# Topic 1
Introduction to Computers and Computing

Introduction

- In today's world, the use of computers has increased so rapidly that we can no longer ignore them.

- They are used to perform several functions that made our life easier.

What is computer science?

- It is the science that deals with methods for the automatic processing of information in solving problems using digital computers.

INPUT DATA → **Processing** → **RESULTS**
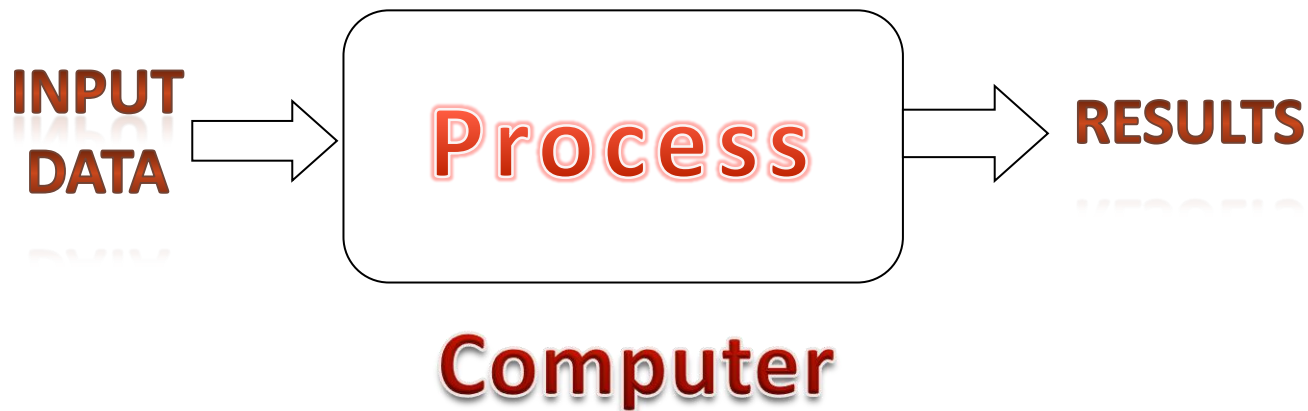
Computer

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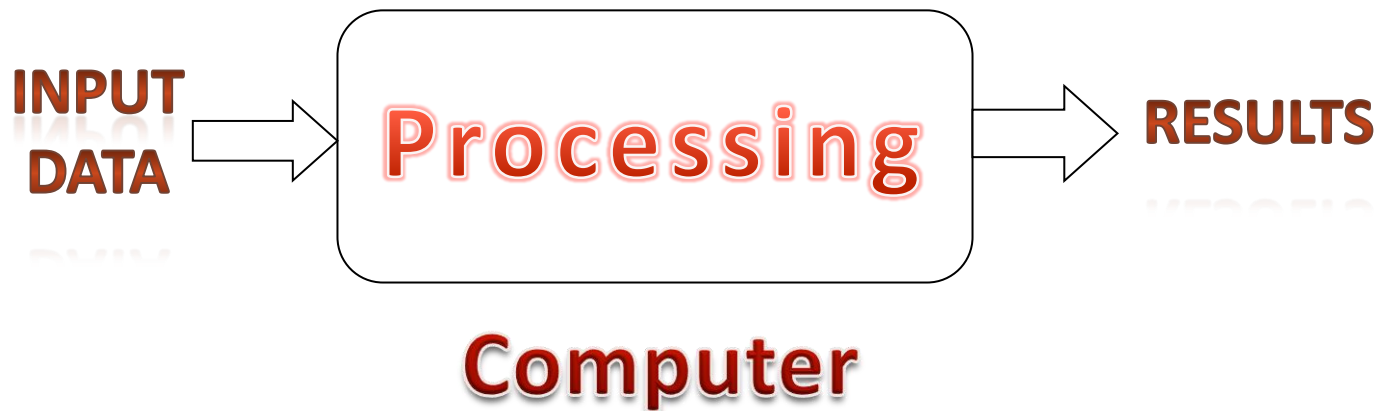
Computer

Information

- When information is entered into and stored in a computer, it is referred to as input data. The result of processing is the output data.

