



Python Programming

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Course Contents

- History and Introduction
- Fundamentals, Functions and Collections
- Functional Programming
- List Comprehension
- Loops, Generators and Decorators
- Python Modules and Packages
- Flask, NumPy & Pandas
- Data Analysis using NumPy and Pandas
- Data Visualization using matplotlib
- Image processing using OpenCV



About your instructor

- **Name:** Dr.Akshita S.Chanchlani
- **Designation :** Associate Head SBU Technical
- **Education :**
 - PhD : Computer Science and Engineering
 - Masters of Engineering (ME) in Information Technology
 - B.Tech in Computer Engineering, From VJTI Mumbai
- **Training Experience**
 - PreCATBatches : C, C++ , Operating System, Networks, AI
 - PG Course : Core Java, Data Structures, Python
 - Modular Batches : Core Java and Python Programming
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 - **13+ years**
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What are we going to cover ?

Introduction

- Overview
- Why python
- Versions

Setup

- Python installation
- Environment setup
- Git configuration

Foundation

- Data types
- Operators
- Statement & Expression

Types

- Basic data types
- Collections (list,set,tuple,dictionary)

Functions

- Named vs Lambda
- Nested functions
- Scopes

Advanced features

- List comprehension
- Generators
- Decorators

OOP

- Class vs Object
- Inheritance
- Special methods



What are we going to cover ?

Modules and packages

- Module creation
- Custom packages
- Package ecosystem

Functional Programming

- map
- filter
- reduce

Database Connectivity

- Connecting to MySQL
- CRUD operations

Data Processing

- Numpy
- Pandas
- matplotlib

OpenCV

- Basic Image processing using OpenCV



What are we NOT going to cover ?

- Data Science
- Analytics and Analysis
- Machine Learning
- Image processing algorithms
- Web development
- Testing fundamentals
- Containerization (Docker)
- DevOps
- Linux administration
- Database fundamentals (MySQL/Mongo)



Daily Topic Wise ppts and codes in format of soft copy will be shared on git

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Language Fundamentals



What is a computer language?

- A language is a medium to interact with computer [cpu]
- A language is used to solve a problem by giving some solution (writing a program)
- Types
 - **Machine languages:** the code written in 0s and 1s and can be directly executed by CPU
 - **Assembly languages:** a language closely related to one or a family of machine languages, and which uses mnemonics to ease writing
 - Programming languages
 - **General purpose languages:** a programming language that is broadly applicable across application domains, and lacks specialized features for a particular domain.eg. C,C++,python
 - **Markup languages:** a grammar for annotating a document in a way that is syntactically distinguishable from the text.eg.XML,HTML,YAML
 - **Stylesheet language:** a computer language that expresses the presentation of structured documents.eg.CSS
 - **Configuration language:** a language used to write configuration files.eg.json,.config,xml
 - **Query language:** a language used to make queries in databases and information systems.eg.sql
 - **Scripting languages:** a language used to write simple to complex scripts. Eg.python, java script



Low Level vs High Level Languages

High Level Language	Low Level Language
It is programmer friendly language	It is a machine friendly language
High level language is less memory efficient	Low level language is high memory efficient
It is easy to understand	It is tough to understand
It is simple to debug	It is complex to debug comparatively
It is simple to maintain	It is complex to maintain comparatively
It is portable	It is non-portable
It can run on any platform	It is machine-dependent
It needs compiler or interpreter for translation	It needs assembler for translation
E.g. Python	E.g. Assembly



Compiled language

- A programming language which involves an executable to execute the logic instead of executing the source code directly
- Fast Performance, OS Dependent
- E.g. C, C++, Pascal, Objective-C, Swift etc.
- Stages
 - Pre-processing
 - Used to preprocess the code
 - Comments removal
 - Code expansion
 - Conditional compilation
 - Compiling
 - Compiler is used to translate pre-processed code into assembly instructions specific to the target processor architecture
 - Assembling
 - Assembler is used to translate the assembly instructions to object code
 - Linking
 - Linker used in this stage re-arranges the code and insert missing files to emit an executable



Interpreted Language

- A language mostly executes source code directly and freely, without previously compiling a program into an executable
- Slower, OS Independent
- E.g. Python, JavaScript, Perl, BASIC etc.
- Interpretation
 - Interpreter used in the language executes the high level source code directly



Python



Introduction

- Python is a general purpose, high level and interpreted language
- It is dynamically typed and garbage collected language
- It supports programming paradigms like
 - Procedural programming
 - Object oriented programming
 - Functional programming
 - Aspect oriented programming (metaprogramming and magic metaobjects)
- Heavily dependent on indentation to create blocks which makes it very easy to read the code
- It has more than 130,000 packages included with wide range of functionality
 - Graphical user interfaces (various libraries)
 - Web frameworks (flask, Django)
 - Networking
 - Automation
 - Web scraping (selenium)



