Module 1h: Introduction to Problem Solving and Python Fundamentals

Premanand S

Assistant Professor,
School of Electronics and Engineering,
Vellore Institute of Technology, Chennai

premanand.s@vit.ac.in

July 19, 2025

Python - Introduction

- Guido Van Rossum, Feb 20, 1991
- Not SNAKE, Monty Python's Flying Circus
- High-level programming language
- General purpose
- Interpreter
- Works in different OS
- Syntax like English
- Few lines of code - libraries
- New line means end of the command
- Python 2.x Vs Python 3.x
- .py or .ipynb

Why choose Python over other languages?

- Simple and Readable
- Beginner Friendly
- Versatile and Powerful
- Huge Library support
- Top-ranked language – Stack Overflow, GitHub, and TIOBE Index
- Massive global community – millions of learners, developers, and educators ready to help.
- Used by Google, Netflix, NASA, Facebook, and Instagram

Famous Apps Built with Python

- Instagram - Uses Python (mainly Django framework)
- YouTube - Recommendation, Data Processing
- Spotify - Used for backend services, data analytics
- Netflix - Machine learning systems that power movie suggestions.
- Dropbox - Entire desktop client is built using Python
- Reddit - Originally written in Lisp, but later rewritten entirely in Python
- Pinterest - manage millions of pins and personalized boards.

Disadvantages of Python

- Slower than compiled languages
- Not ideal for mobile app development - Swift (iOS) or Kotlin (Android)
- High memory usage - issue for low-memory devices or embedded systems
- Dynamic typing can cause hidden bugs
- Weak in mobile and browser-side environments
- Not always the best for multi-threading - Global Interpreter Lock (GIL)
  - Only one thread can run Python code at a time on a single CPU core.
  - Python works great with async, threading, or concurrent.futures
  - For CPU-bound tasks, you can use multiprocessing, which runs separate processes — each with its own Python interpreter and memory space.

Python - Fun Facts

- Hobby Project
- Python overtakes French in school, UK
- Cpython, Jpython, Micro Python, Ruby Python, Brython
- MAANG almost all MNCs
- import antigravity
- import this

Python - Applications

- Website development - Django, Flask
- Desktop GUI applications - Kivy, PyQT, and Tkinter
- Gaming and 3D Graphics - Pygame, PyopenGL, Pyglet, Panda3D
- Computer Vision - Fastai, Ipsdk, Imutils, Keras, Opencv, Pytessarct, PyTorchCV, Scikit-Image, SimpleCV
- Machine Learning - Numpy, Pandas, Matplotlib, Seaborn, Scikit-learn
- Robotics - Pyro, DART, PyRobot, PyDy, Klamp't, Pybotics
- Web Scraping - Beautiful Soup, Selenium
- Scientific Computing - Scipy, BioPython
- Medical - NeuroKit2
- OS

Code Editor vs IDE (for Python)

Feature	Code Editor	IDE (Integrated Development Environment)
Definition	A lightweight tool to write and edit code	A full-featured environment for writing, testing, and managing code
Main Focus	Editing code (syntax highlighting, themes)	All-in-one development (writing, debugging, running)
Speed & Size	Fast, small, and lightweight	Heavier, uses more memory and storage
Examples	VS Code, Sublime Text, Atom, Notepad++	PyCharm, Thonny, Spyder, Visual Studio
Features	- Syntax highlighting - Basic autocomplete	- Debugger - Code suggestions - Project management - Terminal integration
Best For	Beginners or quick edits	Full project development and debugging

Platforms to Code – Python

- **Official Python Website:** https://www.python.org/
- **Anaconda Navigator (Jupyter Notebook):** https://www.anaconda.com/download
- **Thonny IDE (Beginner-friendly):** https://thonny.org/
- **Google Colab (Cloud-based coding):** https://colab.research.google.com/

What is Anaconda Navigator?

- Anaconda Navigator is a textbfgraphical user interface (GUI) for managing Python environments, packages, and tools.
- It comes with the Anaconda distribution, widely used in data science, AI, and education.
- You can launch apps like:
  - Jupyter Notebook
  - Spyder
  - VS Code
  - RStudio (optional)
- It eliminates the need to use the command line for common tasks.

Importance of Anaconda Navigator

- **User-Friendly:** Perfect for beginners—just click to launch tools.
- **Package Management:** Easily install, update, and manage libraries with Conda.
- **Environment Isolation:** Create separate environments to avoid version conflicts.
- **Preloaded Tools:** Comes with 250+ scientific and data analysis packages.
- **Ideal for Learning and Teaching:** Simplifies setup so students can focus on logic.

Languages Supported in Anaconda Navigator

- **Python** – primary language used in data science and ML.
- **R** – widely used in statistical analysis and visualization.
- **Julia** – used for high-performance scientific computing.
- **Other Languages:** Anaconda supports many tools that integrate with C, C++, and Java through bindings.

Note: Python and R are the most commonly supported and used languages in Navigator.