- Information is any acquired knowledge that can be represented inside a digital computer in binary form (numbers, text documents, images, voice and video).
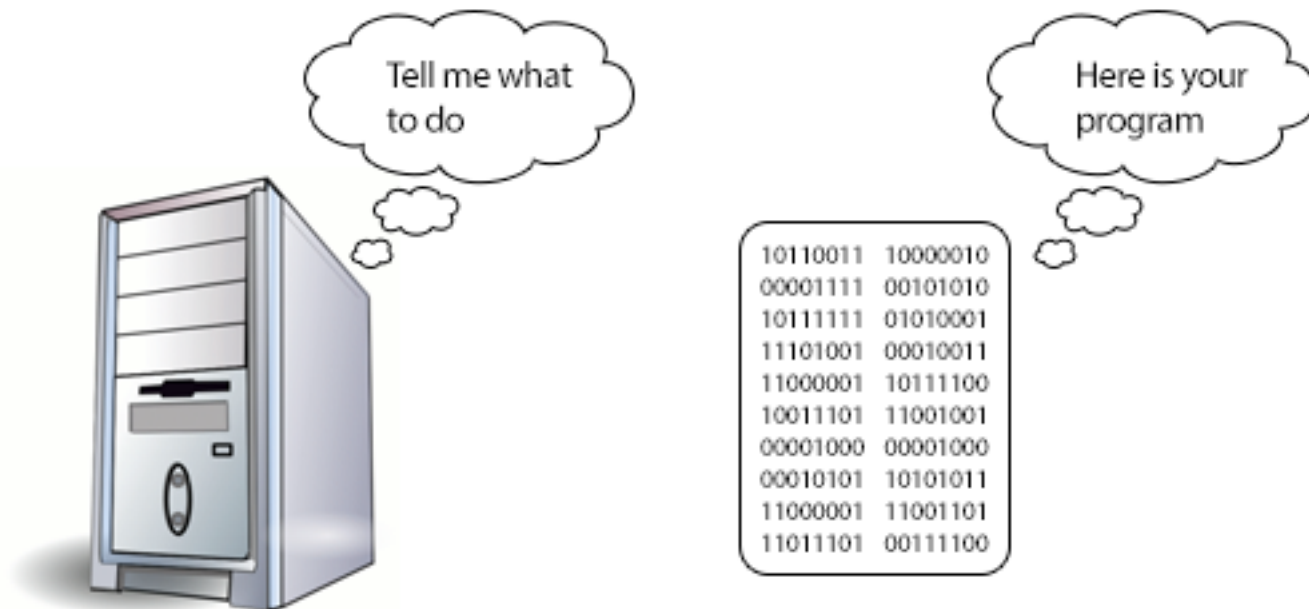
Automatic

- Automatic means with no human intervention

Processing

- Manipulation of data by a computer via a set of instructions which is called a **program**.

Example of a Computer program

Program *Add two numbers*

Begin

Read the 1st number

Read the 2nd number

Calculate the sum of the two numbers

Write the sum

End

What is a Computer?

- It is an electronic device that manipulates information or data and performs computation. It has the ability to store, retrieve, and process data.

- It is a **programmable** machine.

Examples and types of computers

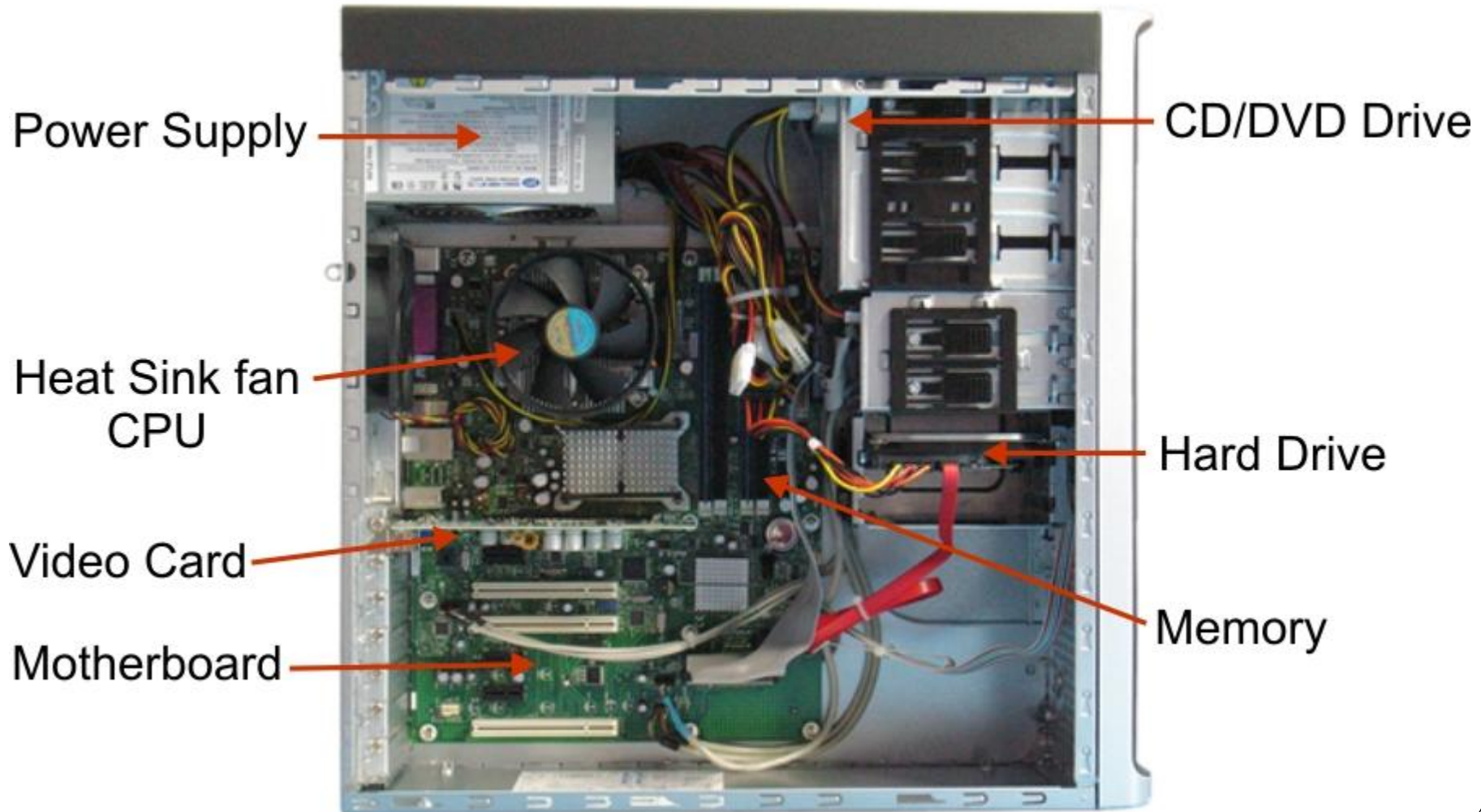Desktop computer   Laptop   Netbook   Hybrid   Tablet   Smartphone

