Computer Fundamentals

Lecture 3

Computer Components
(System Unit, CPU)

The Components of a Computer

A computer contains many electric, electronic, and mechanical components known as hardware

Hardware contains the following units :

1. Input Unit

2. Processing Unit (CPU)

3. Storage Unit

4. Output Unit

5. Power Unit

The Components of a Computer

☐ This Figure shows how Computer Components are connected to each other to carry out a task.
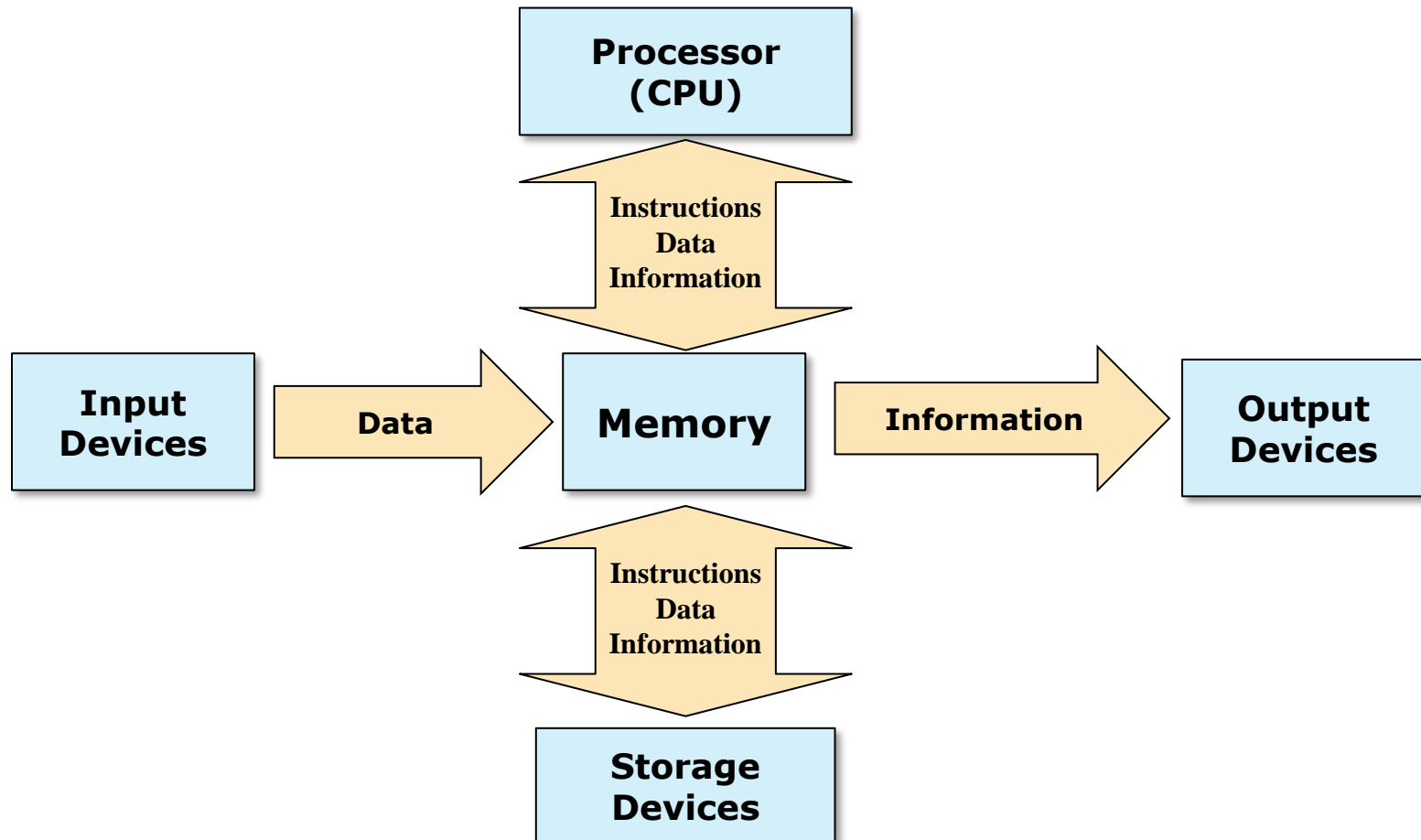
The working of a computer

- The working of a computer can be broadly categorized into following four functions or steps.

  (i) **Receive input** – Accept data/information from user through various input devices like the keyboard, mouse, scanner, etc.

  (ii) **Process information** –Perform arithmetic or logical operations on data/information.

  (iii) **Store information** —Store the information in storage devices like hard disk,CD, pen drive etc.

  (iv) **Produce output** –Communicate information to the user through any of the available output devices like monitor, printer, etc.

Basic Computer Components

System Unit

Monitor

Printer

Speakers

Mouse

Keyboard

System Unit

- The system unit is the main <u>case</u> of a computer or mobile device.

- It contains most of the **electronic components** of the computer.

