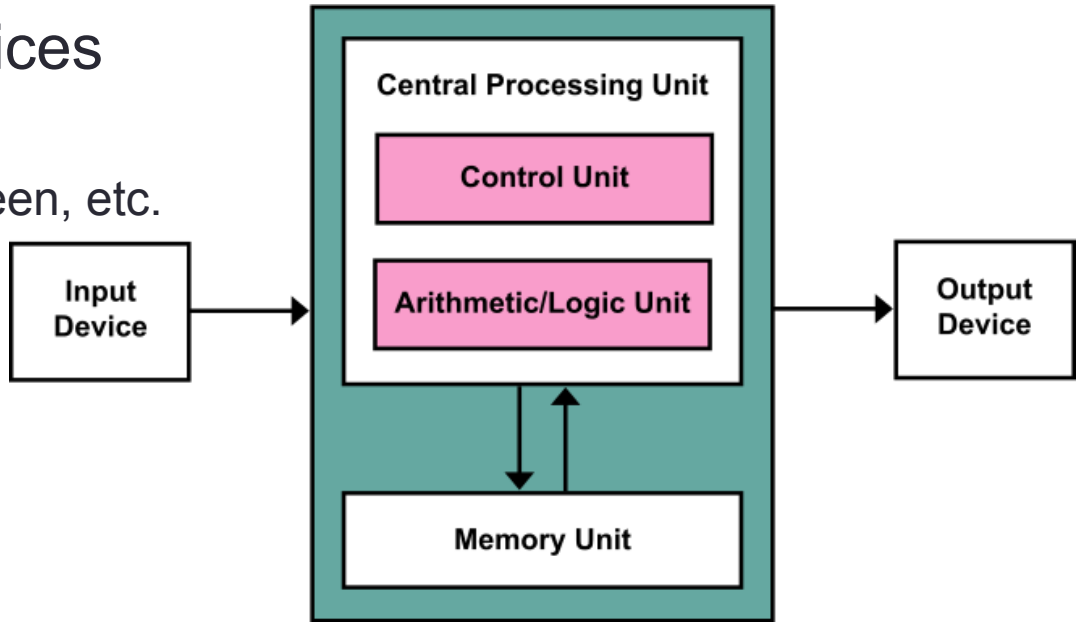
INTRODUCTION TO COMPUTER SCIENCE

Computer model: Von Neumann Model

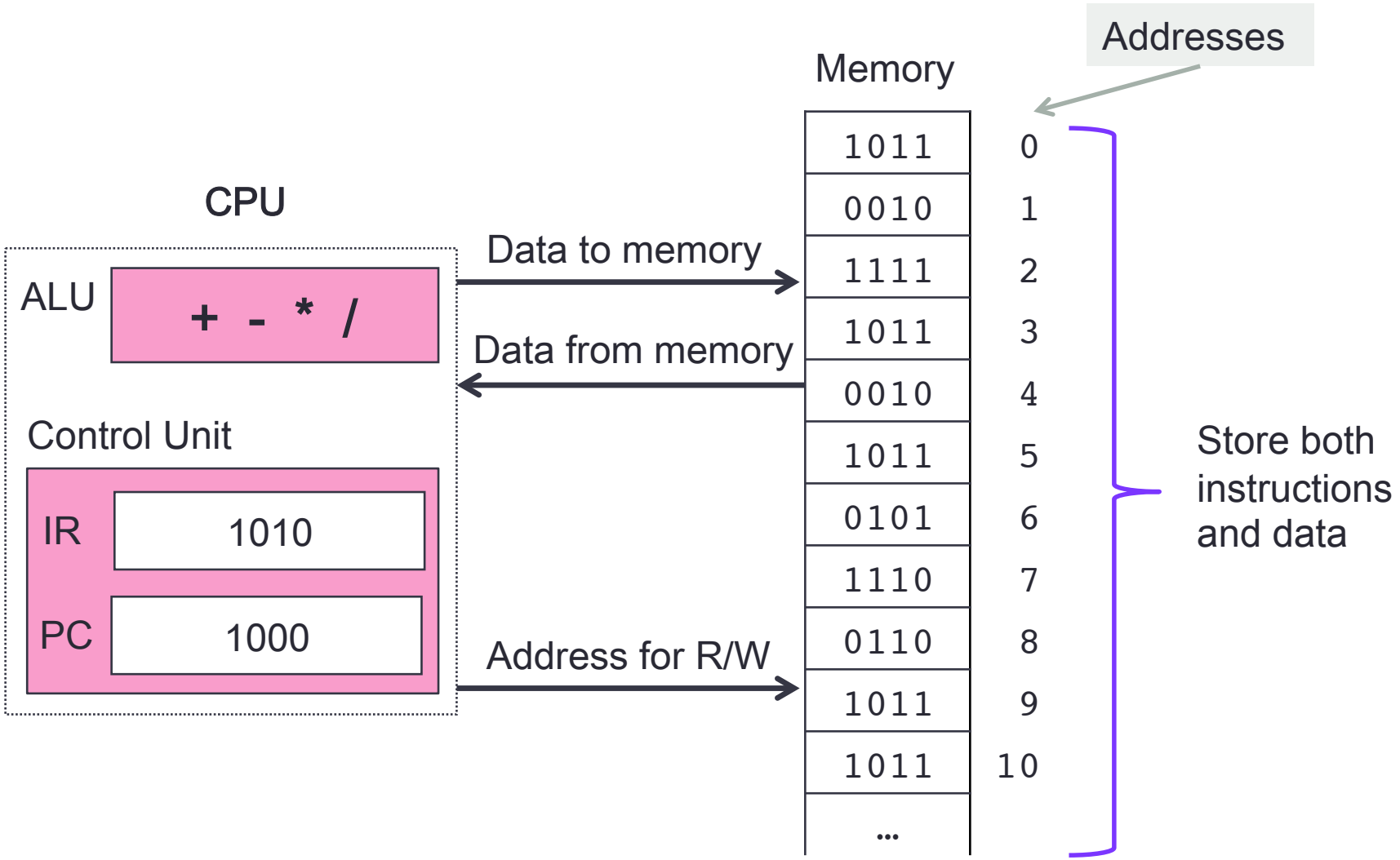
How programs and data are stored: Binary System

Von Neumann Model

- Basic model of a computer architecture
- Processing Unit
  - ALU and processor registers
  - Control Unit: Program Counter and Instruction Register
  - Memory: holds data and instructions
- Input and output devices
  - Human Interface
    - Mouse, keyboard, screen, etc.
  - Storage
  - Networking
  - Graphics