What is Jupyter Notebook?

- Jupyter Notebook is an **interactive web-based tool** that allows you to create and share documents containing:
  - Live Python code
  - Equations (LaTeX)
  - Visualizations (graphs, plots)
  - Explanatory text (Markdown)
- It's widely used in data science, education, and research.
- Files are saved with the extension `.ipynb` (IPython Notebook).
- Run one cell at a time to see step-by-step outputs.

What is Thonny IDE?

- Thonny is a **lightweight Python IDE** designed especially for beginners.
- Developed by the University of Tartu (Estonia).
- Features a simple interface with minimal distractions.
- Best suited for school and college-level programming practice.
- Includes features like:
  - Built-in Python interpreter
  - Simple debugger
  - Variable value display

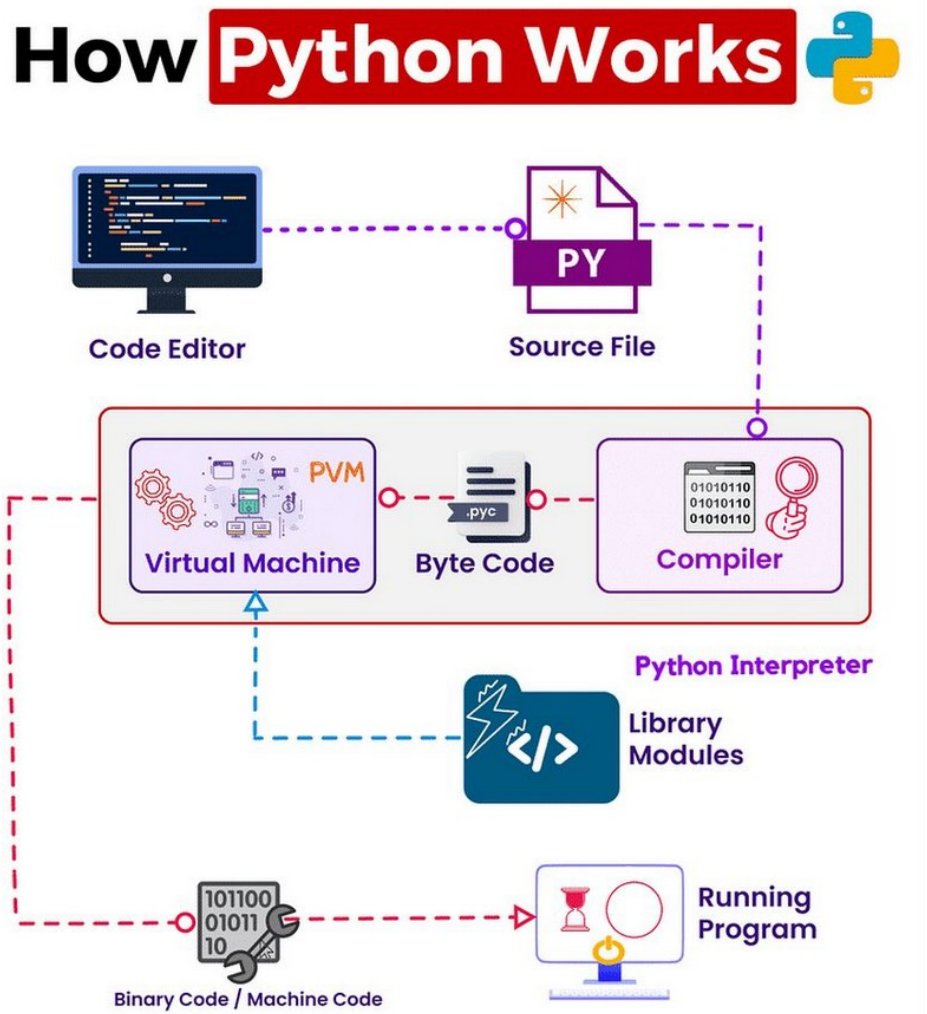
What is Google Colab?

- Google Colab (Colaboratory) is a **cloud-based Python notebook environment**.
- You can write and run Python code in your browser—no installation required.
- It supports:
  - Jupyter-style notebooks
  - GPU and TPU acceleration
  - Integration with Google Drive
- Widely used in data science, ML, and education for collaborative coding.

Python - Modes

- Interactive mode
  - REPL = Read–Eval–Print Loop
  - Use case: Testing small code snippets, doing quick calculations, or learning Python basics.
  - Ex: print("Hello, Python!")
- Script mode
  - Python code in a .py file, then run the whole program at once
  - Building complete programs, automation scripts, and projects.
- IDLE mode
  - Built-in IDE (called IDLE) gives you both an interactive shell and script editor
- Command-Line Mode
  - python -c "print('Hello')"

How Python code works?



mail me: er.anandprem@gmail.com / premanand.s@vit.ac.in
ring me: +91 73586 79961
Follow me: Linkedin
Medium Blogs
Analytics Vidhya: Blogs

Don't just code — think, plan, and solve