  - The most important of these components are the Microprocessor, RAM, Motherboard, Storage Devices, Power Supply … etc.

- Types of casing:

  - **Tower Case**

  - **Horizontal Case**

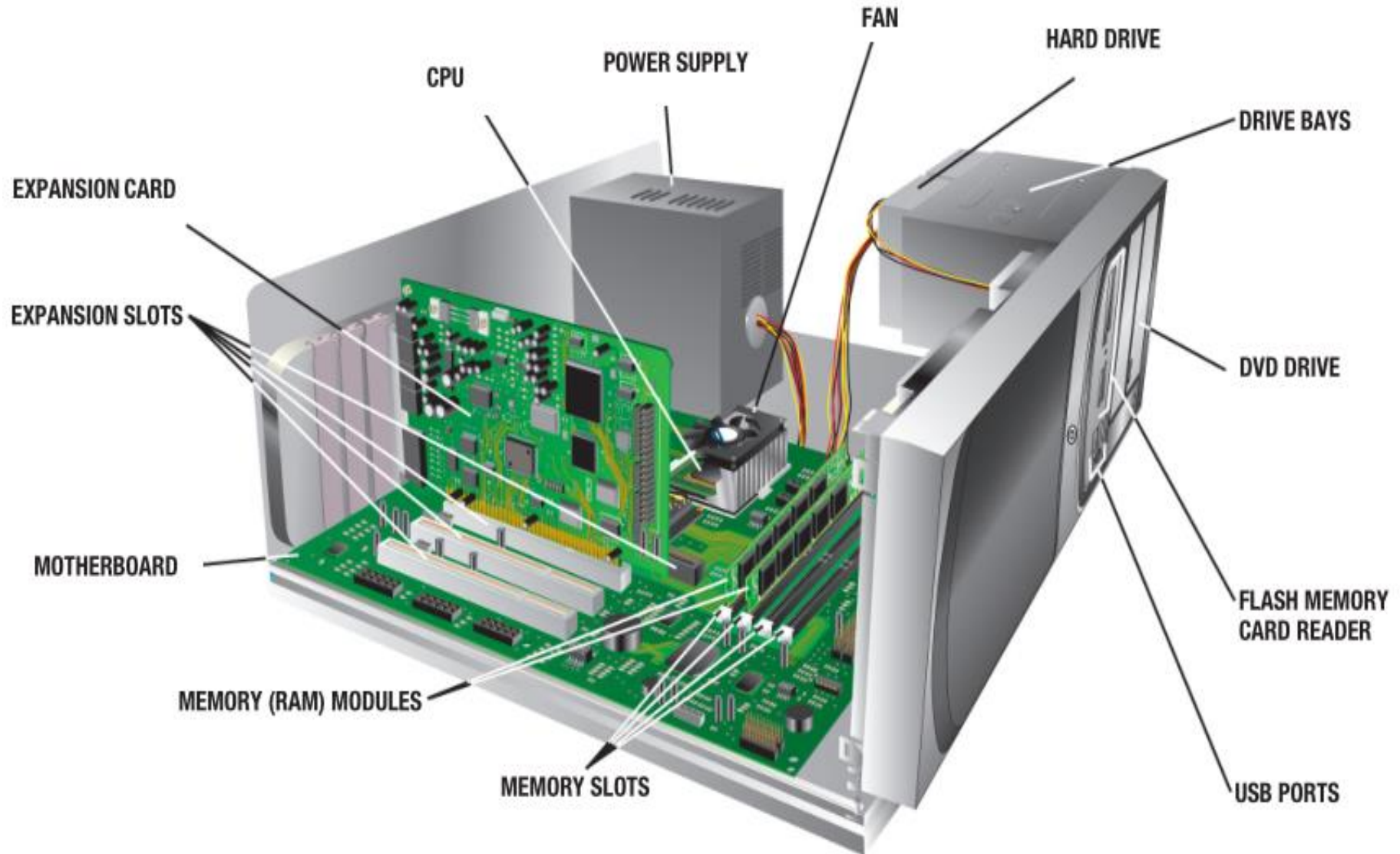 - **All-in-one Case**

Tower Case   **Horizontal Case**   **All-in-one Case**

System Units

System Unit

FAN

POWER SUPPLY

CPU

HARD DRIVE

DRIVE BAYS

EXPANSION CARD

EXPANSION SLOTS

DVD DRIVE

MOTHERBOARD

FLASH MEMORY CARD READER

MEMORY (RAM) MODULES

MEMORY SLOTS

USB PORTS

Inside the System Unit

☐ The most important component inside the system unit:

