#open and read the file after the appending:
f = open("raj.txt", "r")
print(f.read())
```

## File operation on Binary Files:

- Binary file store entire data in the form of bytes.
- Binary file can be used to store text, image, audio and video.
- Usually we can use binary files to store binary data like images,video files, audio files etc.
- In Python, we can perform the following file operations:

- Open a file
- Read or write a file
- Close a file

**Eg:** program to Read an image and that to another.

```
f1=open('mrec.jpg','rb')
f2=open('mrec1.jpg','wb')
#bytes=f1.read()
f2.write(f1.read())
print("Image copied from f1 to f2:\n")
f1.close()
f2.close()
```

## File System in python

- A file system is a process that manages how and where data on storage disk, typically a hard disk drive (HDD), is stored, accessed and managed. It is a logical disk component that manages a disk's internal operations as it relates to a computer and is abstract to a human user.
- A directory simply is a structured list of documents and folders. A directory can have sub-directories and files. When we have too many files, Python directory comes in handy in file management or system with directories and sub-directories.
- Python has os module with multiple methods defined inside for directory and file management or system

## Working with Directories:

It is very common requirement to perform operations for directories like

**To Know Current Working Directory:**

```
import os
print("The cwd=",os.getcwd())
```

**OutPut:**

The cwd= C:\Users\rajas\AppData\Local\Programs\Python\Python39

**To create a sub directory in the current working directory:**

```
import os
```

```
os.mkdir('Raj')
print("The Directory Raj is Created")
```

**OutPut:**

The Directory Raj is Created

**To rename a directory in Python:**

- Python has rename( ) function to rename a directory.

**Syntax: os.rename(old_name,new_name)**

```
import os
os.rename('Raj','mrec')
print("The Directory Raj Renamed to mrec")
```

**OutPut:**

The Directory Raj Renamed to mrec

**To change directories in Python:**

- In Python, chdir( ) function defined in module os is used to change the working directories.

**Example:**Suppose we want to change our working directory to Raj in F: Here is how it is done.

```
>>> import os
>>> os.getcwd()
'C:\\Users\\rajas\\AppData\\Local\\Programs\\Python\\Python39'
>>> os.chdir('F:/')
>>> os.getcwd()
'F:\\'
>>> os.mkdir('Raj')
>>> os.getcwd()
'F:\\'
>>> os.chdir('Raj')
>>> os.getcwd()
'F:\\Raj'
```

**To list directories in Python:**

- Python has listdir( ) function in module os to list all the directories and files in a particular location.
- listdir( ) returns a list containing the names of the entries in the directory given by path. The list is in arbitrary order, and does not include the special entries '.' and '..' even if they are present in the directory.

**Here is an example:**

```
>>> import os
```

```
>>> os.chdir('F:/')
>>> os.listdir()
['$RECYCLE.BIN', 'abcd.txt', 'add.txt', 'Applicant Details-Cloud.doc', 'c.py', 'cal.csv',
'certifiates', 'copy.txt', 'cse1.txt', 'DCIM', 'Download', 'ds.py', 'ds1.py', 'ds2.txt',
'eee.txt', 'exp2.py', 'filedemo.c', 'filedemo.exe', 'filedemo.o', 'first.py', 'first.txt',
'fwdresearchmethodologynotes.zip', 'Game', 'hello.txt', 'JAVA PROGRAMMING',
'm.c', 'm.exe', 'm.o', 'Machine Learning', 'MarriagePhotos', 'merge.c', 'merge.exe',
'merge.o', 'Meterials', 'Microsoft Office Enterprise 2010 Corporate Final (full
activated)', 'ML', 'myfile.txt', 'myfile1.txt', 'new.csv', 'new.py', 'new.txt', 'old',
'package', 'Packages', 'python', 'r.py', 'R20-python', 'Raj', 'raj.bin', 'raj.txt']
```

**To remove a directory:**

- To remove or delete a directory path in Python, rmdir( ) is used which is defined in os module.
- rmdir( ) works only when the directory we want to delete is empty, else it raises an OS error.
- So here are the ways to remove or delete empty and non-empty directory paths.

```
>> import os
>>> os.chdir('F:/Raj')
>>> os.mkdir('cse')
>>> os.listdir()
['cse']
>>> os.rmdir('cse')
```

**To remove multiple directories in the path:**

```
>>> import os
>>> os.chdir('F:/')
>>> os.removedirs('Raj/A')
```

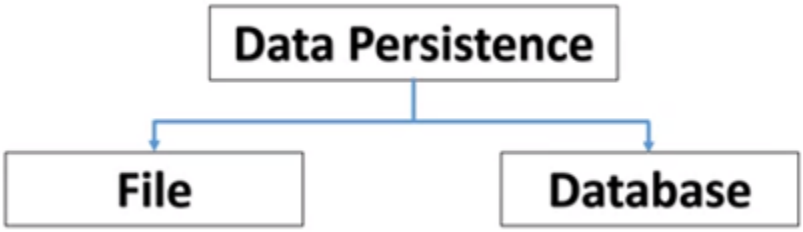
**Check if Given Path is File or Directory**

- To check if the path you have is a file or directory, import os module and use isfile() method to check if it is a file, and isdir() method to check if it is a directory.