Computer overview

Computer

Flat-panel Display (Output Device)

Desktop Computer (System Unit)

Speaker (Output Device)

Keyboard (Input Device)

Mouse (Input Device)

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Inside the system unit

Power Supply

Heat Sink fan
CPU

Video Card

Motherboard

CD/DVD Drive

Hard Drive

Memory

History of the computer

- Origin of "computer" term: The term computer is derived from the word compute which means **calculate**.

- The origin of the word compute is from the Latin "**calculi**" that means pebbles.

- The **abacus** is the first tool used for calculation. Appeared in *Mesopotamia* on the fifth century Before Christ.
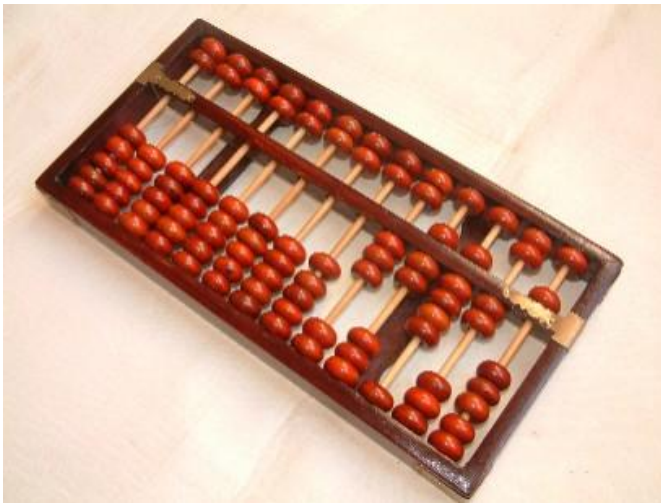
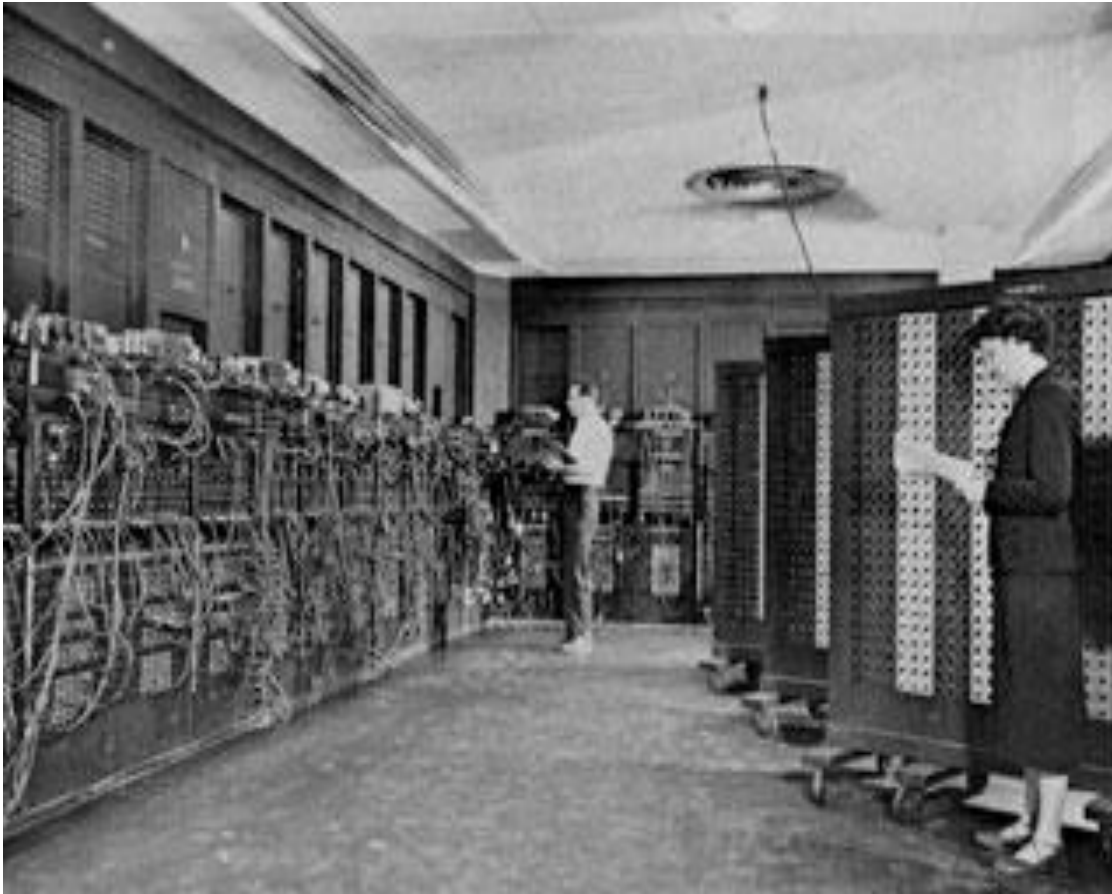**500 B. C. (Abacus)**