  ☐ **The Motherboard**

  ☐ **Processor (CPU)**

  ☐ **Memory (RAM, ROM)**

☐ Other Components

  ☐ **Storage Devices**

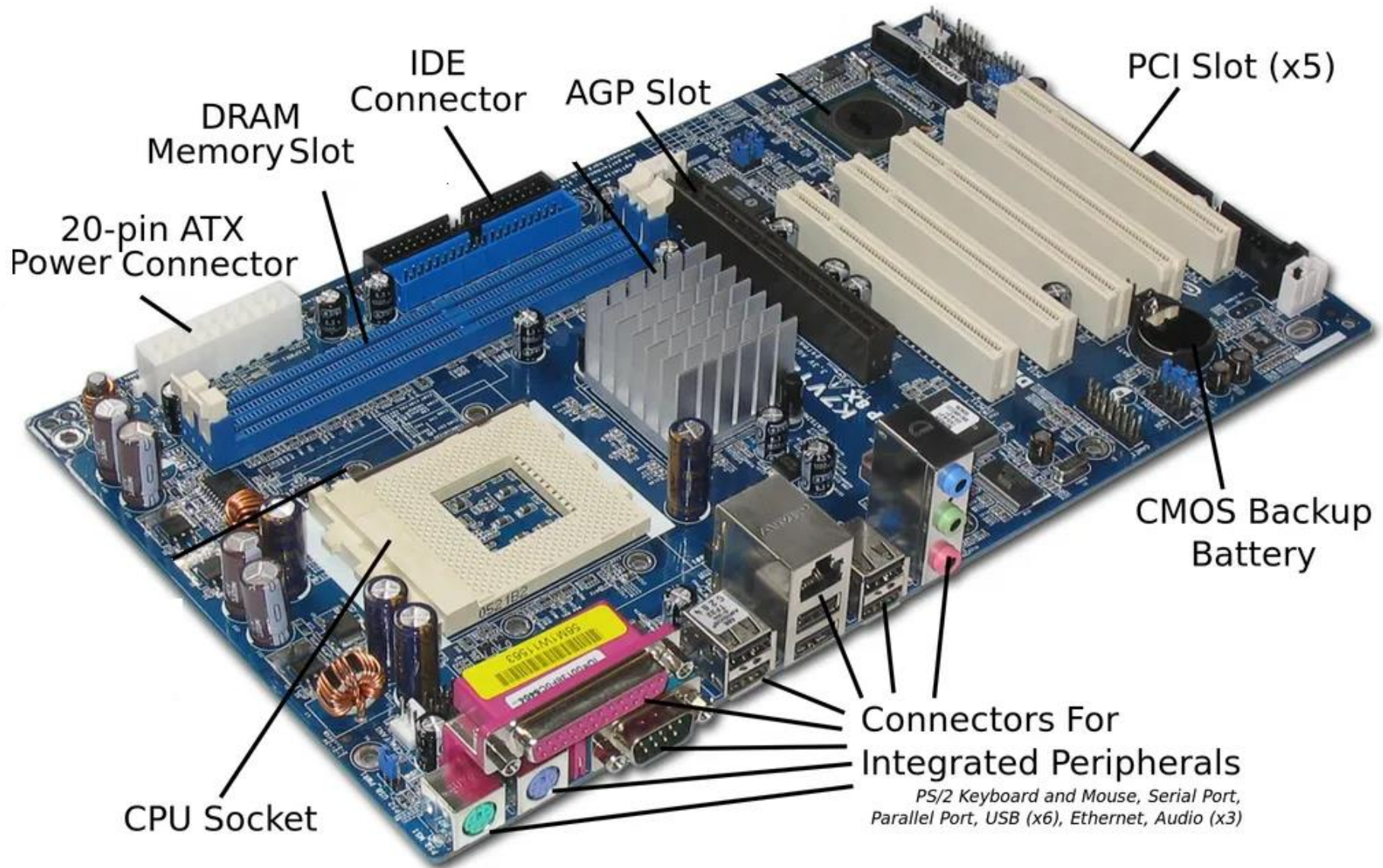 ☐ **Buses**

  ☐ **Ports**

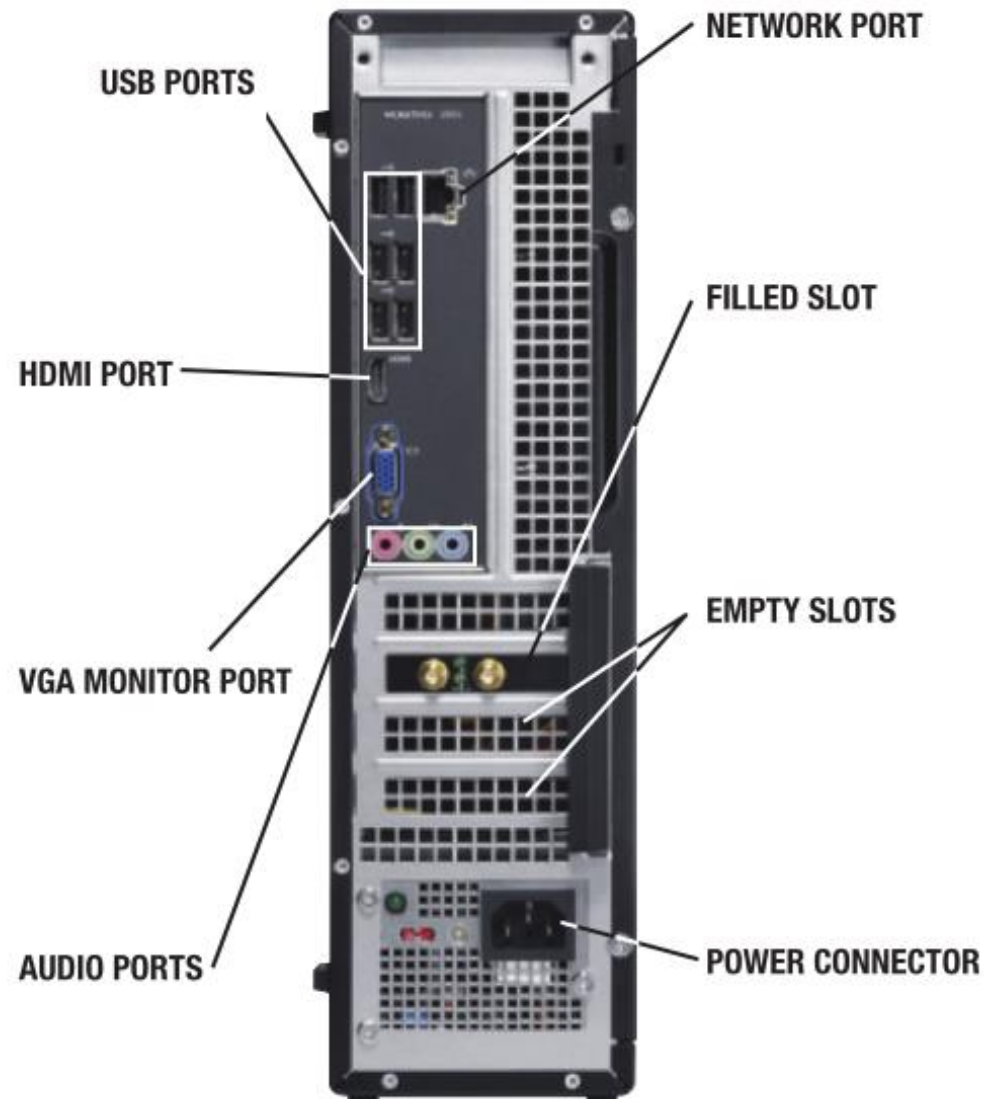 ☐ **Power Supply**

  ☐ **… etc**

Motherboard

Motherboard

- The **motherboard**, sometimes called a **system board.**

- The motherboard is a thin **printed circuit board** (PCB) which links all different components inside your computer.

- It connects the CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables.

- Popular Manufacturers of Motherboard
   - Intel
    - ASUS
    - Gigabyte
    - MSI

Motherboard

IDE Connector

DRAM Memory Slot

AGP Slot

PCI Slot (x5)

20-pin ATX Power Connector

CMOS Backup Battery

Connectors For Integrated Peripherals
PS/2 Keyboard and Mouse, Serial Port, Parallel Port, USB (x6), Ethernet, Audio (x3)

CPU Socket

Motherboard

Ports are used to connect external devices to the motherboard

Processors

☐ **Processor** or **Central Processing Unit (CPU)** or **Microprocessor.**

☐ CPU performs all types of data processing operations.

    ☐ It is known as the 'Brain of the Computer'

