BCA – 502: Artificial Intelligence through Python

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In today's Class we have discused on Introduction and Installation of Python.

What is Python:-

Python is a very popular general-purpose interpreted, interactive, object-oriented, and high-level programming language.

Python is dynamically-typed and garbage-collected programming language. It was created by Guido van Rossum during 1985-1990, and released in 1991. It is great as a first language because it is concise and easy to read, and it is also a good language to have in any programmer's stack as it can be used for everything from web development to software development and scientific applications.

Python supports multiple programming paradigms, including Procedural, Object Oriented and Functional programming language. Python design philosophy emphasizes code readability with the use of significant indentation.

Where is Python used?

Python is used for:

➤ web development (server-side),

➤ software development,

➤ mathematics,

➤ system scripting.

Python is a general-purpose, popular programming language, and it is used in almost every technical field.

The various areas of Python use are given below:-

Data Science: Data Science is a vast field, and Python is an important language for this field because of its simplicity, ease of use, and availability of powerful data analysis and visualization libraries like NumPy, Pandas, and Matplotlib.

Desktop Applications: PyQt and Tkinter are useful libraries that can be used in GUI - Graphical User Interface-based Desktop Applications. There are better languages for this field, but it can be used with other languages for making Applications.

Console-based Applications: Python is also commonly used to create command-line or console-based applications because of its ease of use and support for advanced features such as input/output redirection and piping.

Mobile Applications: While Python is not commonly used for creating mobile applications, it can still be combined with frameworks like Kivy or BeeWare to create cross-

platform mobile applications.

Software Development: Python is considered one of the best software-making languages. Python is easily compatible with both from Small Scale to Large Scale software.

Artificial Intelligence: AI is an emerging Technology, and Python is a perfect language for artificial intelligence and machine learning because of the availability of powerful libraries such as TensorFlow, Keras, and PyTorch.

Web Applications: Python is commonly used in web development on the backend with frameworks like Django and Flask and on the front end with tools like JavaScript and HTML.

Enterprise Applications: Python can be used to develop large-scale enterprise applications with features such as distributed computing, networking, and parallel processing.

3D CAD Applications: Python can be used for 3D computer-aided design (CAD) applications through libraries such as Blender.

Machine Learning: Python is widely used for machine learning due to its simplicity, ease of use, and availability of powerful machine learning libraries.

Computer Vision or Image Processing Applications: Python can be used for computer vision and image processing applications through powerful libraries such as

OpenCV and Scikit-image.

Speech Recognition: Python can be used for speech recognition applications through libraries such as SpeechRecognition and PyAudio.

Scientific computing: Libraries like NumPy, SciPy, and Pandas provide advanced numerical computing capabilities for tasks like data analysis, machine learning, and more.

Education: Python's easy-to-learn syntax and availability of many resources make it an ideal language for teaching programming to beginners.

Testing: Python is used for writing automated tests, providing frameworks like unit tests and pytest that help write test cases and generate reports.

Gaming: Python has libraries like Pygame, which provide a platform for developing games using Python.

IoT: Python is used in IoT for developing scripts and applications for devices like Raspberry Pi, Arduino, and others.

Networking: Python is used in networking for developing scripts and applications for network automation, monitoring, and management.

DevOps: Python is widely used in DevOps for automation and scripting of infrastructure management, configuration management, and deployment processes.

Finance: Python has libraries like Pandas, Scikit-learn, and

Statsmodels for financial modeling and analysis.

Audio and Music: Python has libraries like Pyaudio, which is used for audio processing, synthesis, and analysis, and Music21, which is used for music analysis and generation.

Writing scripts: Python is used for writing utility scripts to automate tasks like file operations, web scraping, and data processing.

History of Python:-

Python was developed by Guido van Rossum in the late eighties and early nineties at the National Research Institute for Mathematics and Computer Science in the Netherlands. Python laid its foundation in the late 1980s. The implementation of Python was started in December 1989.

In February 1991, Guido Van Rossum published the code (labeled version 0.9.0) to alt.sources.