History of the computer

1642 (Pascaline Calculator)

1833 (Babbage Machine)

History of the computer

1946 : ENIAC (Electronic Numerical Integrator And Computer), the first electronic computer developed at the University of Pennsylvania.

Vacuum tubes

History of the computer

1953（IBM 701)
first commercial
scientific computer

Transistor

History of the computer

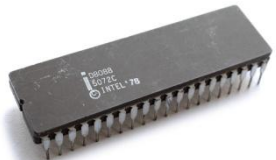1960 (IBM 7000)

1964 (IBM 360)

Transistor

History of the computer

1971 (Kenback 1)

1976 (Apple I)

1981 (IBM first PC with Intel µprocessor 8088)

Intel 8088 µprocessor

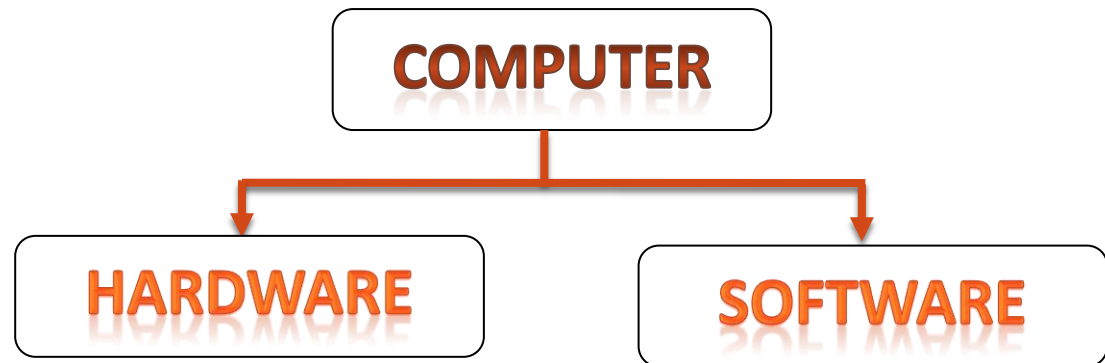**Integrated Circuits**

History of the computer

Today's Computers

What are components of a computer?

- The computer mainly consists of **hardware** and **software**.

- Both of these components work **together** to process data.