☐ It controls the operation of all parts of the computer.
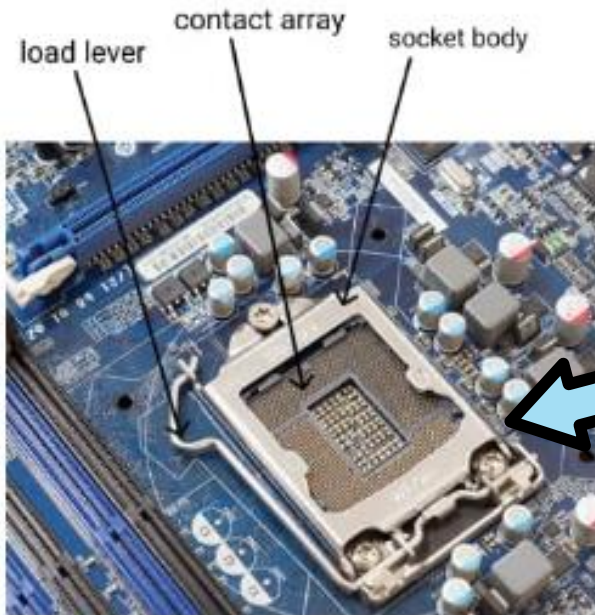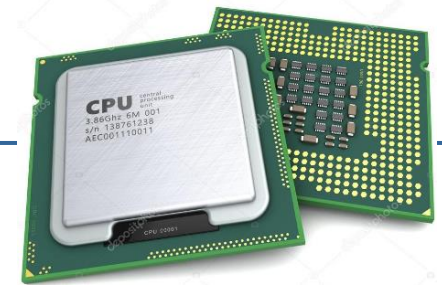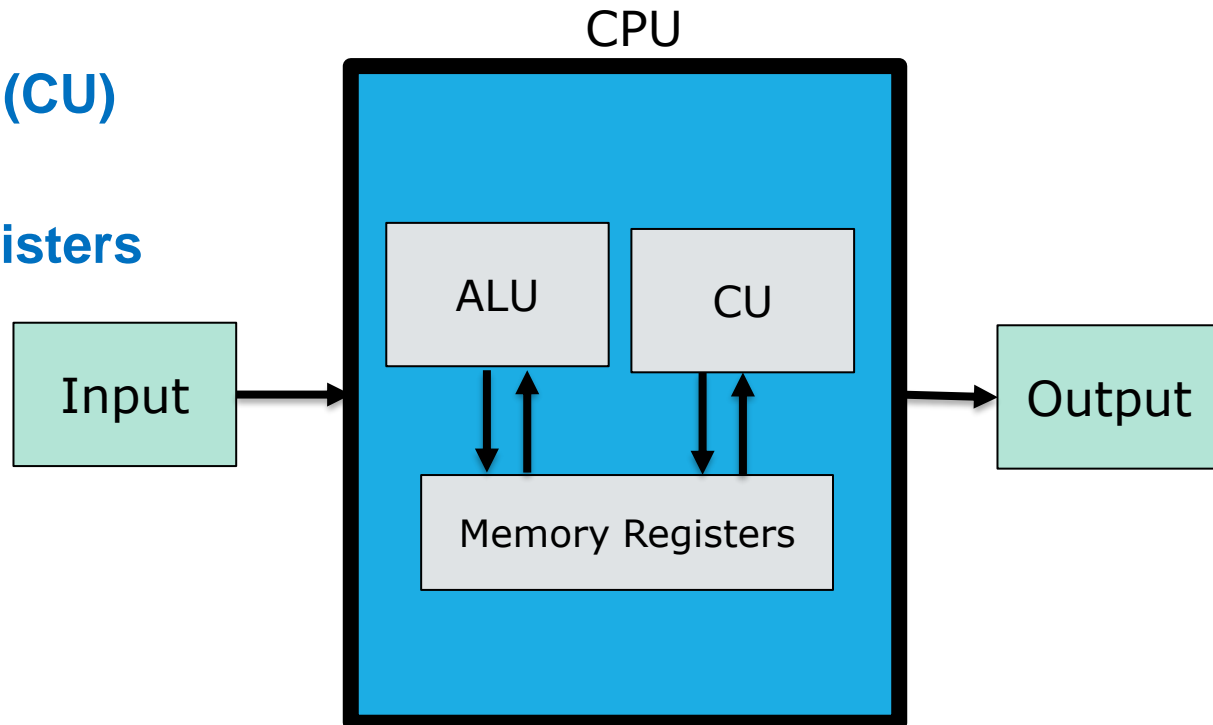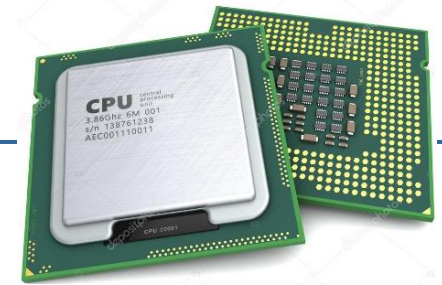

CPU Socket

CPU Chip

Processors

- A typical CPU has the following components:

  1) **Arithmetic Logic Unit (ALU)**

  2) **Control Unit (CU)**

  3) **Memory Registers**

CPU

|	CPU	
ALU		CU

Input → Memory Registers → Output

Processors

1) Arithmetic Logic Unit (ALU)

- Arithmetic Logic Unit or ALU performs two types of operations:

  - **Arithmetic Operation**: such as addition, subtraction, multiplication, and division. **(+, -, x, ÷)**

  - **Logical Operation**: consist of Boolean comparisons such as AND, OR and NOT.

2) Control Unit (CU)

- CU tells when to fetch the data and instructions, what to do, where to store the results, the sequencing of events during processing etc.

