Chapter 1:

Introduction to Computer Science

I.1 Definition of Computer Science

Computer science is defined as the science of automatic information processing using computers. It focuses on the study, design, development, and use of computer systems, both hardware and software.

⌗ What is Computer Science?

Computer science is the discipline that deals with the management and processing of data using computer systems. It encompasses various domains, including:

- Software development and operating systems.
- Database management.
- Image, sound, and video processing.
- Cybersecurity and information protection.

I.2 Computer

A computer is an electronic device that can be programmed to perform specific tasks. It is capable of processing data, executing programs, and storing and retrieving information. Computers are classified into two major categories:

- **Personal Computers (PCs)**: Used for individual tasks (office work, multimedia, gaming).
- **Mainframes**: Used in professional or industrial environments for large-scale data processing tasks.

I.3 Computer Systems

A computer system is a combination of hardware and software working together to accomplish specific tasks. It consists of three main elements:

- **Hardware**: The physical components of the computer.
- **Software**: The programs that control the hardware.
- **User**: The person interacting with the computer system.

Basic Elements of a Computer

The basic elements of a computer include:

- **Processor (CPU)**: The brain of the computer, responsible for executing instructions and performing calculations.
- **Memory (RAM)**: Temporary memory where data and instructions being executed are stored.
- **Storage**: Hard drives (HDD) or solid-state drives (SSD) where data is permanently stored.
- **Input Devices**: Devices that allow users to input information into the computer (keyboard, mouse).
- **Output Devices**: Devices that allow the computer to communicate results to the user (monitor, printer).

Processor (CPU):

Hard drives (HDD)

I.4 Computer Architecture

Computer architecture describes the organization and interconnection of the various components of the computer. It is divided into two main parts:

(a) Hardware

- **Input Devices**: Allow the user to enter data into the computer. Examples: keyboard, mouse, scanner.
- **Output Devices**: Allow the computer to communicate results to the user. Examples: monitor, printer, projector.
- **Input/Output Devices (I/O)**: These devices perform both input and output functions. Examples: touch screens, USB drives.

❖ **Detailed Overview of Peripherals**

➢ **Input Devices**

- **Keyboard**: The primary device for typing information into a computer.
- **Mouse**: Used to control the cursor and interact with graphical elements.
- **Scanner**: Converts physical documents and images into digital form.

➢ **Output Devices**

- **Monitor**: Displays the user interface and applications.
- **Printer**: Produces physical copies of documents and images.
- **Projector**: Displays the screen on a larger surface for presentations.

➢ **Input/Output Devices**

- **Touchscreen**: Allows both input through touch and output by displaying the interface.
- **USB Flash Drive**: Can both read from and write to data, making it both an input and output device

(b) Software

Software is a set of instructions that tells the computer how to perform specific tasks. There are two main types of software:

- **System Software**: Such as operating systems (Windows, macOS, Linux), which manage the computer's resources and allow other software to run.
- **Application Software**: Programs designed to perform specific tasks, such as Microsoft Office, video editing software, or video games.

I.5 Random Access Memory (RAM)

Definition

- **RAM** is a type of volatile memory, meaning that it temporarily stores data that is actively being used or processed by the CPU. Once the computer is turned off, all data stored in RAM is lost. Its primary role is to allow quick access to data needed for running applications and the operating system.
- **Characteristics of RAM:**

- **Volatile Memory**: RAM loses its contents when the computer is powered off.
- **Fast Access**: Data stored in RAM can be read and written quickly, making it ideal for tasks that need immediate access to large amounts of data.

- **Temporary Storage**: RAM is used to store temporary data, such as the information needed for running applications, the operating system's processes, and the cache for frequently accessed files.
- **Capacity**: RAM capacity can range from a few gigabytes (GB) to terabytes (TB) in high-performance systems.

Types of RAM:

1. **DRAM (Dynamic RAM)**: This is the most common type of RAM, found in personal computers, servers, and mobile devices. DRAM needs to be refreshed thousands of times per second to retain data.
2. **SRAM (Static RAM)**: Faster and more expensive than DRAM, SRAM is typically used in smaller quantities for cache memory inside the CPU.

I.6 Read-Only Memory (ROM)

Definition: ROM is a type of non-volatile memory, which means that the data stored in ROM remains intact even when the computer is turned off. It contains essential instructions that are permanently written and cannot be easily modified.

Characteristics of ROM:

- **Non-Volatile Memory**: ROM retains its data even when the system is powered off.
- **Permanent Storage**: The data in ROM is written during manufacturing and is not easily altered or erased by users.
- **Slower Access**: ROM is generally slower compared to RAM, as it is not designed for the frequent read/write processes that RAM handles.

RAM

Types of ROM:

1. **PROM (Programmable ROM)**: Can be programmed once after manufacturing, but cannot be changed afterward.
2. **EPROM (Erasable Programmable ROM)**: Can be erased and reprogrammed multiple times using ultraviolet light.
3. **EEPROM (Electrically Erasable Programmable ROM)**: Can be reprogrammed using electrical signals. This type of ROM is commonly used for firmware updates.

ROM

- **Key Differences Between RAM and ROM:**

Aspect	RAM (Random Access Memory)	ROM (Read-Only Memory)
Volatility	Volatile (loses data when powered off)	Non-volatile (retains data when powered off)
Speed	Faster (used for active processes)	Slower (used for essential instructions)
Data Modification	Data can be written and modified	Data is written once, and changes are limited
Primary Purpose	Temporary storage for running programs and system operations	Permanent storage for system firmware and startup processes
Capacity	Typically larger (4 GB to 128 GB or more)	Smaller, just enough to store essential instructions

---

Conclusion

Both **RAM** and **ROM** are crucial components of a computer system, each serving distinct roles. RAM allows quick access to data needed for running applications, providing the temporary memory space necessary for the system's processes to function efficiently. ROM, on the other hand, is where the essential, unchangeable instructions that start up and control the system's hardware are stored.

By understanding the role and differences between RAM and ROM, you can better appreciate how your computer manages data, processes tasks, and maintains stability during operation

Conclusion of the Chapter

This first chapter covers the basics of computer science, the hardware and software components of a computer, and the architecture of computer systems. These concepts are essential for understanding how computers work and how they process information.

The following chapters will explore the internal workings of systems, as well as programming and other more technical aspects