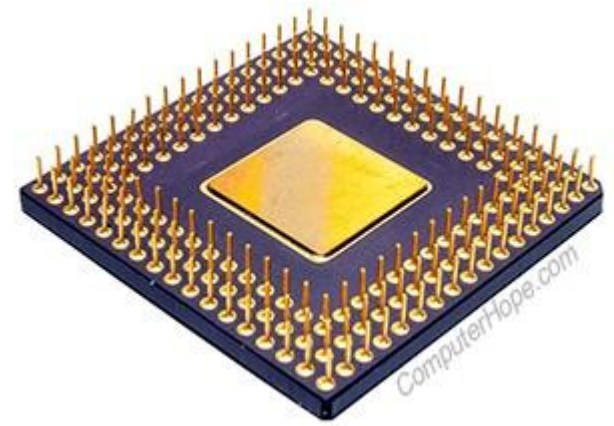**Hardware**: the physical parts of the machine that you can touch.
Software: programs that make the hardware functions.

COMPUTER

HARDWARE   SOFTWARE

Computer System Hardware

- The three major hardware components of a computer are:

    1. CPU (Central Processing Unit):

    2. Memory

        ➢ Main memory

        ➢ Secondary memory

    3. Input/Output devices

CPU

- It is the **brain** of the computer
- It performs **arithmetic** and **logic** operations of the system.
- It **controls** and **coordinates** the operations of the system.
- The power of the system comes from the speed of its CPU carrying out operations.

Components of the CPU

- In the CPU, there are two primary components.

  - ALU (arithmetic logic unit) - performs mathematical, logical, and decision operations.

  - CU (control unit) - directs all the processors operations.

Central Processing Unit

Control Unit

Arithmetic/Logic Unit
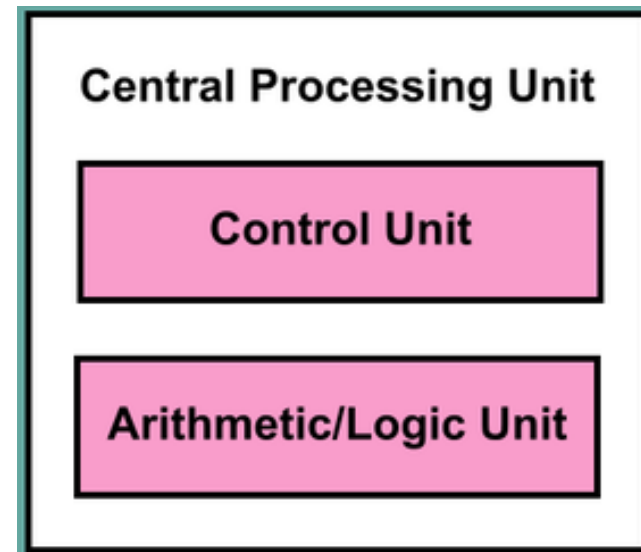
Main Memory (commonly called RAM)

- Any program (data + instructions), to be executed by the CPU, should be first loaded into main memory.

- Main memory intimately connected to the CPU, so moving instructions and data into and out of the processor is very fast.

- RAM is a **Volatile memory** (loses its contents when the computer or hardware device loses power).

How does the RAM look like?

Addresses of
memory cells

Memory contents

0	
1	
2	
3	
4	"big byte array"
5	
6	
7	
8	
9	
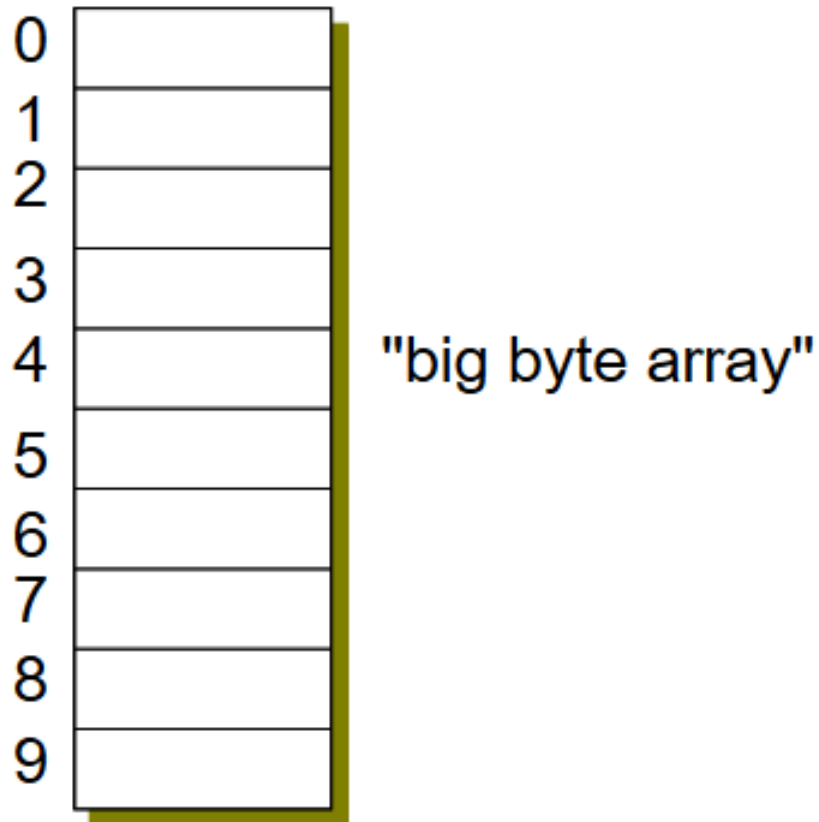
Other types of Main Memory

- Other types of main memory include:
 - ➤ ROM
  - ➤ Cache

ROM (Read Only Memory)

- **Read-only memory** (**ROM**) is a type of **non-volatile** memory used in computers and other electronic devices.