- It acts as a supervisor and, controls and coordinates the activity of the other units of computer.
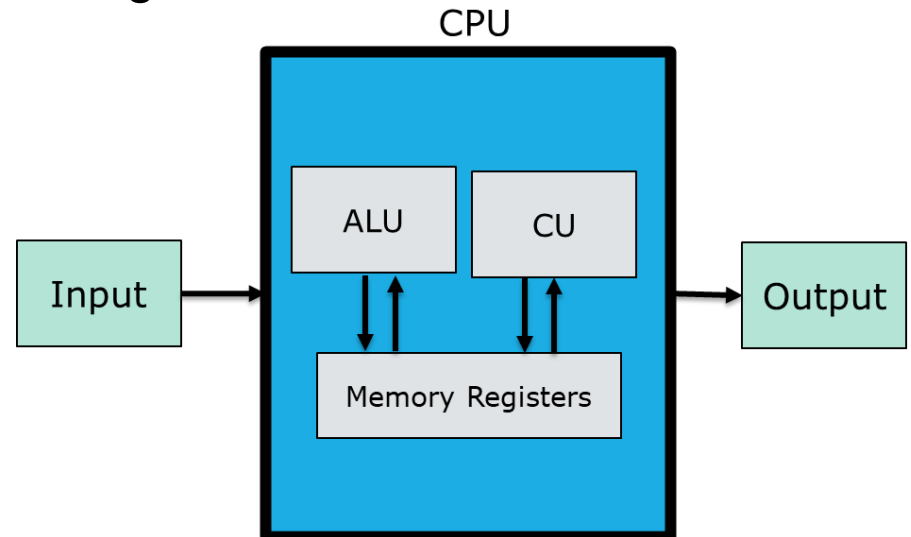
Processors
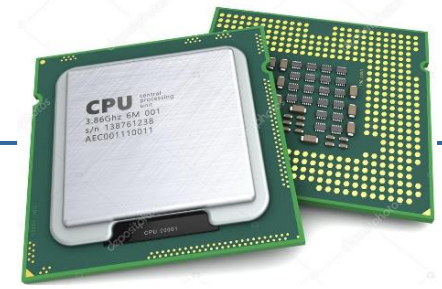
3) Memory Registers

- The CPU contains internal memory units, which are called registers.

- Register memory is the smallest and fastest memory in a computer.

- Registers holding data, instruction and address that are needed by program while running.
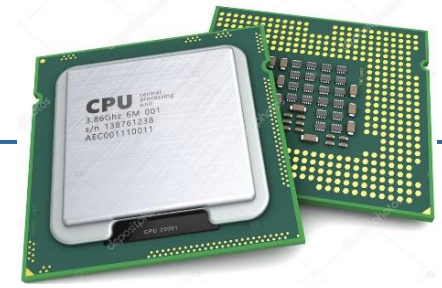
- Why Registers?

CPU

| Input | ALU | CU | Output |

Memory Registers

Processors

- A CPU doesn't offer instructions; the software does.

- Thus, a computer's software and CPU working together in harmony are the brains of the operation.

CPU Clock

What is CPU Clock Speed?

3.70GHz ??

CPU Clock

- A CPU's clock speed represents how many **cycles** per second it can execute. Clock speed is also referred to as clock rate.

- This speed is measured in **Hertz**, a unit of frequency. One hertz means that one cycle per second.

$$\text{Hertz = one cycle per second}$$

- **1 Hertz** = 1 clock cycles per second (frequency)
- **1 MHz** = 1,000,000Hz = 1,000,000 clock cycles per second
- **1 GHz** = 1,000,000,000Hz = 1 billion cycles per second

- A CPU with a clock speed of 3.2 GHz executes 3.2 billion cycles per second.

- Note: Today, modern computer processors' clock speed is a few gigahertz

CPU Clock and Computer's Performance

- The speed of the system clock is just one factor that influences a computer's **performance**.

- **Other factors, such as:**

    - The type of processor chip

    - Amount of cache

    - Memory access time

    - Bus width

    - Bus clock speed

    - Other

    They will be discussed later …

CPU manufacturers

- The two major CPU manufacturers today are:
  - **Intel**
  - **AMD** (Advanced Micro Devices)

- Others??????????

CPU manufacturers - Intel

- **Intel**
  - It has divided its CPUs in about **75 families**. Some of the famous Intel CPU families are
    - **Celeron**
    - **Pentium**
    - **Core i3**
    - **Core i5**
    - **Core i7**
    - **Core i9**
- **AMD**
  - Under AMD, you have 58 types of CPU.
  - Some of the popular ones are:
    - **Ryzen**
    - **Athlon**
    - **Opteron**

Multi-Core CPUs

- Most processor chip manufacturers now offer multi-core processors.

- A multi-core processor is a chip with two or more separate processors.

- **Types of Processors (based on cores)**
  - Single Core Processor
  - Dual Core = **2** Cores
  - Quad Core = **4** Cores
  - Hexa Core = **6** Cores
  - Octa Core = **8** Cores

- As of 2019, the majority of consumer CPUs feature between 2 and 20 cores.

- Server CPUs may feature as many as **48** cores.

AMD vs Intel CPUs - Example

| CPU	Price	Cores / Threads	Clock (GHz)	Cache Memory (L2+L3)	Memory
Ryzen 9 7950X	$782	16 Cores 32 Threads	5.7 GHz	80 MB	DDR5-5200
Core i9-10980XE	$999	18 Cores 36 Threads	3.0 GHz	24.75 MB	Quad DDR4-2933

Cash Memory

☐ Cache memory, lies in between CPU and the Main memory (RAM).

☐ It is also called CPU memory, that a computer microprocessor can access more quickly than it can access regular RAM.

