

Sharif University of Technology
Department of Computer Engineering

Fundamentals of Programming

Python Language



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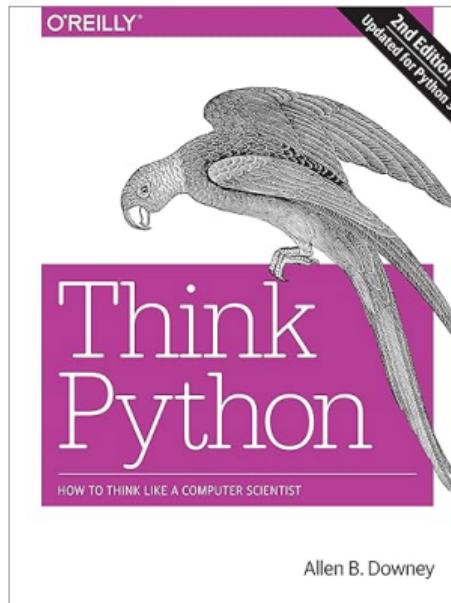
2 Fundamental Concepts

Overview of the Course

Resources

Main Book:

- A. B. Downey. Think Python: How to Think Like a Computer Scientist. 2nd Edition, O'Reilly Media, 2015



Additional Resources

- P. Wentworth, J. Elkner, A. B. Downey, C. Meyers. How to Think Like a Computer Scientist: Learning with Python. 3rd Edition, Open Book Project, 2011.
- J. Campbell, P. Gries, J. Montojo, G. Wilson. Practical Programming: An Introduction to Computer Science Using Python. The Pragmatic Bookshelf, 2009.
- J. M. Zelle. Python Programming: An Introduction to Computer Science. Franklin, Beedle & Associates, 2004.

Syllabus

- ① Fundamental Concepts (e.g., Algorithm, Computer and History of Python)
- ② Python Intro: Constants, Variables, Data Types, Casting and Operators
- ③ Input/Output and Conditional Statement Type 1 (if)
- ④ Loops Part 1 (basic for, for each, nested, etc.)
- ⑤ Loops Part 2 (While, Break, Continue, nested, etc.)
- ⑥ Functions, parameters, and arguments
- ⑦ Combination of Loops and Conditional Logic
- ⑧ Control Flow, Variable Scope, Docstring, Comment, etc.
- ⑨ Strings Intro, Related Operations, Most Commonly Used Functions for Strings, Basic Intro to Regex
- ⑩ Lists (indexing, slicing, useful functions and operations, nesting)

Syllabus

- ⑪ Tuples and Dictionaries
- ⑫ Sets and the Related Operations
- ⑬ Working with Files (Read, Write, Append, etc.), Text vs. Binary Files
- ⑭ Managing Exceptions (Try, Except, Finally, etc.)
- ⑮ Linear Algebra and Data Visualization Intro (using Numpy, Pandas, Scipy, Matplotlib, etc.)
- ⑯ Intro to OOP Part 1: Classes (Definition, Objects, Methods, Constructors, Types of Class Variables, etc.)
- ⑰ Intro to OOP Part 2: Inheritance (although interesting, not included in your exam)
- ⑱ Intro to OOP Part 3: Polymorphism (although interesting, not included in your exam)
- ⑲ Algorithmic Thinking Intro: Searching, Sorting, and Divide and Conquer
- ⑳ Intro to Regex and Text Processing

Syllabus

- ㉑ On the way to be a programmer: Intro to Github
- ㉒ Intro to Clean Code and Design Patterns
- ㉓ Working with Images (opencv and other related modules) (not included in your exam)
- ㉔ Intro to Debugging and Unit Testing
- ㉕ Comprehensive review of all topics included in the final exam

Grading

- Midterm Exam: 5 Points - **Date & Time: 14/09/1402, 1:30 PM**
- Final Exam: 5 Points
- 5+1 Assignments: Each Containing 4 Questions - 7 Points
- Project: 3 Points
- Class Activity: 2 Points (At most)

Useful Information

- Lecturer's E-mail: malekzadeh@ieee.org
- Quera: Quera.org/course/add_to_course/course/14952/
- Head Teaching Assistants:
[Ali Salesi](#) - [Iman Mohammadi](#) - [Donya Navabi](#)
- Telegram Support Channel: [@python_sharif_fall_2023](https://t.me/python_sharif_fall_2023)



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Fundamental Concepts

What is a Computer?