- Data stored in ROM cannot be electronically modified after the manufacture of the memory device.

- Read-only memory is useful for storing software that is rarely changed during the life of the system, sometimes known as firmware.

- Example of such firmware is the **BIOS** (**Basic Input/Output System** and also known as the **System BIOS** which is the first software to run when powered on the computer (booting process). The BIOS initializes and tests the system hardware components, and loads a boot loader which then initializes the operating system.
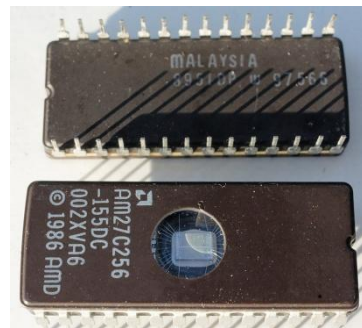
Cache Memory

- **Cache Memory** is a special very high-speed memory.

- It is used to speed up program execution and synchronizing with high-speed CPU.

- Cache memory is an extremely fast memory type that acts as a buffer between RAM and the CPU.

- It holds frequently requested data and instructions so that they are immediately available to the CPU when needed.
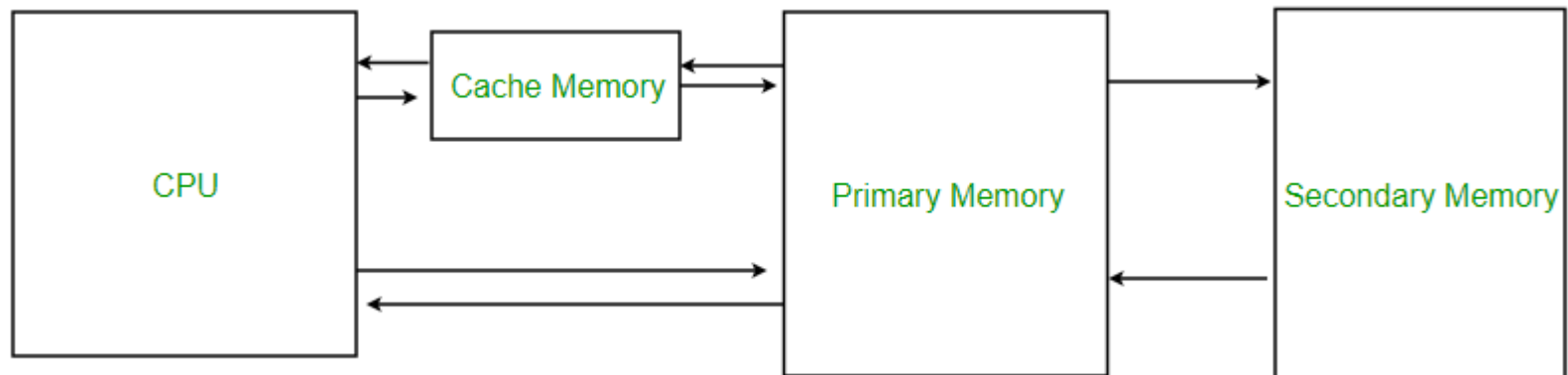
Cache Levels