```
>>> import os
>>> os.chdir('F:/')
>>> os.listdir()
['$RECYCLE.BIN', 'abcd.txt', 'add.txt', 'Applicant Details-Cloud.doc', 'c.py',
'cal.csv', 'exp2.py', 'filedemo.c', 'filedemo.exe', 'filedemo.o', 'first.py', 'first.txt',
'Raj']
>>> os.path.isfile('add.txt')
True
>>> os.path.isdir('Raj')
True
```

## *Persistent Storage Modules*

- The word 'persistence' means "the continuance of an effect after its cause is removed".
- The term data persistence means it continues to exist even after the application has ended. Thus, data stored in a non-volatile storage medium such as, a disk file is persistent data storage.
- Data Persistence is the concept of storing data in a persistent form.
- It means that the data should be permanently stored on disk for further manipulation.
- There are two types of system used for data persistence they are




- There are two aspects to preserving data for long-term use: converting the data back and forth between the object in-memory and the storage format, and working with the storage of the converted data.
- The standard library includes a variety of modules that handle both aspects in different situations.

### *Serialization:*

Serialization in Python is a mechanism of translating data structures or object state into a format that can be stored or transmitted and reconstructed later.

### *De-serialization:*

The reverse operation of serialization is called de-serialization

- The type of manual conversion, of an object to string or byte format (and vice versa) is very cumbersome and tedious. It is possible to store the state of a Python object in the form of byte stream directly to a file, or memory stream and retrieve to its original state. This process is called **serialization** and **de-serialization**.
- Python's built in library contains various modules for serialization and de-serialization process. They are as follows.

| S.No. | Name of the Module | Description |
|---|---|---|
| 1 | **pickle** | Python specific serialization library |
| 2 | **marshal** | Library used internally for serialization |
| 3 | **shelve** | Pythonic object persistence |
| 4 | **csv** | library for storage and retrieval of Python data to CSV format |
| 5 | **json** | Library for serialization to universal JSON format |

Eg: Writing data to binary file without pickle module.

```
f=open('bin.bin','wb')
num=[10,20,30,40,50]
arr=bytearray(num)
f.write(arr)
f.close()
f=open('bin.bin','rb')
num=list(f.read())
print(num)
f.close()
```

**OutPut:**

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

- The problem with above program is the binary file requires bytes object only for that we have convert to bytes object only.
- To provide solution for this we have use any above modules

## *Pickle Module*

- Pickling is the process whereby a python object is converted into byte stream.
- Unpickling is the reverse of this whereby a byte stream is converted back into an object.
- We can implement pickling and unpickling by using pickle module of Python.
- pickle module contains dump() function to perform pickling.
- **Syntax:pickle.dump(object,file)**
- pickle module contains load() function to perform unpickling
- **Syntax:obj=pickle.load(file)**

**Eg:**

```
import pickle
dict={1:"cse",2:"ds"}
f=open('bin.bin','wb')
pickle.dump(dict,f)
f.close()
f=open('bin.bin','rb')
s=pickle.load(f)
print(s)
f.close()
```

**OutPut:**

```
{1: 'cse', 2: 'ds'}
```

## *marshal Module*

- The marshal module is used to serialize data—that is, convert data to and from character strings, so that they can be stored on file.

- The marshal module uses a simple self-describing data format. For each data item, the marshalled string contains a type code, followed by one or more type-specific fields. Integers are stored in little-endian order, strings are stored as length fields followed by the strings' contents (which can include null bytes), tuples are stored as length fields followed by the objects that make up each tuple, etc.
- Just as pickle module, marshal module also defined load() and dump() functions for reading and writing marshalled objects from / to file.

**marshal.dump(value, file[, version]) :**
This function is used to write the supported type value on the open writeable binary file. A ValueError exception is raised if the value has an unsupported type.

**marshal.load(file) :**
This function reads one value from the open readable binary file and returns it. EOF Error, ValueError or TypeError is raised if no value is read.

**Example:**

```
import marshal
dict={1:"cse",2:"ds"}
f=open('bin.bin','wb')
marshal.dump(dict,f)
f.close()
f=open('bin.bin','rb')
s=marshal.load(f)
print(s)
f.close()
```

**OutPut:**