Definition

A computer is an electronic apparatus that operates under the governance of commands preserved in its internal memory. It possesses the capacity to receive data (input), process this data following predefined algorithms, generate information (output), and retain this information for subsequent utilization.

Logically thinking, a computer consists of

- Input Unit (e.g., Keyboard, Mouse, Microphone, Light Pen)
- Central Processing Unit (CPU) which contains Arithmetic and Logic Unit (ALU)
- Memory Unit (RAM)
- Secondary Storage Unit (e.g., USB Flash Drive)
- Output Unit (e.g., Speakers, Headphones)

Input Unit



Output Unit



Note: Some of these devices are considered as both input and output unit. (e.g., Modem)

Central Processing Unit



Figure: An actual CPU

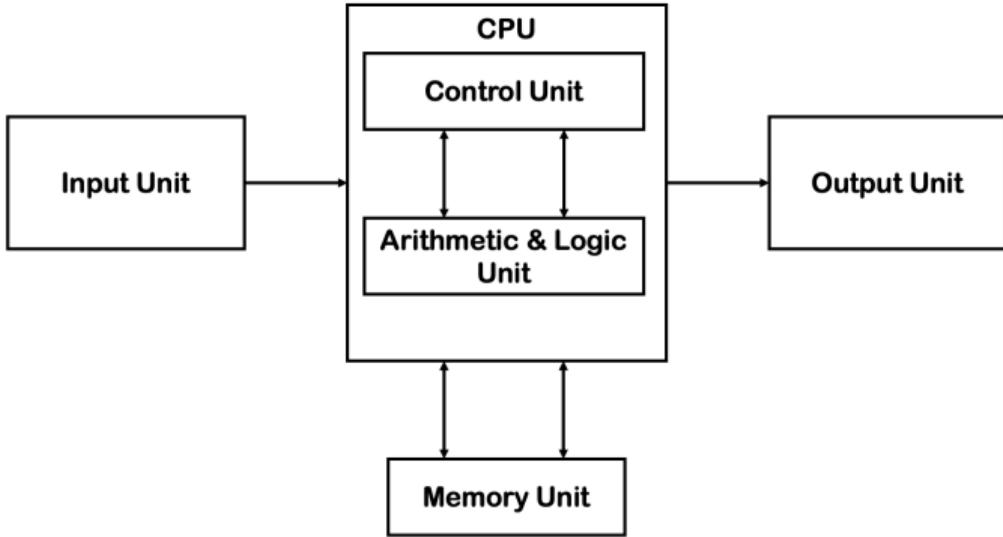


Figure: How CPU Interacts with the Other Units

Central Processing Unit

- The Central Processing Unit, often referred to as the CPU, is essentially the brain of a computer.
- It's a highly significant component that carries out most of the processing inside computers.
- The CPU has several key responsibilities:
 - It performs calculations and executes instructions given by software and applications.
 - Basic functions: like input from your keyboard
 - Complex tasks: like running video games or software applications.

Central Processing Unit

- The CPU has several key responsibilities:
 - Moreover, it also manages system resources and interacts with other hardware components in the system.
 - To put it simply, the CPU takes care of almost all tasks that make your computer function effectively and efficiently.

Arithmetic and Logic Unit

- The Arithmetic and Logic Unit, often referred to as the ALU, is a fundamental building block of the Central Processing Unit (CPU) in a computer.
- Its main responsibility is to carry out arithmetic and logical operations on the data that the computer processes.
- In more detail, when it comes to arithmetic operations, the ALU performs functions such as addition, subtraction, multiplication and division.

Arithmetic and Logic Unit

- On the other hand, for logical operations, it handles tasks such as comparing two pieces of data to determine if one is greater than, less than or equal to the other.
- It can also perform functions like AND, OR and NOT operations.
- In essence, the ALU plays a critical role in executing instructions of a computer program and performing essential mathematical computations that allow your computer to function effectively.

References

References I

- [1] B Downey, A. (2015). Think Python: How to Think Like a Computer Scientist-2nd Edition.
- [2] Deitel, H. M., Deitel, P. J. (2004). C: How to program. Pearson Educación.



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