Introduction to Computer

Textbook

- Foundations of Computer Science – From Data Manipulation to Theory of Computation
- By Behrouz A. Forouzan
- 歐亞書局
- 02-89121188

Introduction

OBJECTIVES

After reading this chapter, the student should be able to:

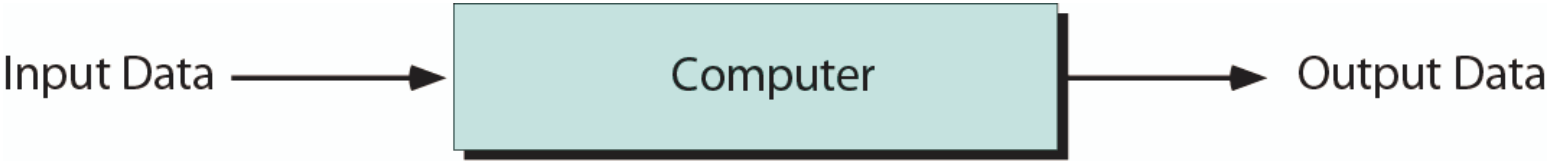
- Understand the concept of a black box, a data processor , and a programmable data processor.
- Define the ***von Neumann*** model and name its components: memory, arithmetic/logic unit, control unit, and input/output.
- Understand the stored program concept.
- Understand the sequential execution of statements in a program.
- Name the components of a computer: hardware, software, and data.

1.1

THE COMPUTER AS A BLOCK BOX

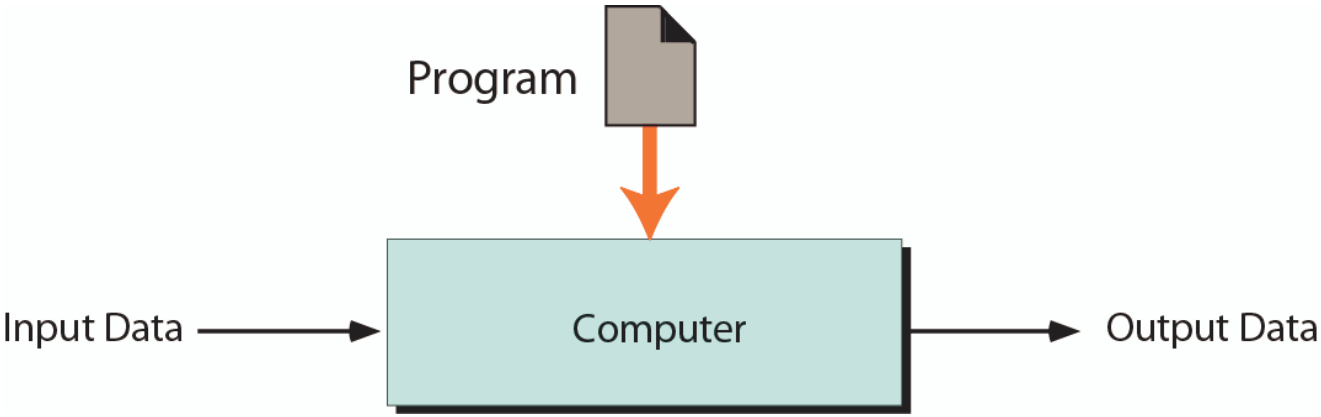
Data processor model

- We provide two common computer models
  - Data processor model
  - Programmable data processor model
- Data processor model



- The model has two problem
  - Too general
  - It does not specify the type of processing: specific-purpose or general-purpose machine?