```
{1: 'cse', 2: 'ds'}
```

## *Command-line Arguments*

- There are many different ways in which a program can accept inputs from the user. The common way in Python Command-line Arguments is the input() method.
- Another way to pass input to the program is Command-line arguments. Almost every modern programming language support command line arguments.
- In a similar fashion, python does support command line arguments. It's a very important feature as it allows for dynamic inputs from the user.
- In a command-line argument, the input is given to the program through command prompt rather than python script like input() method.
- The Argument which are passing at the time of execution are called **Command Line Arguments.**
- Python supports different modules to handle command-line arguments. one of the popular one of them is **sys module.**

## *sys module:*

- This is the basic and oldest method to handle command-line arguments in python. It has a quite similar approach as the C library argc/argv to access the arguments.
- sys module implements the command line arguments through list structure named sys.argv argv is the internal list structure which holds the arguments passed in command prompt
- argv is not Array it is a List. It is available sys Module.
- argv à list to handle dynamic inputs from the user
  - argv[0] à python filename
  - argv[1] àargument 1
  - argv[2] à argument 2
  - argv[3] à argument 3 and so on.
- Steps to create command line arguments program:
  1. Write a python program
  2. Save the python program as <program name>.py extension
  3. Open a command prompt and change the directory to the python program path
  4. Use the below command to execute the program
  5. py < python file.py > < arg1 > < arg2 > < arg3 >
  6. **Example:** py demo.py 10 20 30 40 50
- The first item in argv list i.e argv[0] is the python file name à in this case demo.py
- argv[1] is the first argument à 10
- argv[2] is the second argument à 20
- argv[3] is the third argument à 30 and so on
- By default, the type of argv is "String" so we have to typecast as per our requirement.

**Example1:**

```
import sys
print(type(sys.argv))
```

**Output:**

```
D:\>py c.py
<class 'list'>
```

**Example2:**

```
from sys import argv
print('The Number of Command Line Arguments:', len(argv))
print('The List of Command Line Arguments:', argv)
print('Command Line Arguments one by one:')
```

```
for x in argv:
    print(x)
```

**OutPut:**

```
D:\>py c.py Raj cse ds 10
The Number of Command Line Arguments: 5
The List of Command Line Arguments: ['c.py', 'Raj', 'cse', 'ds', '10']
Command Line Arguments one by one:
c.py
Raj
cse
ds
10
```

**Example3:Add two values using command line**

```
from sys import argv
a=int(argv[1])
b=int(argv[2])
sum=a+b
print("The Sum:",sum)
```

**OutPut:**

```
D:\>py c.py 1 2
The Sum: 3
```

**Example2:Sum of elements**

```
from sys import argv
sum=0
args=argv[1:]
for x in args :
    n=int(x)
    sum=sum+n
print("The Sum:",sum)
```

**OutPut:**

```
D:\>py c.py 1 2 3 4 5
The Sum: 15
```

## *Exception Handling in Python*

Generally any programming language supports two types of errors,

1. Syntax errors
2. Runtime errors

## *Syntax errors:*

- The errors which occur because of invalid syntax are called **syntax errors**.
- Programmer is responsible to correct these syntax errors. Once all syntax errors are corrected then only program execution will be started.

**Eg 1:**

```
a=10
if a==10
 print("Raj")
SyntaxError: invalid syntax
```

**Eg 2:**

```
print "Raj"
SyntaxError: Missing parentheses in call to 'print'
```

## *Runtime errors:*

- Runtime errors are also called exceptions.
- When the program is executing, if something goes wrong because of end user input or, programming logic or memory problems etc then we will call them runtime errors.

## *Exception:*

An exception is nothing but an unwanted or unexpected block which disturbs the normal execution flow of program.

- An Exception is a run time error that happens during the execution of program.
- An exception is an error that happens during the execution of a program.
- Python raises an exception whenever it tries to execute invalid code.
- Error handling is generally resolved by saving the state of execution at the moment the error occurred and interrupting the normal flow of the program to execute a special function or piece of code, which is known as the exception handler.
- Depending on the kind of error ("division by zero", "file open error" and so on) which had occurred, the error handler can "fix" the problem and the program can be continued afterwards with the previously saved data.

**Eg:**

1. print(2/0) ==>ZeroDivisionError: division by zero
2. print(2/"ten") ==>TypeError: unsupported operand type(s) for /: 'int' and 'str'

