4th Edition

YASHAVANT KANETKAR
ADITYA KANETKAR

Python Is Future, Embrace It Fast
Learn Python Quickly
A Programmer-Friendly Guide

Let Us Python

bpb

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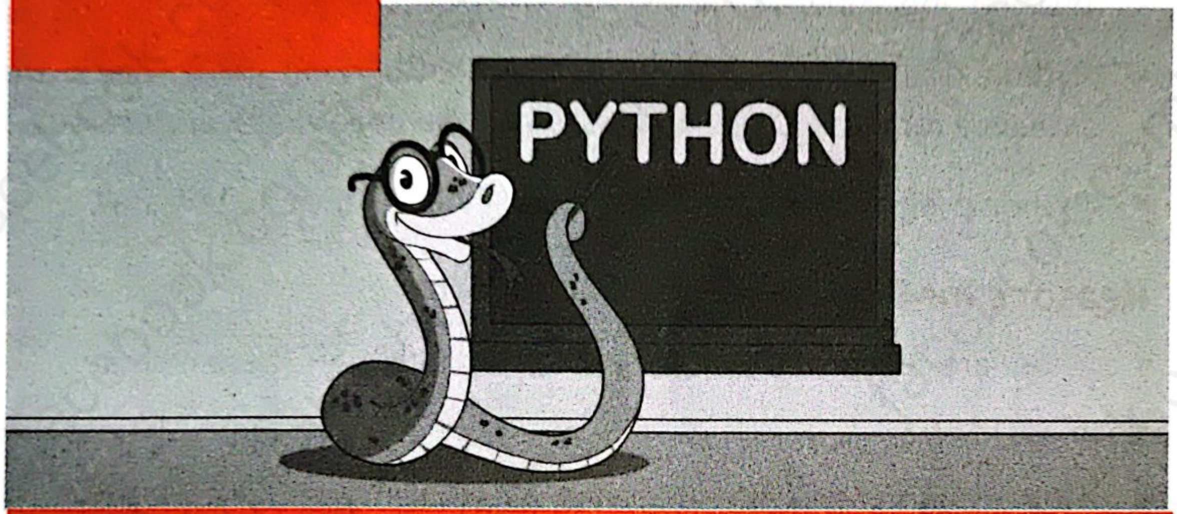
1 Introduction to Python



"Wet your feet..."

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- What is Python?
- Reasons for Popularity
- What sets Python apart?
- Where is Python Used?
- Who uses Python today?
- Programming Paradigms
- Functional Programming Model
- Procedural Programming Model
- Object-oriented Programming Model
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What is Python?

- Python is a high-level programming language created by Guido Van Rossum - fondly known as Benevolent Dictator For Life.
- Python was first released in 1991. Today Python interpreters are available for many Operating Systems including Windows and Linux.
- Python programmers are often called Pythonists or Pythonistas.

Reasons for Popularity

- There are severa' reasons for Python's popularity. These include:

(a) Free:

- Python is free to use and distribute and is supported by community.
- Python interpreter is available for every major platform.

(b) Software quality:

- Better than traditional and scripting languages.
- Readable code, hence reusable and maintainable.
- Support for advance reuse mechanisms.

(c) Developer productivity:

- Much better than statically typed languages.
- Much smaller code.
- Less to type, debug and maintain.
- No lengthy compile and link steps.

(d) Program portability:

- Python programs run unchanged on most platforms.
- Python runs on every major platform currently in use.
- Porting program to a new platform usually need only cut and paste. This is true even for GUI, DB access, Web programming, OS interfacing, Directory access, etc.

(e) Support libraries:

- Strong library support from Text pattern matching to networking.
- Vast collection of third-party libraries.
- Libraries for Web site construction, Numeric programming, Game development, Machine Learning etc.

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(f) Component integration:

- Can invoke C, C++ libraries and Java components.
- Can communicate with frameworks such as COM, .NET.
- Can interact over networks with interfaces like SOAP, XML-RPC, CORBA.
- With appropriate glue code, Python can subclass C++, Java, C#. classes, thereby extending the reach of the program.
- Popularly used for product customization and extension.

(g) Enjoyment:

- Ease of use.
- Built-in toolset.
- Programming becomes pleasure than work.

What sets Python apart?

(a) Powerful:

- Dynamic typing.
- No variable declaration.
- Automatic allocation and Garbage Collection.
- Supports classes, modules and exceptions.
- Permits componentization and reuse.
- Powerful containers - Lists, Dictionaries, Tuples, etc.

(b) Ready-made stuff:

- Support for operations like joining, slicing, sorting, mapping, etc.
- Powerful library.
- Large collection of third-party utilities.

(c) Ease of use:

- Type and run.
- No compile and link steps.
- Interactive programming experience.
- Rapid turnaround.
- Programs are simpler, smaller and more flexible.

Where is Python used?

- Python is used for multiple purposes. These include:

(a) System programming

(b) Building GUI applications

(c) Internet scripting

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(d) Component integration

(e) Database programming

(f) Rapid prototyping

(g) Numeric and Scientific programming

(h) Game programming

(i) Robotics programming

Who uses Python today?

