Computer Basics

ZERO TO HERO

What is Computer?

- A computer is an **electronic device** that processes **data**, performs **tasks** according to instructions, and stores information for future use.
- It consists of **hardware components**, such as the **central processing unit (CPU)**, **memory**, **storage devices**, **input/output devices**, and a **motherboard** that connects and coordinates these components
- The software, including the **operating system** and **applications**, enables users to interact with the computer and perform various functions, such as **creating documents**, **browsing the internet**, **playing games**, and running software programs.

Characteristics of Computer

- **Speed** − Typically, a computer can carry out **3-4 million** instructions per second.
- **Accuracy** − Computers exhibit a very high degree of accuracy. Errors that may occur are usually due to inaccurate data, wrong instructions or bug in chips – all human errors.
- **Reliability** − Computers can carry out same type of work repeatedly without throwing up errors due to tiredness or boredom, which are very common among humans.
- **Storage Capacity** − Computers can store a very large amount of data at a fraction of cost of traditional storage of files. Also, data is safe from normal wear and tear associated with paper.

Adv & Disadvantage of Using Computer

- **Advantage**
  - Computers can do the same task repetitively with same accuracy.
  - Computers do not get tired or bored.
- **Disadvantage**
  - Computers have no intelligence; they follow the instructions blindly without considering the outcome.
  - Regular electric supply is necessary to make computers work, which could prove difficult everywhere especially in developing nations.

Booting

- Starting a computer or a computer-embedded device is called **booting**. Booting takes place in two steps −
  - Switching on power supply
  - Loading operating system into computer's main memory
  - Keeping all applications in a state of readiness in case needed by the user
- The first program or set of instructions that run when the computer is switched on is called **BIOS** or **Basic Input Output System**.
- If a system is already running but needs to be restarted, it is called **rebooting**. Rebooting may be required if a software or hardware has been installed or system is unusually slow.

Types of Booting

There are two types of booting −

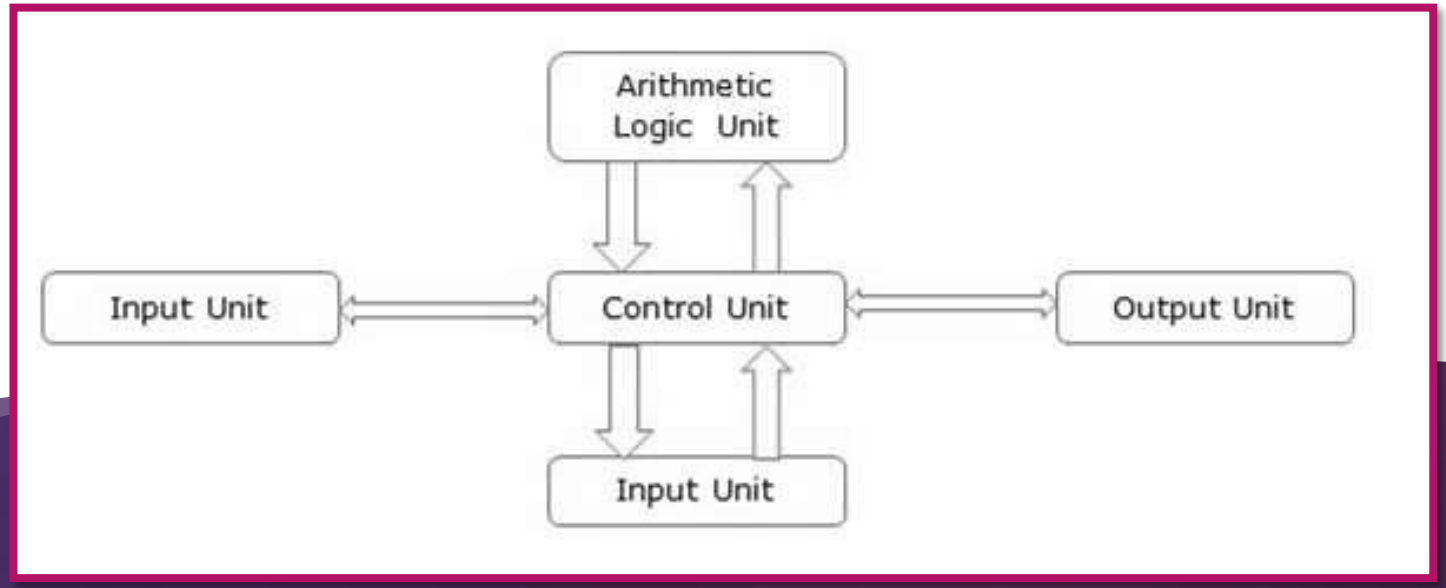
- **Cold Booting** − When the system is started by switching on the power supply it is called **cold booting**. The next step in cold booting is loading of **BIOS**.
- **Warm Booting** − When the system is already running and needs to be restarted or rebooted, it is called warm booting. Warm booting is faster than cold booting because BIOS is not reloaded.