☐ The basic purpose of cache memory is to store program instructions that are frequently re-referenced by software during operation. Fast access to these instructions increases the overall speed of the software program. The main function of cache memory is to speed up the working mechanism of computer.
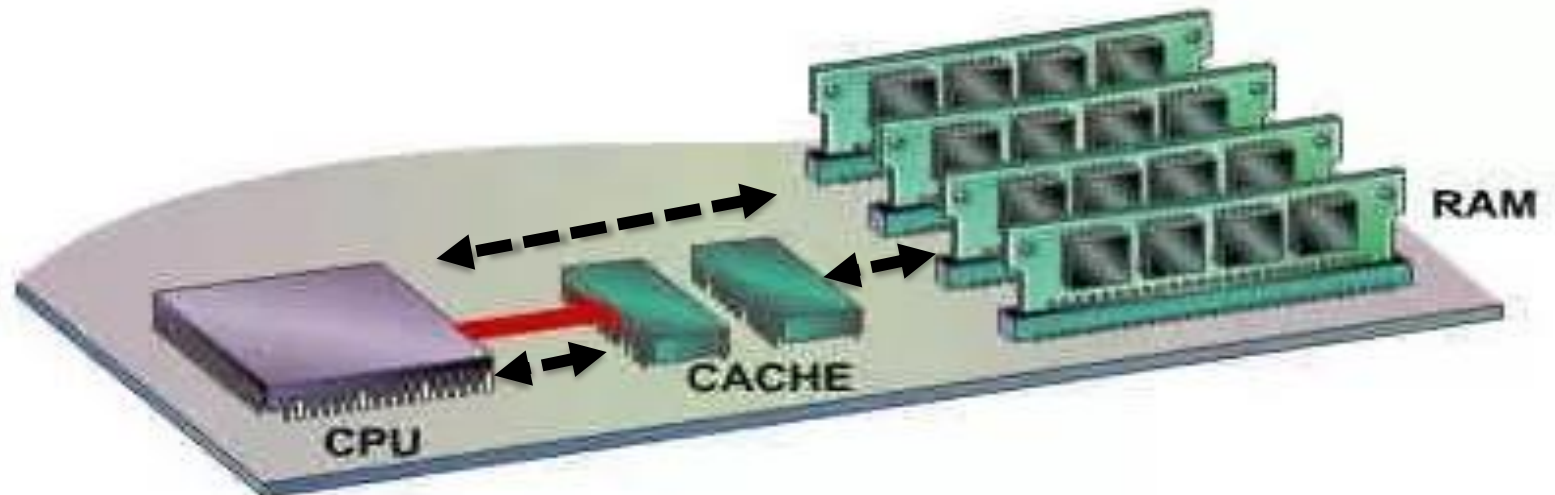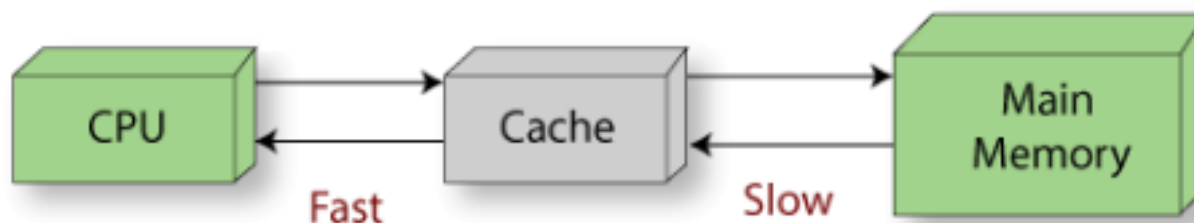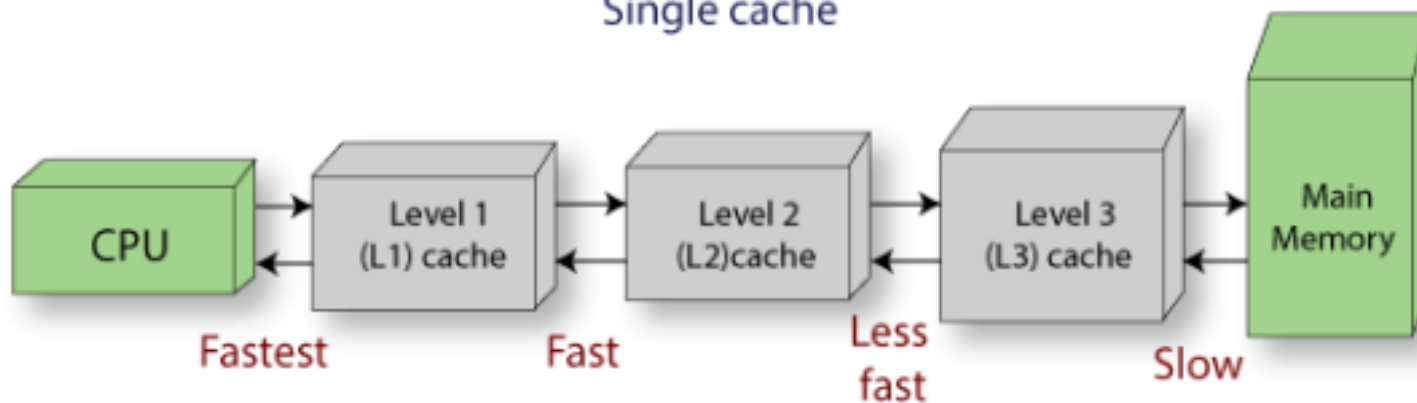
Cache Memory