- Various levels of cache memory exist (inside or outside the CPU).
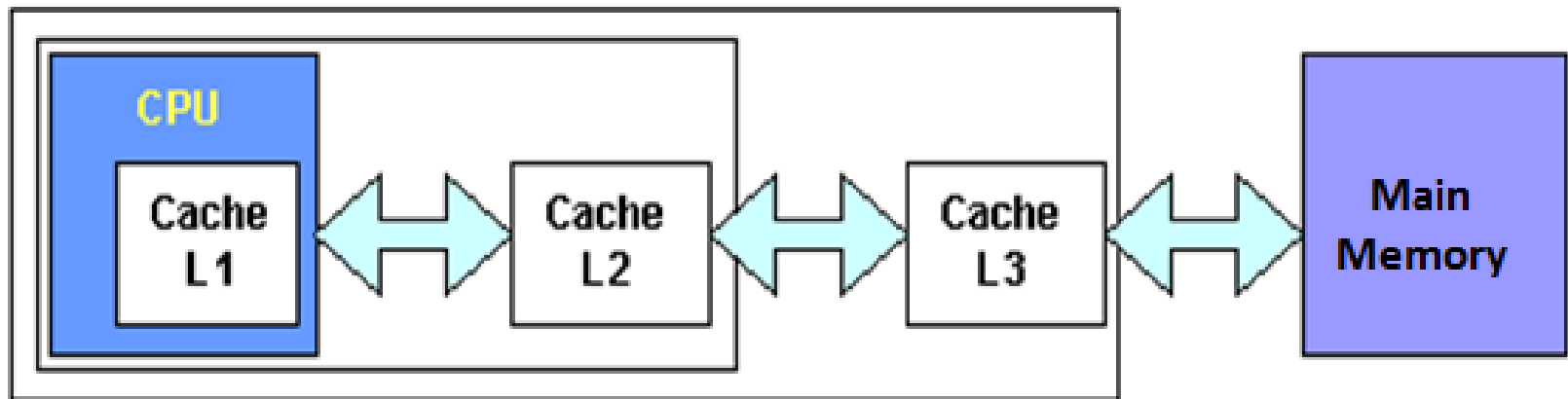
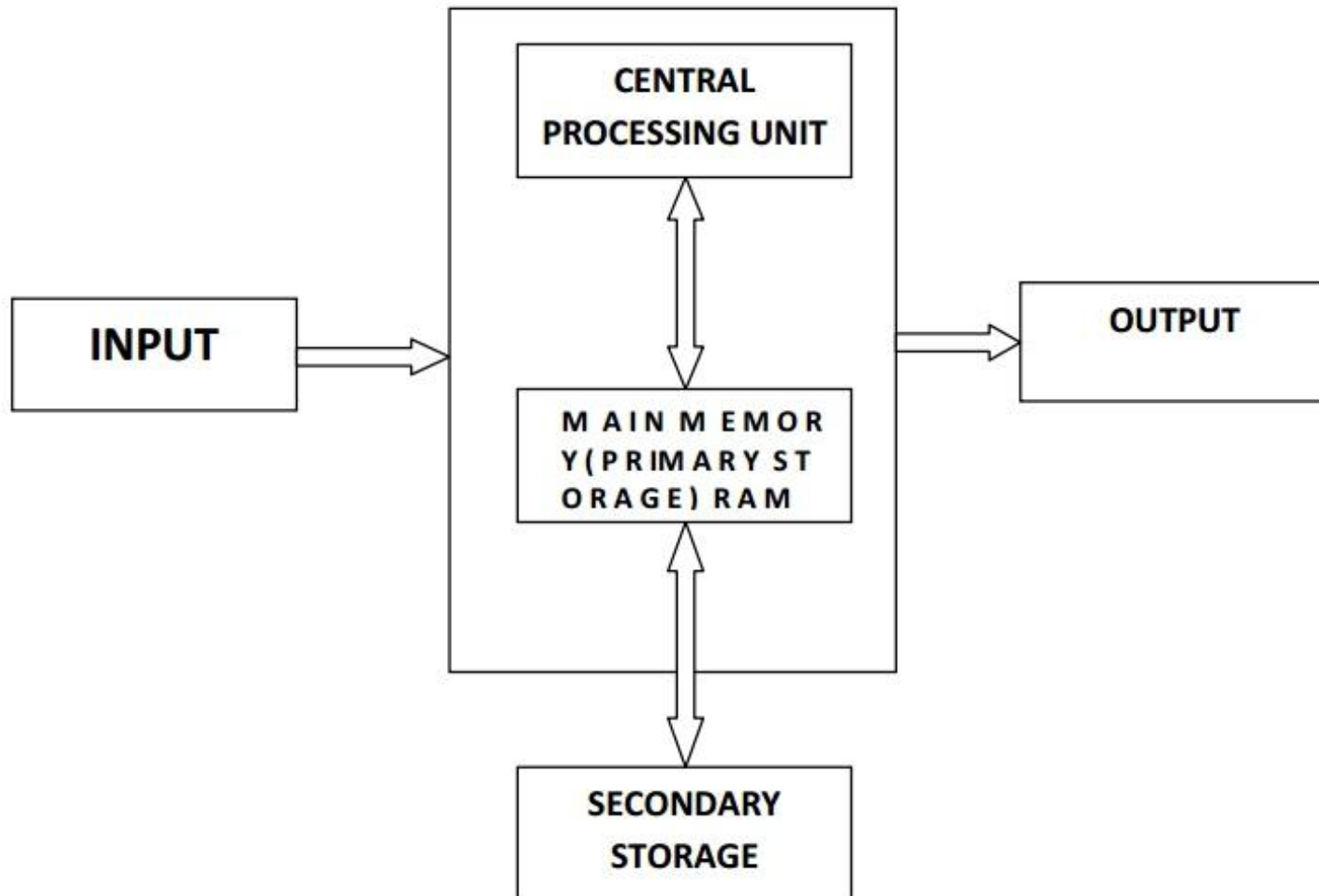# Secondary memory (Auxiliary Memory)

- Where programs and data are kept on a long-term basis.