Input-Process-Output Model

- Computer input is called **data** and the output obtained after processing it, based on user's instructions is called **information**.

- The processes that can be applied to data are of two types −

- **Arithmetic operations** − Examples include calculations like addition, subtraction, differentials, square root, etc.
- **Logical operations** − Examples include comparison operations like greater than, less than, equal to, opposite, etc.
- The corresponding figure for an actual computer looks something like this −



The basic parts of a computer are as follows −

- **Input Unit** − Devices like keyboard and mouse that are used to input data and instructions to the computer are called input unit.
- **Output Unit** − Devices like printer and visual display unit that are used to provide information to the user in desired format are called output unit.
- **Control Unit** − As the name suggests, this unit controls all the functions of the computer. All devices or parts of computer interact through the control unit.
- **Arithmetic Logic Unit** − This is the brain of the computer where all arithmetic operations and logical operations take place.
- **Memory** − All input data, instructions and data interim to the processes are stored in the memory. Memory is of two types – **primary memory** and **secondary memory**. Primary memory resides within the CPU whereas secondary memory is external to it.

Control unit, arithmetic logic unit and memory are together called the **central processing unit** or **CPU**. Computer devices like keyboard, mouse, printer, etc. that we can see and touch are the **hardware** components of a computer. The set of instructions or programs that make the computer function using these hardware parts are called **software**. We cannot touch software. Both hardware and software are necessary for working of a computer.

Computers - Classification

- Historically computers were classified according to **processor** types because development in processor and processing speeds were the developmental benchmarks
- All modern computers and computing devices use **microprocessors** whose speeds and storage capacities are skyrocketing day by day. The developmental benchmark for computers is now their size. Computers are now classified on the basis of their **use or size** −
  - Desktop
  - Laptop
  - Tablet
  - Server
  - Mainframe
  - Supercomputer

Desktop

- **Desktop** computers are **personal computers (PCs)** designed for use by an individual at a fixed location
- **IBM** was the first computer to introduce and popularize use of desktops
- A desktop unit typically has a CPU (Central Processing Unit), monitor, keyboard and mouse. Introduction of desktops popularized use of computers among common people as it was compact and affordable.

Laptop

- Despite its huge popularity, desktops gave way to a more compact and portable personal computer called laptop in 2000s.
- Laptops are also called **notebook computers** or simply **notebooks**
- Laptops run using batteries and connect to networks using Wi-Fi (Wireless Fidelity) chips.
- They also have chips for energy efficiency so that they can conserve power whenever possible and have a longer life.
- Modern laptops have enough processing power and storage capacity to be used for all office work, website designing, software development and even audio/video editing.

Tablet

- After laptops computers were further miniaturized to develop machines that have processing power of a desktop but are small enough to be held in one's palm
- Tablets have touch sensitive screen of typically 5 to 10 inches where one finger is used to touch icons and invoke applications.
- Keyboard is also displayed virtually whenever required and used with touch strokes
- Applications that run on tablets are called **apps**
- They use operating systems by Microsoft (Windows 8 and later versions) or Google (Android). Apple computers have developed their own tablet called **iPad** which uses a proprietary OS called **iOS**.

Server

- Servers are computers with high processing speeds that provide one or more services to other systems on the **network**. They may or may not have screens attached to them
- A group of computers or digital devices connected together to share resources is called a **network**.
- Servers have high processing powers and can handle multiple requests simultaneously. Most commonly found servers on networks include −
  - File or storage server
  - Game server
  - Application server
  - Database server
  - Mail server
  - Print server

Mainframe

- **Mainframes** are computers used by organizations like banks, airlines and railways to handle millions and trillions of online transactions per second. Important features of mainframes are −
  - Big in size
  - Hundreds times Faster than servers, typically hundred megabytes per second
  - Very expensive
  - Use proprietary OS provided by the manufacturers
  - In-built hardware, software and firmware security features

Supercomputer

- **Supercomputers** are the fastest computers on Earth. They are used for carrying out complex, fast and time intensive calculations for scientific and engineering applications. Supercomputer speed or performance is measured in teraflops, i.e. 1012 floating point operations per second.
- Chinese supercomputer **Sunway TaihuLight** is the world's fastest supercomputer with a rating of 93 petaflops per second, i.e. 93 quadrillion floating point operations per second.