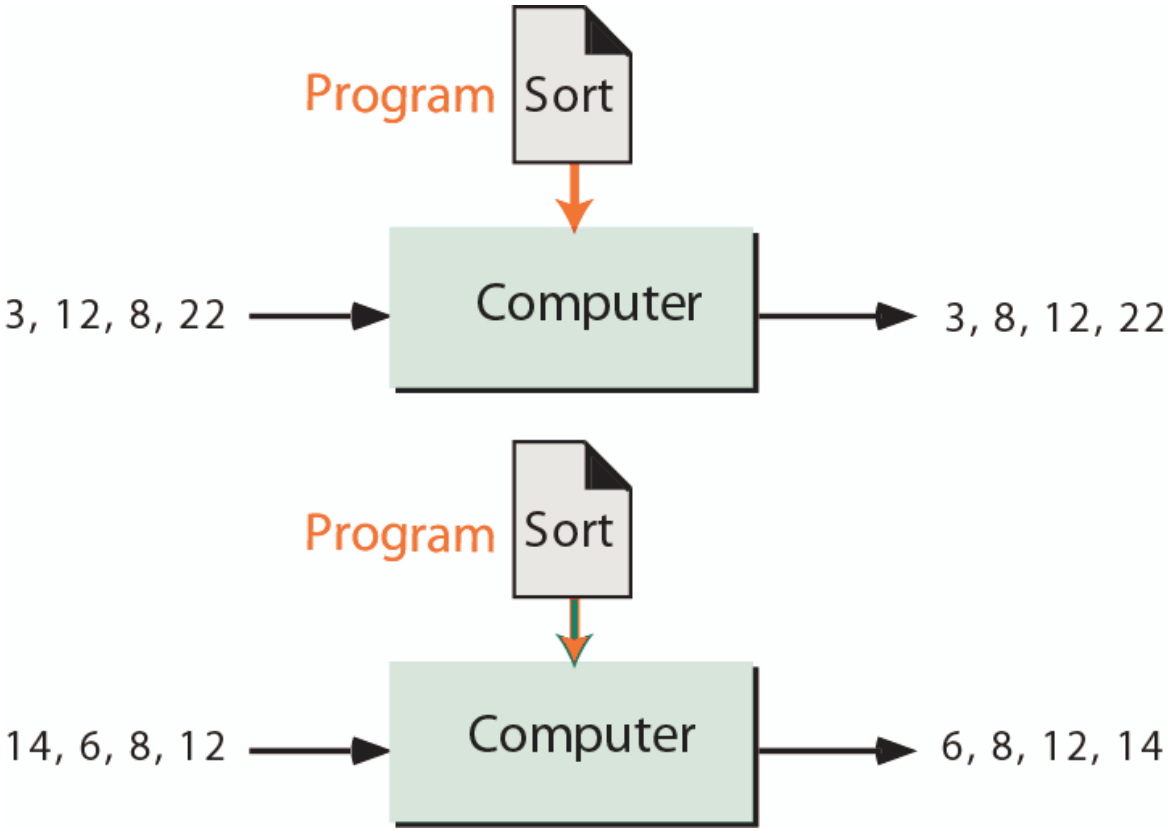
Programmable data processor model



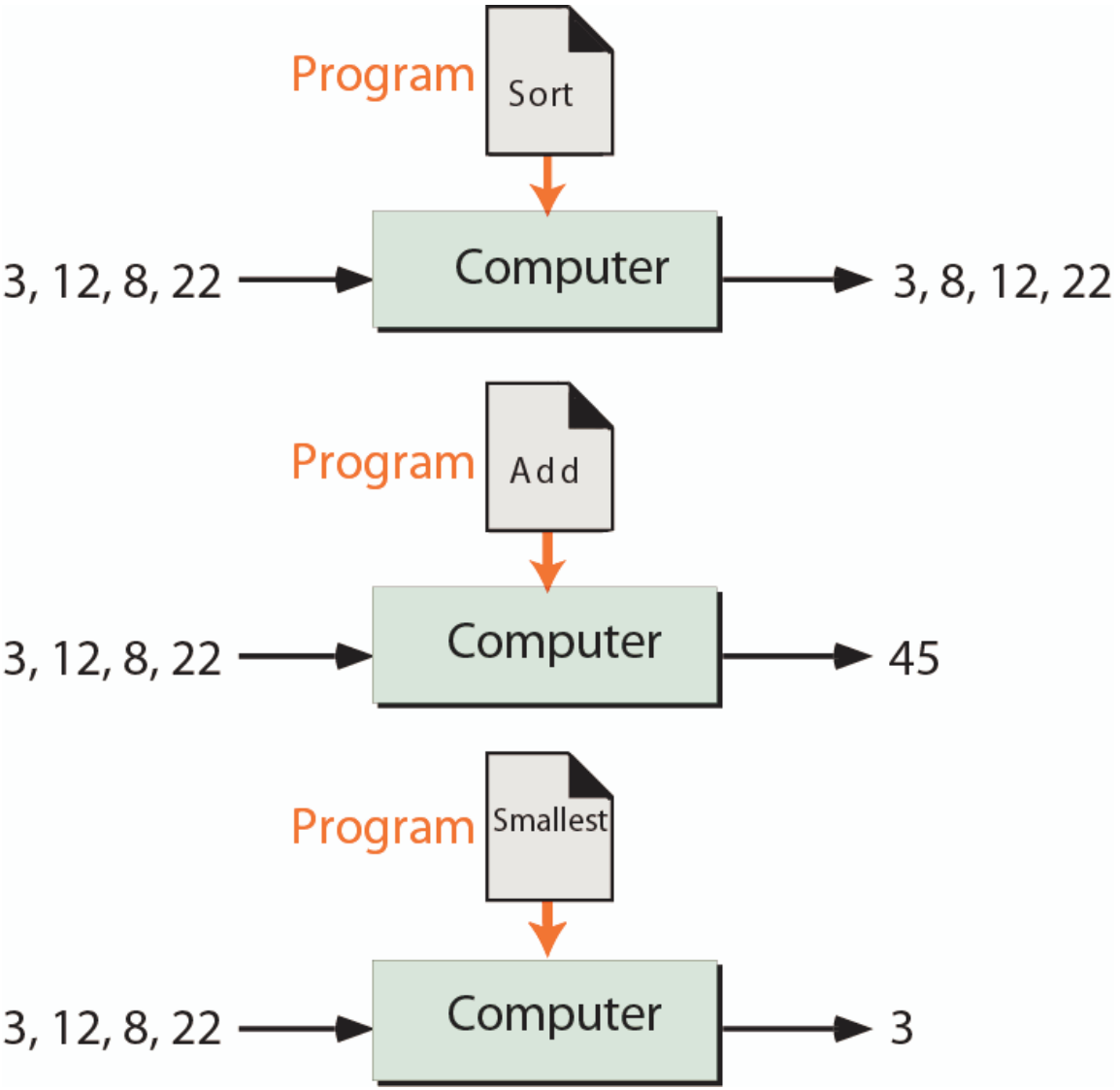
- Computers, as the term is used today, are general-purpose machines
- A better model for a general-purpose computer is programmable data processor model
- A program is a set of instructions written in a computer language