```
a=int(input("Enter Number:"))
 print(a)
  D:\>py test.py
2
 Enter Number:ten
 ValueError: invalid literal for int() with base 10: 'ten'
```

## *Types of Exceptions:*

Exceptions are divided into two types they are,

1. System defined exceptions
2. User defined exceptions

## *System defined exceptions:*

- These exceptions are defined by system so these are called **system defined or pre-defined exceptions.**
- Every exception in Python is an object. For every exception type the corresponding classes are available.
- Whevever an exception occurs PVM will create the corresponding exception object and will check for handling code. If handling code is not available then Python interpreter terminates the program abnormally and prints corresponding exception information to the console.
- The rest of the program won't be executed
- Some of system defined exceptions are as follows,

| S. No | Name of the Built□in Exception | Explanation |
|---|---|---|
| 1 | ZeroDivisionError | It is raised when the denominator in a division operation is zero |
| 2 | NameError | It is raised when a local or global variable name is not defined |
| 3 | IndexError | It is raised when the index or subscript in a sequence is out of range. |
| 4 | TypeError | It is raised when an operator is supplied with a value of incorrect data type. |
| 5 | ValueError | It is raised when a built-in method or operation receives an argument that has the right data type but mismatched or inappropriate values. |
| 6 | KeyError | **KeyError** exception is what is raised when you try to access a key that isn't in a dictionary ( dict ). |
| 7 | FileNotFoundError | The error **FileNotFoundError** occurs because you either don't know where a file actually is on your computer. Or, even if you do, you don't know how to tell your **Python** program where it is. |
| 8 | ModuleNotFoundError | A **ModuleNotFoundError** is raised when Python cannot successfully import a module. |

1. **ZeroDivisionError:**

```
>>> a=10
>>> b=0
>>> print(a/b)
Traceback (most recent call last):
  File "<pyshell#2>", line 1, in <module>
    print(a/b)
ZeroDivisionError: division by zero
```

2. NameError:

```
>>> print("a=",a)
Traceback (most recent call last):
  File "<pyshell#0>", line 1, in <module>
    print("a=",a)
NameError: name 'a' is not defined
```

3. IndexError:

```
>>> name="MREC"
>>> print(name[10])
Traceback (most recent call last):
  File "<pyshell#2>", line 1, in <module>
    print(name[10])
IndexError: string index out of range
```

4. ValueError:

```
>>> a=int(input("Enter a value:"))
Enter a value:Raj
Traceback (most recent call last):
  File "<pyshell#10>", line 1, in <module>
    a=int(input("Enter a value:"))
ValueError: invalid literal for int() with base 10: 'Raj'
```

5. TypeError:

```
>>> a=10
>>> b="raj"
>>> print(a/b)
Traceback (most recent call last):
  File "<pyshell#4>", line 1, in <module>
    print(a/b)
TypeError: unsupported operand type(s) for /: 'int' and 'str'
```

6. **KeyError:**

```
>>> D={1:'MREC',2:'CSE',3:'DS',4:'RAJ'}
>>> print(D[1])
MREC
>>> print(D[5])
Traceback (most recent call last):
  File "<pyshell#8>", line 1, in <module>
    print(D[5])
KeyError: 5
```

7. **FileNotFoundError:**

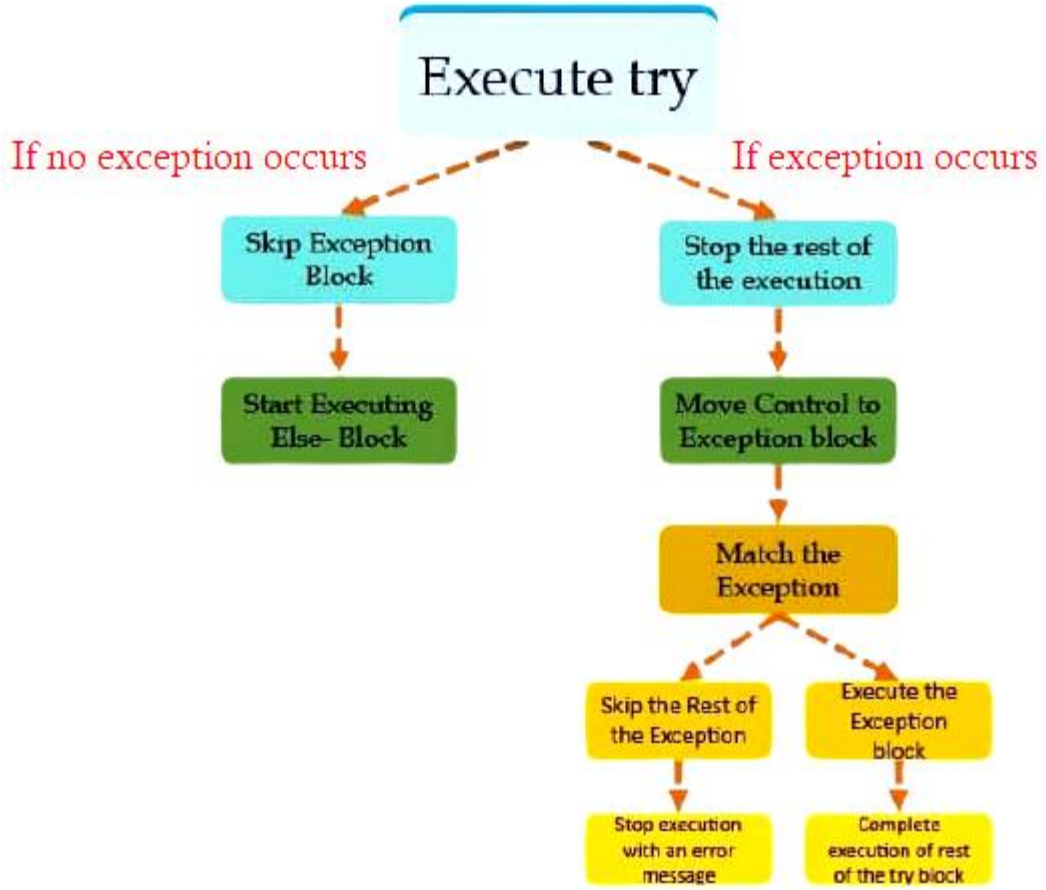
```
>>> f=open('Raj.txt','r')
Traceback (most recent call last):
  File "<pyshell#22>", line 1, in <module>
    f=open('Raj.txt','r')
FileNotFoundError: [Errno 2] No such file or directory: 'Raj.txt'
```

8. **ModuleNotFoundError:**