☐ The CPU control unit automatically checks cache for instructions before requesting data from RAM. This saves fetching the instructions and data repeatedly from RAM
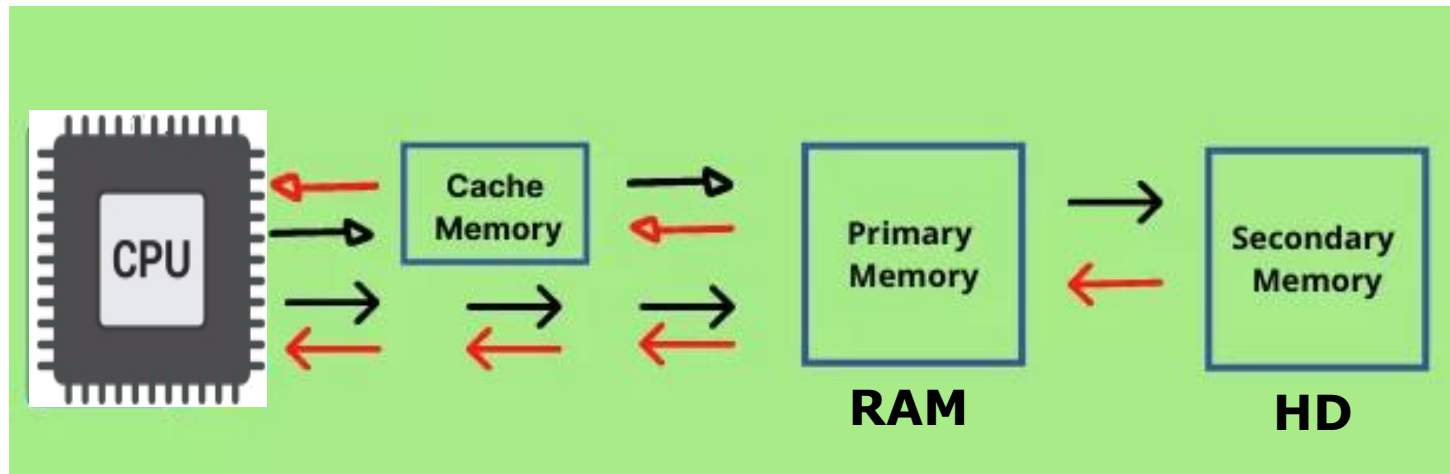
Cache Levels

Single cache

Three-level cache organization

Storage Capacity

- Computers developed using numbering system of 1s and 0s or *binary system.*

- For computer to store information, must have memory chips installed.

- Memory measured in *bits* and *bytes.*

  - **Bit** is smallest unit of data used by computers (0 or 1).

  - Group of eight bits make one byte

  - Example: 11011101 = 1 byte

1 Kilobyte	= 1,024 Bytes ≈	1 Thousand Bytes
1 Megabyte	= 1,048,576 Bytes ≈	1 Million Bytes
1 Gigabyte	= 1,073,741,824 Bytes ≈	1 Billion Bytes
1 Terabyte	= 1,099,511,627,776 Bytes ≈	1 Trillion Bytes
1 Petabyte (PB)	= 1,125,899,906,842,624 Bytes	

- All data made up of bytes in combinations calculated by computer.

  - Every file used in software program has specific file size.

  - Data file size increases or decreases based on contents stored.

Data Storage Units Chart

Unit	Shortened	Capacity
Bit	b	1 or 0
Byte	B	8 bits
Kilobyte	KB	1024 Bytes
Megabyte	MB	1024 Kilobytes
Gigabyte	GB	1024 Megabytes
Terabyte	TB	1024 Gigabytes
Petabyte	PB	1024 Terabytes

For Practical

☐ How to Check Number of Cores and Threads in your Processor?

☐ How to check the CPU speed? Brand?

Review Questions

- ☐ Define the term, motherboard.

- ☐ What are the main components of the motherboard?

- ☐ What is main components of CPU?

- ☐ What is the purpose of register memory?

Review Questions

☐ The _____ is the main circuit board of the computer.

    a. ALU

    b. CPU

    c. motherboard

    d. system chassis

☐ A _____ is a single chip with two or more separate processor cores.

    a. transistor

    b. multi-core processor

    c. resistor

    d. capacitor

☐ _____ include basic calculations such as addition, subtraction, multiplication, and division.

    a. Arithmetic operations   c. Machine cycles

    b. Comparison operations   d. Transistors