History

- Python was conceived in the late 1980s by Van Guido Rossum in Netherlands
- It is considered as a successor to the ABC language (itself inspired by SETL (SET Language))
- Its implementation began in December 1989
- Van Rossum continued as Python's lead developer until July 12, 2018
- When he announced his permanent vacation from his responsibilities, a team of five members was developed in Jan 2019 to lead the project



Versions

- Version 0.9.0 [Feb 1991]
 - Having features like classes with inheritance, exception handling, functions etc.
 - One of the major versions of python
- Version 1 [Jan 1994]
 - The major new features included in this release were the functional programming tools like labda, map, filter, reduce
 - The last version released was 1.6 in 2000
- Version 2 [Oct 2000]
 - Introduced features like list comprehension, garbage collection, generators etc.
 - Introduced its own license known as Python Software Foundation License (PSF)
 - The last version released was 2.7.16 in Mar 2019
- Version 3 [Dec 2008]
 - Python 3.0 is also called "Python 3000" or "Py3K"
 - It was designed to rectify fundamental design flaws in the language
 - Python 3.0 had an emphasis on removing duplicative constructs and modules



Features

- Free and open source
- Mature programming language
- Supportive user community
- Elegant design and easy to learn
- Extremely portable [Python Virtual Machine PVM]
- Compiles to interpreted byte code
- Memory management using reference counting [garbage collection]
- Provides interfaces to various languages



What it is used for

- Console application development
- GUI application development
- Web scripting
- Scientific application development
- Extension languages
- XML/JSON processing
- Applications heavily dependent on data
- Machine learning
- Image processing
- Testing application
- Linux Administration



Environment Setup

- Python installation
 - Download and install from <https://www.python.org/downloads/>
- IDE
 - Offline
 - Visual studio code
 - Spyder
 - PyCharm
 - Online compilers



Python compilers

- Python has many versions like
 - CPython
 - Pypy
 - Jython
 - IronPython
 - Nuitka
 - Pyjs
 - RPython
- The standard version is called as CPython which is what most of us get when we download from the official site
- Henceforth when we say we are using python, it will be CPython



CPython



- CPython is the default and most widely used implementation of the language
- One of the reference implementation of Python language
- It is written in C and python
- Can be referred as both, compiler and interpreter
- It comes with a whole range of tools, libraries, and components



Python Virtual Machine (PVM)

- Written in C
- Compiles the bytecode into machine language
- It emulates the machine or CPU
- Executes bytecodes similar to the way a CPU executes the machine instructions
- Python memory manager
- Computation Stacks



How does it work ?

- Lexing
 - Breaks the lines into tokens
- Parsing
 - Parser uses the tokens generated by lexer to generate Abstract Syntax Tree (AST)
 - It depicts the relationship between the tokens
- Compiling
 - The compiler turns the AST into the code objects
- Interpreting
 - Interpreter executes generated code with the help of CPU



Foundation



Statements

- Instructions that a Python interpreter can execute are called statements
 - E.g., `a = 1` is an assignment statement
- **Single line statements**
 - The end of a statement is marked by a newline character
- **Multi-line statement**
 - We can make a statement extend over multiple lines with the line continuation character (`\`)
 - Line continuation is implied inside parentheses `()`, brackets `[]`, and braces `{ }`
 - We can also put multiple statements in a single line using semicolons
- **Comments**
 - Comments are very important while writing a program
 - Ignored while execution of a program
 - They describe what is going on inside a program, so that a person looking at the source code does not have a hard time figuring it out
 - In Python, we use the hash (`#`) symbol to start writing a comment



Variable

- A variable is a named location used to store data in the memory
- It is helpful to think of variables as a container that holds data that can be changed later
- E.g.
 - value = 20
 - name = "steve"



Constants

- Constants are written in all capital letters and underscores separating the words
- E.g.
 - $\text{PI} = 3.14$
- In reality, we don't use constants in Python
- Naming them in all capital letters is a convention to separate them from variables, however, it does not actually prevent reassignment



Rules and Conventions

- Constant and variable names should have a combination of letters in lowercase (**a to z**) or uppercase (**A to Z**) or digits (**0 to 9**) or an underscore (**_**)
- If you want to create a variable name having two words, use underscore to separate them
- Create a name that makes sense (use meaningful names)
- Use capital letters possible to declare a constant
- Never use special symbols like **!**, **@**, **#**, **\$**, **%**, etc.
- Don't start a variable name with a digit