```
>>> import cse_ds
Traceback (most recent call last):
  File "<pyshell#6>", line 1, in <module>
    import cse_ds
ModuleNotFoundError: No module named 'cse_ds'
```

## *Detecting and Handling Exceptions or Exception Handing in Python*

- Exception handling is a concept used in Python to handle the exceptions that occur during the execution of any program. Exceptions are unexpected errors that can occur during code execution.
- Exception handling does not mean repairing exception; we have to define an alternative way to continue rest of the program normally.
- It is highly recommended to handle exceptions. The main objective of exception handling is Graceful Termination of the program.
- Exception can be handled in two ways They are
  1. **Default Exception Handling**
  2. **Customized Exception Handling**
- The flowchart describes the exception handling process.




## *Default Exception Handling*

- Every exception in Python is an object. For every exception type the corresponding classes are available.
- Whenever an exception occurs PVM will create the corresponding exception object and will check for handling code.
- If handling code is not available then Python interpreter terminates the program abnormally and prints corresponding exception information to the console.
- The rest of the program won't be executed. This entire process we call it as **Default Exception Handling**
- If an exception raised inside any method then the method is responsible to create Exception object with the following information.
  - ✓ Name of the exception.
  - ✓ Description of the exception.

- ✓ Location of the exception.

- After creating that Exception object the method handovers that object to the PVM.
- PVM checks whether the method contains any exception handling code or not. If method won't contain any handling code then PVM terminates that method abnormally.
- PVM identifies the caller method and checks whether the caller method contain any handling code or not. If the caller method also does not contain handling code then PVM terminates that caller also abnormally
- Then PVM handovers the responsibility of exception handling to the default exception handler.
- Default exception handler just print exception information to the console in the following formats and terminates the program abnormally.
- Name of exception: description
- Location of exception

**Example:**

```
print("Start:")
print("Default Exception Handling:")
print(15/0)
print("No Exception Block:")
print("Stop")
```

**OutPut:**

```
Start:
Default Exception Handling:
Traceback (most recent call last):
  File    "C:/Users/rajas/AppData/Local/Programs/Python/Python39/test.py",
line 3, in <module>
    print(15/0)
ZeroDivisionError: division by zero
```

## *Customized Exception Handling*

- It is highly recommended to handle exceptions.
- The Exceptions can be handled with the help of the following keywords or clauses in python.

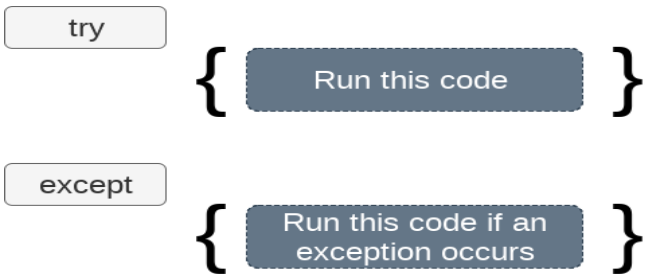
| S. No | Name of the Exception Type Keyword | Explanation |
|---|---|---|
| 1. | try | It will run the code block in which you expect an error to occur. |
| 2. | except | Define the type of exception you expect in the try block |

| | | |
|---|---|---|
| 3. | else | If there no exception, then this block of code will be executed |
| 4. | finally | Irrespective of whether there is an exception or not, this block of code will always be executed. |
| 5. | raise | An exception can be raised forcefully by using the **raise** clause in Python. |

- The code which may raise exception is called risky code and we have to take risky code inside try block. The corresponding handling code we have to take inside except block.
- We can handle the Exception with following ways.

## *1. The try-expect statement*

- If the Python program contains suspicious or risky code that may throw the exception, we must place that code in the try block.
- The try block must be followed with the except statement, which contains a block of code that will be executed if there is some exception in the try block.
- Within the try block if anywhere exception raised then rest of the try block wont be executed even though we handled that exception. Hence we have to take only risky code inside try block and length of the try block should be as less as possible.
- If any statement which is not part of try block raises an exception then it is always abnormal termination.




**Syntax:**