Most common uses of supercomputers include −

- Molecular mapping and research
- Weather forecasting
- Environmental research
- Oil and gas exploration

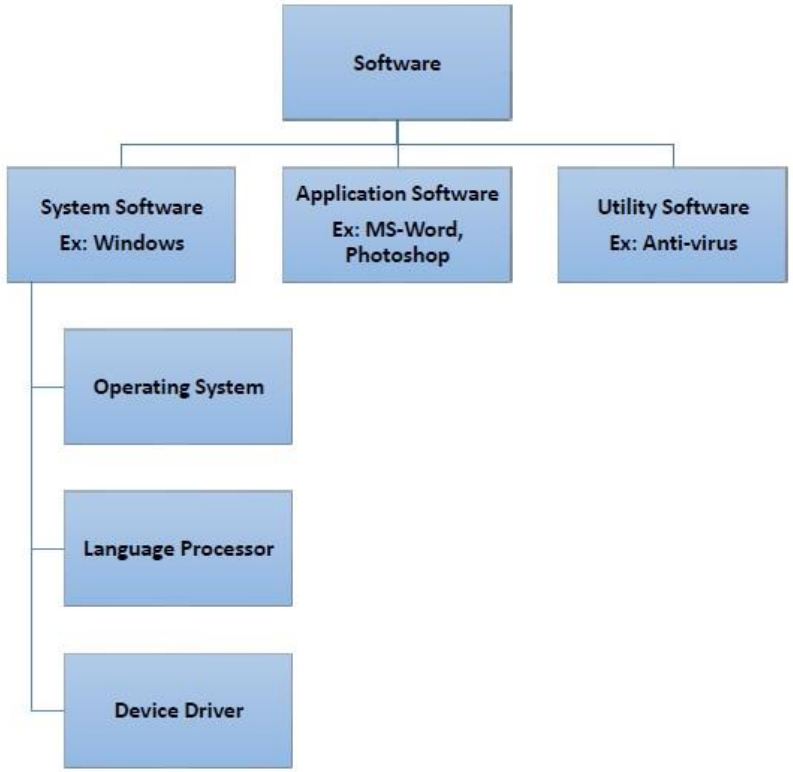
Software Concepts

- Software is like a recipe for computers. It's a set of instructions that tells a computer what to do, like how to run programs, play games, or browse the internet.
- For example, a word-processing software enables the user to create, edit and save documents. A web browser enables the user to view and share web pages and multimedia files.

Types of Software

There are two categories of software −

- System Software
- Application Software
- Utility Software



System Software

- System software is like the **manager** of a computer. It includes programs that control the basic functions of the computer, like the **operating system (OS)**, which manages **hardware resources**, **runs applications**, and provides a **user interface**.
- Other system software includes **device drivers**, **utility programs**, and **system tools** that help the computer operate smoothly.
- System software acts as **interface** between hardware and user applications. An interface is needed because hardware devices or machines and humans speak in different languages.
- Machines understand binary (0s and 1s); humans use languages like English, French, etc. We need software to translate human instructions into machine code, which is the job of system software.

Types of System Software

Based on its function, system software is of four types −

- Operating System
- Language Processor
- Device Drivers
- utility software

Operating System

- System software that is responsible for functioning of all hardware parts and their interoperability to carry out tasks successfully is called **operating system (OS)**. OS is the first software to be loaded into computer memory when the computer is switched on and this is called **booting**. OS manages a computer's basic functions like storing data in memory, retrieving files from storage devices, scheduling tasks based on priority, etc.
- An example of an operating system is **Microsoft Windows**, **macOS by Apple**, and Linux distributions like **Ubuntu**.

Language Processor

- A language processor is a software tool or program that translates high-level programming languages into machine code that a computer can understand and execute. When we talk of human machine interactions, languages are of three types −
- **Machine-level language :** This language is nothing but a string of 0s and 1s that the machines can understand. It is completely machine dependent.
- **Assembly-level language**
- **High level language**