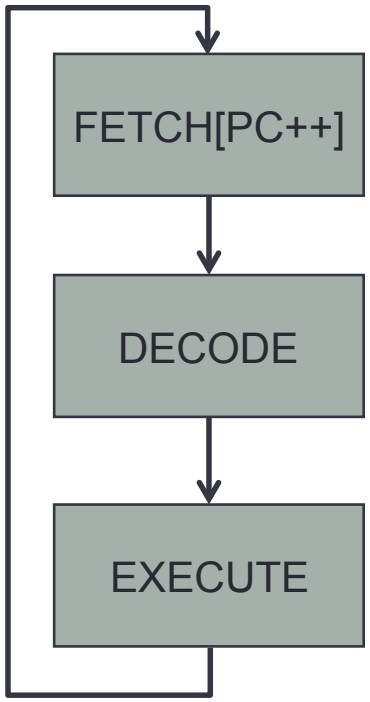


Von Neumann Model: closer look



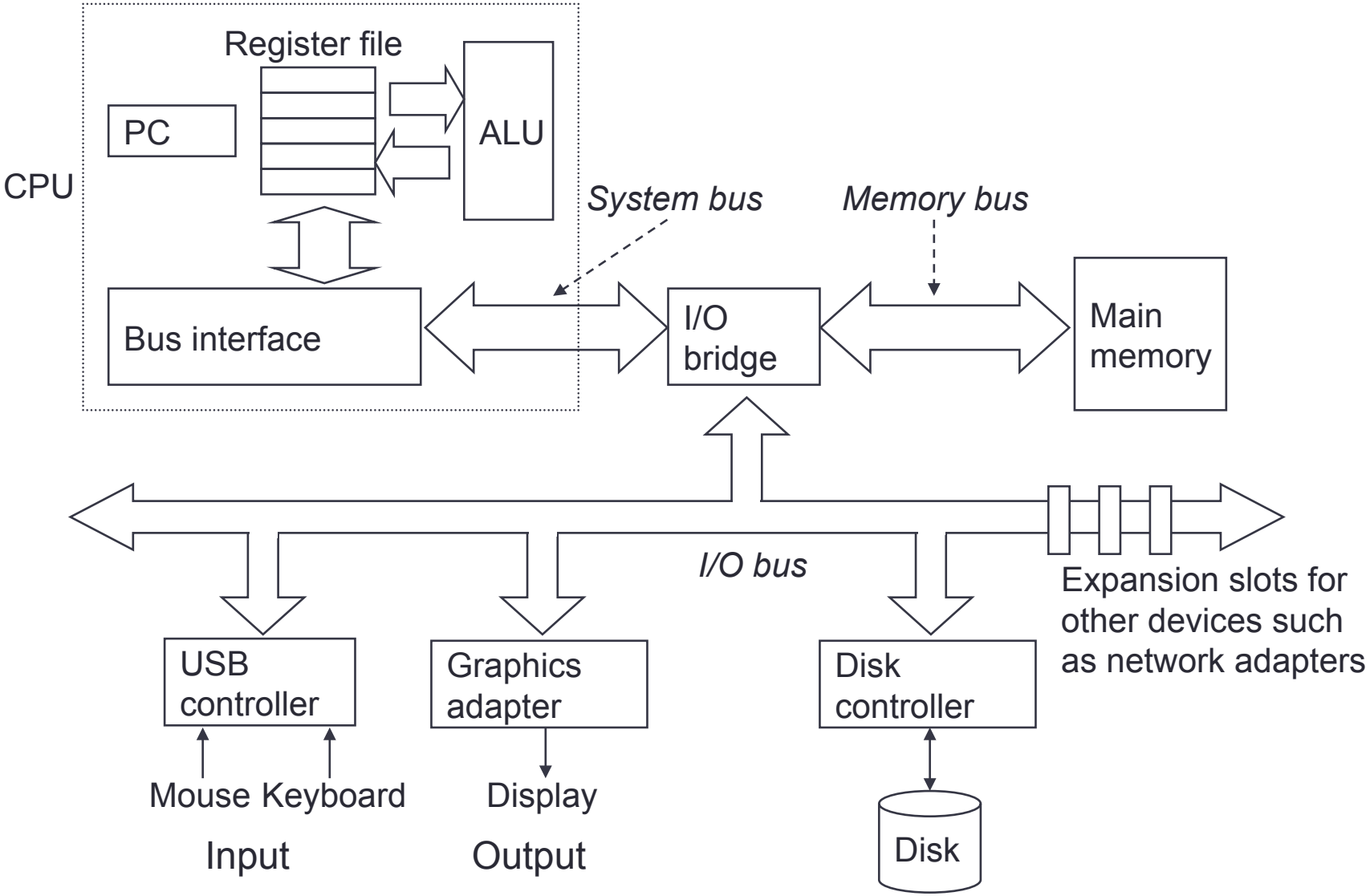
CPU Fetch-and-Execute Cycle

- Programs
  - Written in a high level language
  - Translated into machine language that can be executed by the CPU
- CPU executing a program
  - Program is in main memory



Arithmetic: +, -, *, /
Logic: bre, jmp

Von Neumann Model: in practice



How data is stored?

- Computers use the binary system to represent data.
- All data from numbers, alphabet to images are represented using the binary system
  - Register file
  - Disk
  - Memory
  - Network

Binary Numbers

- Base 2
  - Symbols = {0,1} often called {false, true} or {off, on}
- Numbers are written as $d_n...d_2d_1d_0$
- The decimal value of a binary number is $\sum_{i=0}^{n} d_i \times 2^i$
  - 101

1	0	1
2^2	2^1	2^0

→ $2^2 + 2^0 = 5$

  - 1101

1	1	0	1
2^3	2^2	2^1	2^0

→ $2^3 + 2^2 + 2^0 = 13$

- Binary representation is used in computers
- Bit and byte