INTRODUCTION TO PYTHON

- Python is the programming language that combines features of C and Java.
- Python was developed by **Guido Van Rossum** in the year 1991.
- Python is open- source software.

Features of Python

1. Simple
2. Easy is learn
3. Open-source
4. High-level Language
5. Dynamically typed
6. Platform independent
7. Portable
8. Procedure and object oriented

Execution of a Python Program

- Python program with the name **x.py**
- Every python program is typed with an extension name **.py**
- The compiler converts the python program into another code called **byte code**.
- Byte code instructions are contained in the file x.pyc (python compiled file).
- The next step is to run the program.
- Byte code into machine code: **PVM (Python Virtual Machine)**.
- PVM uses an interpreter which understands the byte code and converts it into machine code.
- An interpreter translates the program source code line by line.
- The advantage of JIT (Just In Time) compiler is to improve speed of the execution of python program and thus improving the performance.

Steps of Execution of a Python Program

Python Program (x.py) -> Python compiled file(x.pyc) -> PVM (machine code) -> computer

Python Program (x.py): Source code

Python compiled file(x.pyc): Byte Code

C:\> python x.py

Python Virtual Machine(PVM)

- Byte code represents the fixed set of instructions.
- The size of each byte code instruction is 1 byte.

Byte Code -> Interpreter (PVM) -> machine code -> Computer

- Role of PVM is to convert the byte code instructions into machine code so that the computer can execute those machine code instructions and display the final output.

Memory Management in Python

- Memory allocation and de-allocation are done during run-time automatically.
- For every object, memory should be allocated.
- Memory manager inside the PVM allocates memory required for objects created in Python Program.
- All these objects are stored on a separate memory called **heap**.

Garbage Collection in Python

- Garbage collector is a module in Python that is useful to delete objects from memory which are not used in the program.
- The module that represents the garbage collector is named as **gc**.
- To maintain a count for each object regarding how many times that object is referenced (or used).
- Garbage collector can detect **reference cycles**.
- A reference cycle is a cycle of references pointing to the first object to last object.
- Garbage collector classifies the object into **three** generations.
  1. The newly created objects are considered as **generation 0** object.
  2. When the GC examines the object in memory and is used by the program, **generation 1.**
  3. Older objects belong to **generation 2.**
- GC runs automatically.
- Python schedules garbage collector depending upon a number called **threshold**.
- This number represents the frequency of how many times the garbage collector removed the objects.

Comparisons between C and Python

Sr. No.	C	Python
1.	Procedure-oriented programming language.	Object-oriented language.
2.	C programs execute faster.	Python programs are slower in compared to C.
3.	Compulsory to declare datatypes of variables, arrays etc. in C.	Type declaration is not required.
4.	Type discipline : Static and weak.	Type discipline : dynamic and strong.
5.	Pointers concept is available.	Python does not use pointers.
6.	Does not exception handling facility.	Handles exceptions.
7.	C has do..while, while and for loops.	Python has while and for loops.
8.	C has switch statement.	Does not have switch statement.
9.	The variable in for loops does not increment automatically.	The variable in for loops increments automatically.
10.	The programmer should allocate and deallocate memory.	Memory allocation and de-allocation is done automatically by PVM.
11.	C does not contain a garbage collector.	Automatic GC is available.
12.	C supports single and multi-dimensional arrays.	Supports single dimensional arrays. Multi-dimensional arrays: Numpy Application.
13.	The array index should be positive integer.	The array index can be positive or negative integer. Negative index represents locations from the end of the array.
14.	A semicolon is used to terminate the statements in C and comma is used to separate expressions.	New line indicates end of the statements and semicolon is used as separator.