- Common secondary storage devices are the hard disks and optical disks.

- Permanent and non-volatile memory

- Storage capacity greater than main memory but slower than it.

- Not connected directly to the CPU

Input/output devices (also called peripherals):

- They allow the computer to interact with outside world by moving data into and out of the system.

- Input devices: keyboard, mouse, microphone, …etc

- Output devices: monitor, printer, speaker, …etc

Basic Computer Organization
(Von Neumann Basic Structure)

CPU-RAM Diagram

Machine Cycle

Step 2 decode instructions into commands

Step 3 execute commands

| Control Unit | ALU |

Step 1 Fetch instruction from memory

Step 4 Store results in memory

| Main Memory |

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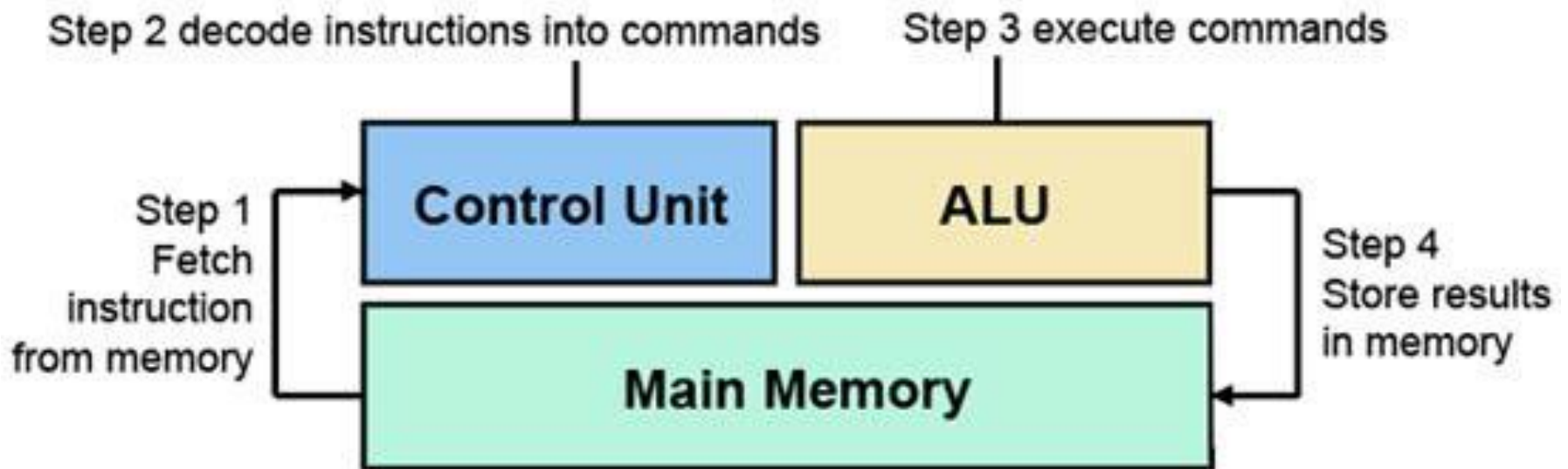
Computer System Software:

- Computer software consists of both programs and data.

- Program consists of a set of instructions telling the computer exactly what to do to perform a useful task.

- Two main software types:

  ➢ Systems software (operating systems).

  ➢ Applications software (user applications).

  ➢ Programming software (programming languages)

Operating systems (OS)

- OS is the first software that is first loaded when powering on the computer.

- OS is always present when a computer is running.

- OS Controls and coordinates operation of the hardware and software components (running programs and managing the resources they need).

- Examples of OSs: Windows, Linux, Mac OS, Android, …etc

Application Programs
(commonly called Applications)

- They are programs that people use to get their work done.

- Users of those programs not necessarily programmers.

- Examples: word processor, web browser, game programs, …etc

Programming Languages

- A **programming language** is a vocabulary and set of grammatical rules for instructing a **computer** or computing device to perform specific tasks.

- The term **programming language** usually refers to high-level **languages**, such as BASIC, C, C++, COBOL, Java, FORTRAN, Ada, and Pascal.

Conclusion

To program means telling a computer what to do through a set of instruction for solving a certain problem. Those instructions written in a computer's language are called **computer programs**.