Same program, different data

- In programmable data processor model, the output data depend on the combination of two factors: the input data and the program.



Same data, different programs

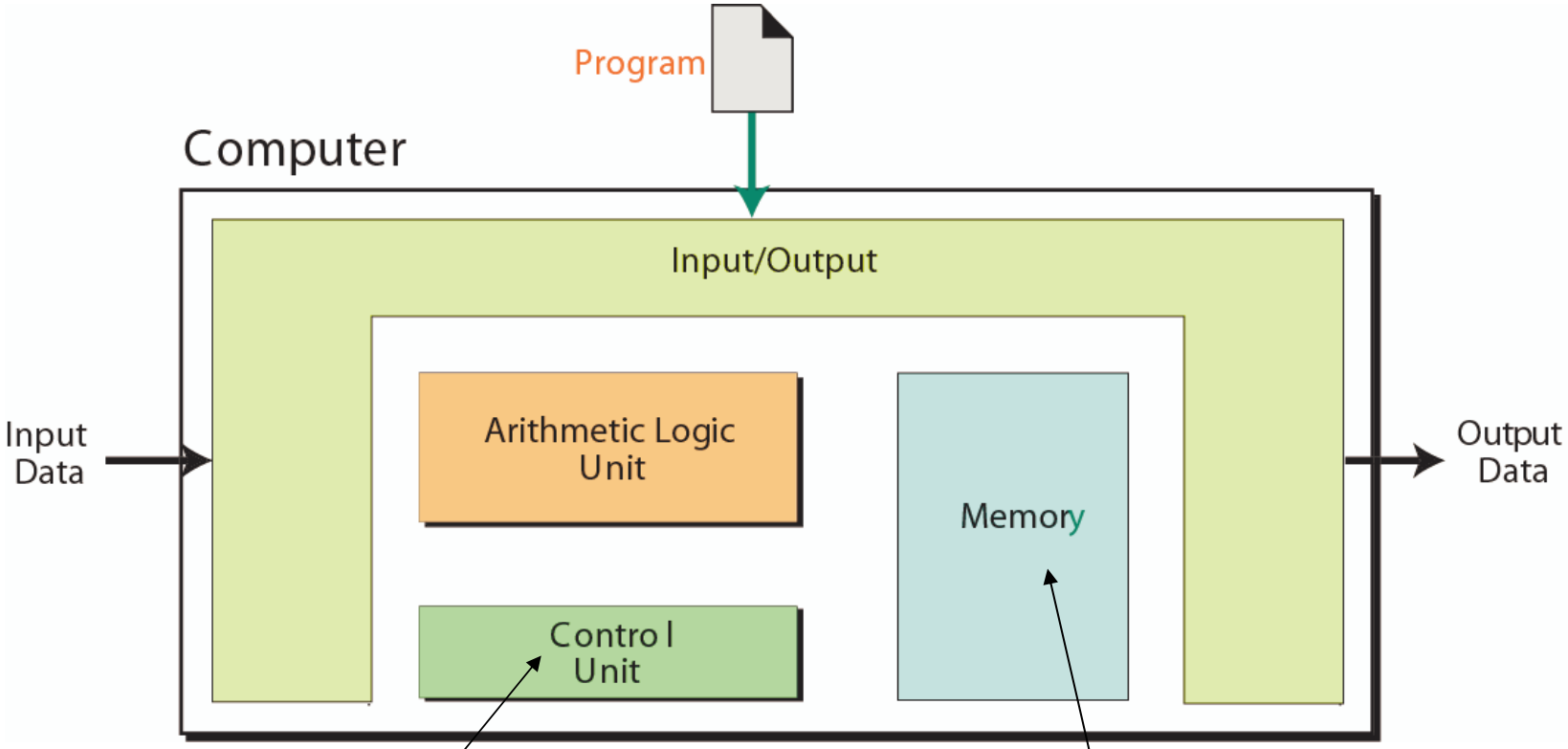


1.2

von NEUMANN MODEL

Von Neumann model

The model defines a computer as four subsystems: memory, arithmetic logic unit, control unit, and I/O



Sequential execution of instructions

The data and program are stored as binary patterns in memory

1.3 COMPUTER HARDWARE

- ALU
- CU
- Memory
- I/O

1.4

DATA

Storing data

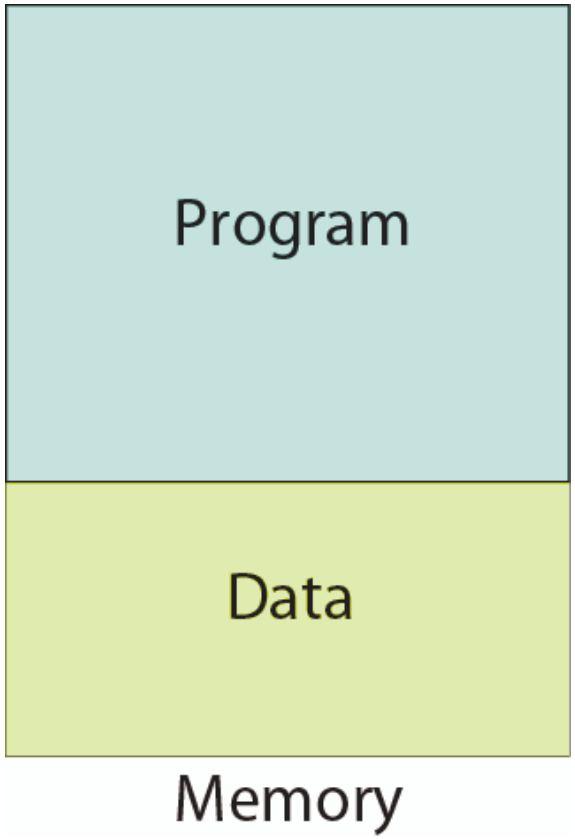
- Computer = electronic device $\Rightarrow$ to store data: electrical signal form (0: off, 1: on)
- Obviously, the data use in daily life are not just in one of two states, they need to be changed
  - Numbering system: 0 ~ 9
  - Other types of data (text, image, audio, video…)
- Data outside a computer can take many forms: data organization. It can be organized into small units, larger units, and so on.

1.5

COMPUTER SOFTWARE

Program and data in memory

- The main feature of the von Neumann model:
  - The programs are stored in computer memory
  - The program must be a sequence of instructions, each instruction operates on one or more data items



Program made of instructions

- One instruction can change the effect of a previous instruction

1. Input first data item into memory.
2. Input second data item into memory.
3. Add the two together and store the result in memory.
4. Output the result.

Program

- This program that inputs two numbers, adds them, and prints the result
- Algorithms: step-by-step solution to a problem
- Languages: using symbols to represent binary patterns
- Software engineering: design and writing of programs in a structured form
- Operating systems: originally worked as a manager to facilitate access of the computer components for a program. Today, it do much more.

1.6

HISTORY