In 1994, Python 1.0 was released with new features like lambda, map, filter, and reduce.

Python 2.0 added new features such as list comprehensions, garbage collection systems.

On December 3, 2008, Python 3.0 (also called "Py3K") was released. It was designed to rectify the fundamental flaw of the language.

Current **Python** version is **3.11.4**, which was released on **6 June 2023**.

Python is derived from many other languages, including ABC, Modula-3, C, C++, Algol-68, SmallTalk, and Unix shell and other scripting languages.

ABC programming language is said to be the predecessor of Python language, which was capable of Exception Handling and interfacing with the Amoeba Operating System.

ABC language and Modula-3 programming languages influence Python.

Python is now maintained by a core development team at the institute, although Guido van Rossum still holds a vital role in directing its progress.

Why the Name Python?

There is a fact behind choosing the name Python. G**uido van Rossum** was reading the script of a popular BBC comedy series "**Monty Python's Flying Circus**". It was late on-air 1970s.

Van Rossum wanted to select a name which unique, sort, and little-bit mysterious. So he decided to select naming Python after the "**Monty Python's Flying Circus**" for their newly created programming language.

What can Python do?

➤ Python can be used on a server to create web applications.

➤ Python can be used alongside software to create workflows.

➤ Python can connect to database systems. It can also read and modify files.

➤ Python can be used to handle big data and perform complex mathematics.

➤ Python can be used for rapid prototyping, or for production-ready software development.

Why to learn Python?

➤ Python works on different platforms (Windows, Mac, Linux, Raspberry Pi, etc).

➤ Python has a simple syntax similar to the English language.

➤ Python has syntax that allows developers to write programs with fewer lines than some other programming languages.

➤ Python runs on an interpreter system, meaning that code can be executed as soon as it is written. This means that prototyping can be very quick.

➤ Python can be treated in a procedural way, an object-oriented way or a functional way.

➤ Python is Open Source which means its available free of cost.

➤ Python is simple and so easy to learn

➤ Python is versatile and can be used to create many different things.

➤ Python has powerful development libraries include AI, ML etc.

➤ Python is much in demand and ensures high salary

Key Advantage of learning Python:-

➤ **Python is Interpreted** – Python is processed at runtime by the interpreter. You do not need to compile your program before executing it. This is similar to PERL and PHP.

➤ **Python is Interactive** – You can actually sit at a Python prompt and interact with the interpreter directly to write your programs.

➤ **Python is Object-Oriented** – Python supports Object-Oriented technique of programming that encapsulates code within objects.

➤ **Python is a Beginner's Language** – Python is a great language for the beginner-level programmers and

supports the development of a wide range of applications from simple text processing to WWW browsers to games.

Careers with Python :-

Today, Python is very high in demand and all the major companies are looking for great Python Programmers to develop websites, software components, and applications or to work with Data Science, AI, and ML technologies.

Today, there is a high shortage of Python Programmers where as market demands more number of Python Programmers due to it's application in Machine Learning, Artificial Intelligence etc.

Some big companies like Google, Intel, NASA, PayPal, Facebook, IBM, Amazon, Netflix, Pinterest, Uber and Many more are using Python.

If you know Python nicely, then you have a great career ahead. Here are just a few of the career options where Python is a key skill:

➤ Game developer

➤ Web designer

➤ Python developer

➤ Full-stack developer

➤ Machine learning engineer

➤ Data scientist

➤ Data analyst

➤ Data engineer

➤ DevOps engineer

➤ Software engineer

➤ Many more other roles

Characteristics / Features of Python :-

The latest release of Python is 3.x. As mentioned before, Python is one of the most widely used language over the web. Python's features include –

➤ **Easy-to-learn** – Python has few keywords, simple structure, and a clearly defined syntax. This allows the student to pick up the language quickly.

➤ **Easy-to-read** – Python code is more clearly defined and visible to the eyes.

➤ **Easy-to-maintain** – Python's source code is fairly easy-to-maintain.

➤ **A broad standard library** – Python's bulk of the library is very portable and cross-platform compatible on UNIX, Windows, and Macintosh.