```
try :
   #statements in try block
except :
   #executed when error in try block
```

**Example: Without Specific error type:**

```
print("Start:")
print("Exception Handling without Specific Error Type:")
try:
   print(15/0)
except:
```

```
        print("Error occured")
    print("Stop")
```

**OutPut:**

```
Start:
Exception Handling without Specific Error Type:
Error occured
Stop
```

**Example: Catch Specific Error Type**

```
print("Start:")
print("Exception Handling with Specific Error Type:")
try:
    print(15/0)
except ZeroDivisionError:
    print("we can't divide the value with zero")
print("Stop")
```

**OutPut:**

```
Start:
Exception Handling with Specific Error Type:
we can't divide the value with zero
Stop
```

## *try with multiple except blocks:*

- The way of handling exception is varied from exception to exception. Hence for every exception type a separate except block we have to provide. i.e try with multiple except blocks is possible and recommended to use.
- As we know, a single try block may have multiple except blocks. The following example uses two except blocks to process two different exception types:

**Example:**

```
print("Start:")
print("Exception Handling with Specific Error Type:")
try:
    print(15/0)
except TypeError:
    print('Unsupported operation')
except ZeroDivisionError:
    print("we can't divide the value with zero")
print("Stop")
```

**OutPut:**

```
Start:
Exception Handling with Specific Error Type:
we can't divide the value with zero
Stop
```

## *Default except block:*

- We can use default except block to handle any type of exceptions.
- In default except block generally we can print normal error messages.
- If try with multiple except blocks available then default except block should be last, otherwise we will get Syntax Error.

**Syntax:**

```
except:
    statements
```

**Eg:**

```
print("Start:")
print("Default except block:")
try:
  x=int(input("Enter First Number: "))
  y=int(input("Enter Second Number: "))
  print(x/y)
except ZeroDivisionError:
  print("ZeroDivisionError:Can't divide with zero")
except:
  print("Default Except:Plz provide valid input only")
print("Stop")
```

**OutPut:**

```
Start:
Default except block:
Enter First Number: 5
Enter Second Number: a
Default Except:Plz provide valid input only
Stop
```

## *except statement using with exception variable:*

- We can use the exception variable with the except statement. It is used by using the **as** keyword. this object will return the cause of the exception. Consider the following example:

```
print("Start:")
try:
  x=int(input("Enter First Number: "))
```

```
        y=int(input("Enter Second Number: "))
        print(x/y)
    except Exception as e:
        print("ZeroDivisionError:Can't divide with zero")
        print(e)
    print("Stop")
```

**OutPut:**

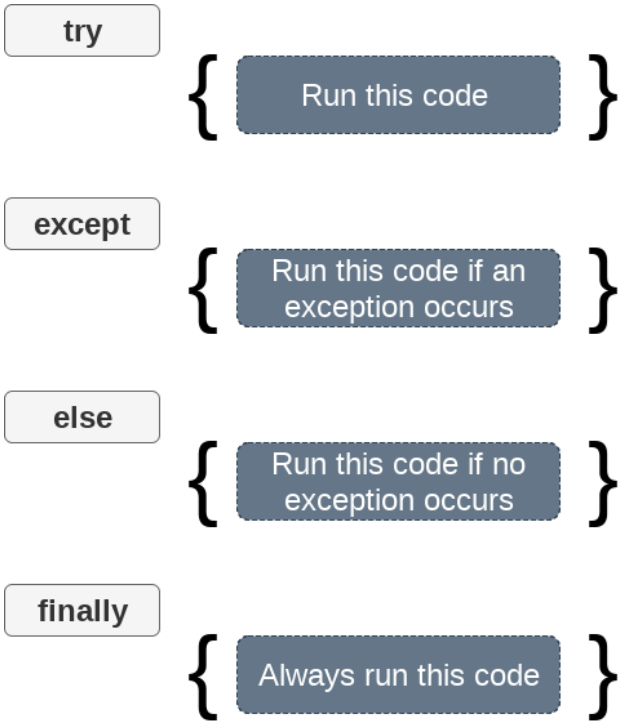
```
Start:
Enter First Number: 5
Enter Second Number: 0
ZeroDivisionError:Can't divide with zero
division by zero
Stop
```

## *2.else and finally:*

- In Python, keywords are else and finally can also be used along with the try and except clauses.
- In python, you can also use else clause on the **try-except block** which must be present after all the except clauses. The code enters the else block only if the try clause does not raise an exception.

**Syntax:**

```
try:
    #statements in try block
except:
    #executed when error in try block
else:
    #executed if try block is error-free
finally:
    #executed irrespective of exception occured or not
```




- The finally block consists of statements which should be processed regardless of an exception occurring in the try block or not. As a consequence, the error-free try block skips the except clause and enters the finally block before going on to execute the rest of the code.
- If, however, there's an exception in the try block, the appropriate except block will be processed, and the statements in the finally block will be processed before proceeding to the rest of the code.
- The example below accepts two numbers from the user and performs their division. It demonstrates the uses of else and finally blocks.

