

Introduction to Computer Science & Engineering

Lecture 5: Computing Components and
von Neumann Machine

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Size in Perspective

1/2 지

7/2 지

Power of 10	Power of 2	Value of Power of 2	Prefix	Abbreviation	Derivation
10^{-12}			pico	p	Italian for <i>little</i>
10^{-9}			nano	n	Greek for <i>dwarf</i>
10^{-6}			micro	μ	Greek for <i>small</i>
10^{-3}			milli	m	Latin for <i>thousandth</i>
10^3	2^{10}	1024	kilo	K	Greek for <i>thousand</i>
10^6	2^{20}	1,048,576	mega	M	Greek for <i>large</i>
10^9	2^{30}	1,073,741,824	giga	G	Greek for <i>giant</i>
10^{12}	2^{40}	not enough room	tera	T	Greek for <i>monster</i>
10^{15}	2^{50}	not enough room	peta	P	Greek prefix for <i>five</i>

Von Neumann Architecture

폰 노이만

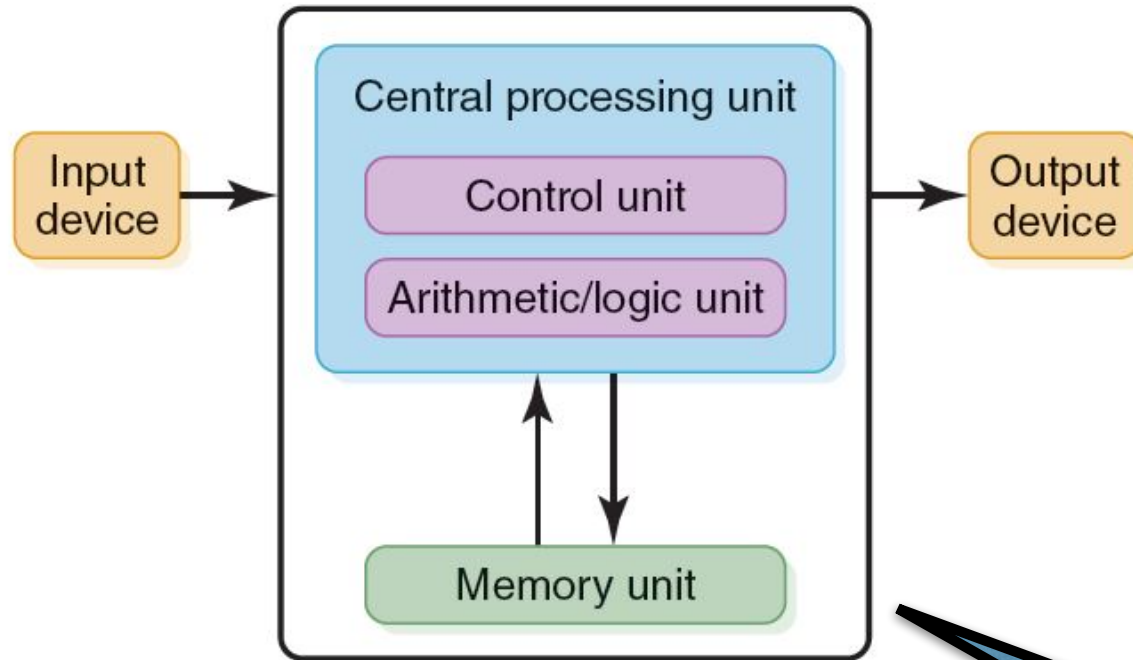


FIGURE 5.1 The von Neumann architecture.

Instructions and data
both stored in memory unit

Memory

- A collection of cells, each with a unique physical address
- Most computers are byte-addressable
- Cell at address 11111110 contains 10101010

Address	Contents
00000000	11100011
00000001	10101001
⋮	⋮
11111100	00000000
11111101	11111111
11111110	10101010
11111111	00110011

Should be careful!: Could be address or contents

Arithmetic/Logic Unit

- Performs basic arithmetic operations such as addition and subtraction
- Performs logical operations such as AND, OR, and NOT
- Most modern ALUs have a small amount of special storage units called **registers** that can be accessed faster than main memory

Input/Output Units

- Input
 - Keyboard, mouse, etc..
- Output
 - Monitor, etc..

Control Unit

- Control unit
 - ▶ The organizing force in the computer
- Instruction register (IR)
 - ▶ Contains the instruction that is being executed
- Program counter (PC)
 - ▶ Contains the address of the next instruction to be executed
- Central Processing Unit (CPU)
 - ▶ ALU and the control unit called the Central Processing Unit, or CPU

Information Flow

- Bus
 - ▶ A communication system that transfers data between components inside a computer or between computers; the medium (wires, optical fiber, etc.) and the protocols (rules for sharing the medium nicely)
 - ▶ “The” bus: Connects the CPU, main memory, I/O devices, and possibly other components (e.g. hard disk drive)

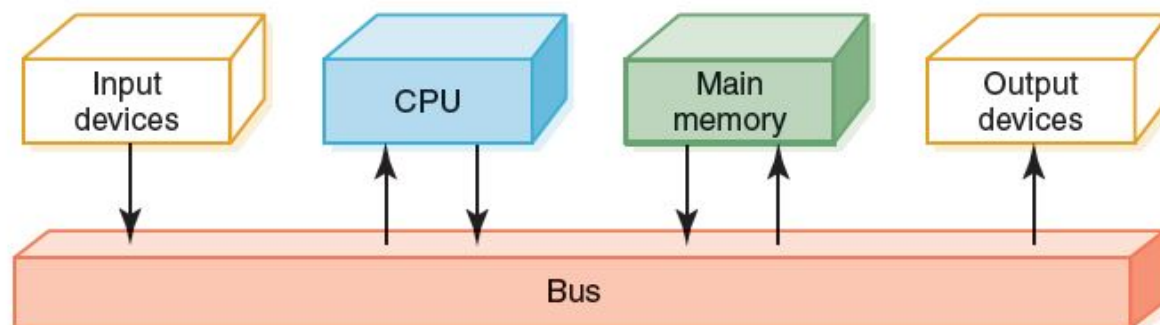


FIGURE 5.2 Data flow through a von Neumann machine

MATLAB

- Install MATLAB
- And get used to it!