- Many organizations use Python for varied purposes. These include:

(a) Google - In web search system

(b) YouTube - Video Sharing service

(c) Bit-torrent - Peer to Peer file sharing system

(d) Intel, HP, Seagate, IBM, Qualcomm - Hardware testing

(e) Pixar, Industrial Light and Magic - Movie animation

(f) JP Morgan, Chase, UBS - Financial market forecasting

(g) NASA, FermiLab - Scientific programming

(h) iRobot - Commercial robot vacuum cleaners

(i) NSA - Cryptographic and Intelligence analysis

(j) IronPort - Email Servers

Programming Paradigms

- Paradigm means organization principle. It is also known as model.
- Programming paradigm/model is a style of building the structure and elements of computer programs.
- There exist many programming models like Functional, Procedural, Object-oriented, Event-driven, etc.
- Many languages facilitate programming in one or more paradigms. For example, Python supports Functional, Procedural, Object-oriented and Event-driven programming models.

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- There are situations when Functional programming is the obvious choice, and other situations where Procedural programming is the better choice.
- Paradigms are not meant to be mutually exclusive. A single program may use multiple paradigms.

Example

Functional Programming Model

- Functional programming decomposes a problem into a set of functions. These functions provide the main source of logic in the program.
- Functions take input parameters and produce outputs. Python provides functional programming techniques like lambda, map, reduce and filter. These are discussed in Chapter 15.
- In this model computation is treated as evaluation of mathematical functions. For example, to get factorial value of a number, or nth Fibonacci number we can use the following functions:

```
factorial(n)  = 1                    if n == 0
          = n * factorial(n - 1)    if n > 0

fibo(n) = 0                 if n = 0
        = 1                 if n = 1
        = fibo(n - 2) + fibo(n - 1)     if n > 1
```

- The output value of a function depends only on its arguments, so calling a function with the same value for an argument always produces the same result. As a result, it is a good fit for parallel execution.
- No function can have side effects on other variables (state remains unaltered).
- Functional programming model is often called a 'Declarative' programming paradigm as programming is done with expressions or declarations instead of statements.

Procedural Programming Model

- Procedural programming solves the problem by implementing one statement (a procedure) at a time. Thus, it contains explicit steps that are executed in a specific order.

- It also uses functions, but these are not mathematical functions like the ones used in functional programming. Functional programming focuses on expressions, whereas Procedural programming focuses on statements.
- The statements don't have values and instead modify the state of some conceptual machine.
- Same language expression can result in different values at different times depending on the global state of the executing program. Also, the functions may change a program's state.
- Procedural programming model is often called Necessary 'Imperative' programming as it changes state with an explicit sequence of statements.

Object-oriented Programming Model

- This model mimics the real world by creating inside the computer a mini-world of objects.
- In a University system objects can be VC, Professors, Non-teaching staff, students, courses, semesters, examinations, etc.
- Each object has a state (values) and behavior (interface/methods). Objects get state and behavior based on the class from which it created.
- Objects interact with one another by sending messages to each other, i.e., by calling each other's interface methods.

Event-driven Programming Model

- This model is popularly used for programming GUI applications containing elements like windows, check boxes, buttons, combo-boxes, scroll bars, menus, etc.
- When we interact with these elements (like clicking a button, or moving the scrollbar or selecting a menu item) events occur and these elements emit messages. There are listener methods which are registered with these GUI elements which react to these events.
- Since there is no guaranteed sequence in which events may occur (based on how we interact with GUI elements), the listeners should be able to handle them in asynchronous manner.

EX Exercises

[A] Answer the following:

(a) Mention 5 fields in which Python is popularly used.

(b) Where is event-driven programming popularly used?

(c) Why Python is called portable language?

(d) What is the single most important feature of different programming models discussed in this chapter?

(e) Which of the following is not a feature of Python?

- Static typing
- Dynamic typing
- Run-time error handling through error numbers
- Library support for containers like Lists, Dictionaries, Tuples

(f) Give an example application of each of the following programming models:

- Functional model
- Procedural model
- Object-oriented model
- Event-driven model

[B] State whether the following statements are True or False:

(a) Python is free to use and distribute.

(b) Same Python program can work on different OS - microprocessor combinations.

(c) It is possible to use C++ or Java libraries in a Python program.

(d) In Python type of the variable is decided based on its usage.

(e) Python cannot be used for building GUI applications.

(f) Python supports functional, procedural, object-oriented and event-driven programming models.

(g) GUI applications are based on event-driven programming model.

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(h) Functional programming model consists of interaction of multiple objects.

[C] Match the following pairs:

a. Functional programming	1. GUI element based interaction
b. Event-driven programming	2. Interaction of objects
c. Procedural programming	3. Statements
d. OOP	4. Maths-like functions

[D] Fill in the blanks:

(a) Functional programming paradigm is also known as ________ programming model.

(b) Procedural programming paradigm is also known as ________ programming model.

(c) Python was created by ________.

(d) Python programmers are often called ________.

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