```
print("Start:")
try:
   print('try block')
   x=int(input('Enter a number: '))
   y=int(input('Enter another number: '))
   z=x/y
except ZeroDivisionError:
   print("except ZeroDivisionError block")
   print("Division by 0 not accepted")
else:
   print("else block")
   print("Division = ", z)
finally:
   print("finally block")
```

```
    x=0
    y=0
print ("Out of try, except, else and finally blocks." )
print("Stop")
```

**OutPut:**

```
Start:
try block
Enter a number: 5
Enter another number: 0
except ZeroDivisionError block
Division by 0 not accepted
finally block
Out of try, except, else and finally blocks.
Stop
```

## *3.Raise an Exception*

- An exception can be raised forcefully by using the raise clause in Python. It is useful in in that scenario where we need to raise an exception to stop the execution of the program.
- **Syntax : raise Exception_class,<value>**
- To raise an exception, the raise statement is used. The exception class name follows it.An exception can be provided with a value that can be given in the parenthesis.
- To access the value "as" keyword is used. "e" is used as a reference variable which stores the value of the exception.
- We can pass the value to an exception to specify the exception type

**Example 1:**

```
print("Start:")
try:
    x=int(input('Enter a number upto 100: '))
    if x > 100:
        raise ValueError(x)
except ValueError:
    print(x, "is out of allowed range")
else:
    print(x, "is within the allowed range")
print("Stop")
```

**OutPut:6**

```
Start:
Enter a number upto 100: 200
```

```
200 is out of allowed range
Stop
```

**Example 2 Raise the exception with user defined message**

```
print("Start:")
try:
   x=int(input('Enter a positive integer:'))
   if x <0:
      raise ValueError("You entered negative number")
except ValueError as e:
   print(e)
print("Stop")
```

**Output:**

```
Start:
Enter a positive integer:-2
You entered negative number
Stop
```

## *User defined exceptions*

- Some time we have to define and raise exceptions explicitly to indicate that something goes wrong, such type of exceptions are called User Defined Exceptions or Customized Exceptions.
- Programmer is responsible to define these exceptions and Python not having any idea about these. Hence we have to raise explicitly based on our requirement by using "raise" Keyword.
- steps to create user defined exceptions

**Step 1: Create User Defined Exception Class**

- Write a new class for custom exception and inherit it from an in-build Exception class.
- Define function __init__() to initialize the object of the new class.
- You can add as many instance variables as you want, to support your exception. For simplicity, we are creating one instance variable called message.

```
class YourException(Exception):
  def __init__(self, message):
    self.message = message
```

You have created a simple user-defined exception class.

**self :**

- self represents the instance of the class. By using the "self" keyword we can access the attributes and methods of the class in python.

**__init__ :**

- "__init__" is a reseved method in python classes. It is known as a constructor in object oriented concepts. This method called when an object is created from the class and it allow the class to initialize the attributes of a class.

**Step 2: Raising Exception**

- Now you can write a try-except block to catch the user-defined exception in Python.
- For testing, inside the try block we are raising exception using raise keyword.
- **raise YourException("Userdefined Exceptions")**
- It creates the instance of the exception class YourException. You can pass any message to your exception class instance.

**Step 3: Catching Exception**

- Now you have to catch the user-defined exception using except block.

```
except YourException as err:
  print(err.message)
```

- We are catching user defined exception called YourException.

**Step 4: Write a Program for User-Defined Exception in Python**

```
class ChildrenException(Exception):
    def __init__(self,arg):
        self.msg=arg
class YouthException(Exception):
    def __init__(self,arg):
        self.msg=arg
class AdultException(Exception):
    def __init__(self,arg):
        self.msg=arg
class SeniorException(Exception):
    def __init__(self,arg):
        self.msg=arg
age=int(input("Enter Age:"))
if (age<18) and (age>0):
    raise ChildrenException("The Person having the age between (0-18)!!!")
elif (age<25) and (age>=19):
    raise YouthException("The Person having the age between (19-24)!!!")
```

```
elif (age<65) and (age>=25):
   raise AdultException("The Person having the age between (25-64)!!!")
elif (age>=65):
   raise SeniorException("The Person having the age between (65 above)!!!")
else:
   print("You have entered invalid age!!!")
```

**Output:**