➤ **Interactive Mode** – Python has support for an interactive mode which allows interactive testing and

debugging of snippets of code.

➤ **Portable** – Python can run on a wide variety of hardware platforms and has the same interface on all platforms.

➤ **Extendable** – You can add low-level modules to the Python interpreter. These modules enable programmers to add to or customize their tools to be more efficient.

➤ **Databases** – Python provides interfaces to all major commercial databases.

➤ **GUI Programming** – Python supports GUI applications that can be created and ported to many system calls, libraries and windows systems, such as Windows MFC, Macintosh, and the X Window system of Unix.

➤ **Scalable** – Python provides a better structure and support for large programs than shell scripting.

Apart from the above-mentioned features, Python has a big list of good features, few are listed below −

➤ It supports functional and structured programming methods as well as OOP.

➤ It can be used as a scripting language or can be compiled to byte-code for building large applications.

➤ It provides very high-level dynamic data types and supports dynamic type checking.

- ➤ It supports automatic garbage collection.

- ➤ It can be easily integrated with C, C++, COM, ActiveX, CORBA, and Java.

Python Syntax compared to other programming languages:

- ➤ Python was designed for readability, and has some similarities to the English language with influence from mathematics.

- ➤ Python uses new lines to complete a command, as opposed to other programming languages which often use semicolons or parentheses.

- ➤ Python relies on indentation, using whitespace, to define scope; such as the scope of loops, functions and classes. Other programming languages often use curly-brackets for this purpose.

- ➤ It is possible to write Python in text editor and an Integrated Development Environment, such as Thonny, Pycharm, Netbeans or Eclipse which are particularly useful when managing larger collections of Python files.

- ➤ The most recent major version of Python is Python 3. However, Python 2, although not being updated with anything other than security updates, is still quite popular.

Python Environment Setup:-

Python Install:-

Many PCs will have python already installed.

To check if you have python installed on a Windows PC, search in the start bar for Python or run the following on the Command Line (cmd.exe):

C:\Users\User Name>python --version

If you find that you do not have Python installed on your computer, then you can download it for free from the following website: https://www.python.org/

Installation on Windows:-

Here are the steps to install Python on Windows machine.

➤ Open a Web browser and go to https://www.python.org/downloads/.

➤ Follow the link for the Windows installer python-XYZ.msi file where XYZ is the version you need to install.

➤ To use this installer python-XYZ.msi, the Windows system must support Microsoft Installer 2.0. Save the installer file to your local machine and then run it to find out if your machine supports MSI.

➤ Run the downloaded file. This brings up the Python

install wizard, which is really easy to use. Just accept the default settings, wait until the install is finished, and you are done.

Setting up PATH:-

Programs and other executable files can be in many directories, so operating systems provide a search path that lists the directories that the OS searches for executables.

The path is stored in an environment variable, which is a named string maintained by the operating system. This variable contains information available to the command shell and other programs.

Setting path at Windows:-

To add the Python directory to the path for a particular session in Windows –

At the command prompt – type path %path%;C:\Python and press Enter.

Note – C:\Python is the path of the Python directory

Python Environment Variables:-

Here are important environment variables, which can be recognized by Python –

PYTHONPATH:- It has a role similar to PATH. This variable tells the Python interpreter where to locate the module files imported into a program. It should include the Python source library directory and the directories containing Python source code. PYTHONPATH is sometimes preset by the Python installer.

PYTHONSTARTUP:- It contains the path of an initialization file containing Python source code. It is executed every time you start the interpreter. It is named as .pythonrc.py in Unix and it contains commands that load utilities or modify PYTHONPATH.

PYTHONCASEOK:- It is used in Windows to instruct Python to find the first case-insensitive match in an import statement. Set this variable to any value to activate it.

PYTHONHOME:- It is an alternative module search path. It is usually embedded in the PYTHONSTARTUP or PYTHONPATH directories to make switching module libraries easy.

Note:- In Next Class we will discuss on Running Python Programme and Basic Syntax.