```
Enter Age:35
Traceback (most recent call last):
 File
"C:/Users/rajas/AppData/Local/Programs/Python/Python39/user.py",
line 19, in <module>
   raise AdultException("The Person having the age between (25-64)!!!")
AdultException: The Person having the age between (25-64)!!!-
```

**Example2:**

```
class PassException(Exception):
   def __init__(self,arg):
      self.msg=arg
class FailException(Exception):
   def __init__(self,arg):
      self.msg=arg
class MarksException(Exception):
   def __init__(self,arg):
      self.msg=arg

try:
   marks=int(input("Enter the marks of a subject:"))
   if(marks<35) and (marks>=0):
      raise FailException("Fail")
   elif(marks>=35):
      raise PassException("Pass")
   else:
      raise MarksException("Marks should be positive")
except FailException as e:
   print(e)
except PassException as e:
   print(e)
except MarksException as e:
```

```
        print(e)
    print("Stop")
```

**Output:**

```
Enter the marks of a subject:-25
Marks should be positive
Stop
```

## *ASSERTIONS in python*

- Python assert keyword is defined as a debugging tool that tests a condition. The Assertions are mainly the assumption that asserts or state a fact confidently in the program.
- The process of identifying and fixing the bug is called debugging.
- Very common way of debugging is to use print() statement. But the problem with the print() statement is after fixing the bug,compulsory we have to delete the extra added print() statments,otherwise these will be executed at runtime which creates performance problems and disturbs console output.
- To overcome this problem we should go for assert statement. The main advantage of assert statement over print() statement is after fixing bug we are not required to delete assert statements. Based on our requirement we can enable or disable assert statements.
- Hence the main purpose of assertions is to perform debugging. Usully we can perform debugging either in development or in test environments but not in production environment. Hence assertions concept is applicable only for dev and test environments but not for production environment.

**Types of assert statements:**

There are 2 types of assert statements

1. Simple Version
2. Augmented Version

**1. Simple Version:**

**Syntax:** **assert conditional_expression**

**2. Augmented Version:**

**Syntax:** **assert conditional_expression,message**

- conditional_expression will be evaluated and if it is true then the program will be continued.If it is false then the program will be terminated by raising AssertionError. By seeing AssertionError, programmer can analyze the code and can fix the problem.

**Examples:1**

```
assert True
```

```
print("Validation Passed")
```

**Output:** Validation Passed

**Examples:2**

```
assert False
print("Validation Passed")
```

**Output:**

```
Traceback (most recent call last):
  File "D://assert1.py", line 1, in <module>    assert False
AssertionError
```

**Examples:3**

```
assert False ,"Validation Failed"
print("Validation Passed")
```

**Output:**

```
Traceback (most recent call last):
  File "D://assert1.py",, line 1, in <module>
    assert False ,"Validation Failed"
AssertionError: Validation Failed
```

**Example: 4**

```
assert "Python" in "Python Programming"
print("Validation Passed")
```

**Output:**

```
Validation Passed
```

**Example:5**

```
assert "Python" in "python Programming","Validation Failed"
print("Validation Passed")
```

**Output:**

```
Traceback (most recent call last):
  File "D: /assert1.py", line 1, in <module>
    assert "Python" in "python Programming","Validation Failed"
AssertionError: Validation Failed
```

**Example:6**

```
str1="Raj"
str2="Raj"
assert str1==str2,"Strings are not matched"
print("String are matched")
```

**Output:**

```
String are matched
```

**Example:7**

```
str1="Raj"
str2="Raj"
assert str1==str2,"Strings are not matched"
print("String are matched")
```

**Output:**

```
Traceback (most recent call last):
  File "D:/assert1.py", line 3, in <module>
    assert str1!=str2,"Strings are not matched"
AssertionError: Strings are not matched
```

**Example:8**

```
assert "Raj" in ["MREC","CSE","DS","Raj"],"Validation Failed"
print("Validation passed")
```

**Output:**

```
Validation passed
```

**Example:9**

```
assert "raj" in ["MREC","CSE","DS","Raj"],"Validation Failed"
print("Validation passed")
```

**Output:**

```
Traceback (most recent call last):
  File "D:/assert1.py", line 1, in <module>
    assert "raj" in ["MREC","CSE","DS"],"Validation Failed"
AssertionError: Validation Failed
```

**Example:10**

```
import math
assert math.factorial(5)==120,"Validation Failed"
print("Validation passed")
```

**Output:**

```
Validation passed
```

**Example:11**

```
import math
assert math.factorial(5)!=120,"Validation Failed"
print("Validation passed")
```

**Output:**

```
Traceback (most recent call last):
  File "D:/assert1.py", line 2, in <module>
    assert math.factorial(5)!=120,"Validation Failed"
AssertionError: Validation Failed
```