

# Unit-1

## INTRODUCTION

What is a Computer?

A **computer** is an electronic device that accepts data from the user, processes it, produces results, displays them to the users, and stores the results for future usage.

**Data** is a collection of unorganized facts & figures and does not provide any further information regarding patterns, context, etc. Hence data means "unstructured facts and figures".

**Information** is a structured data i.e. organized meaningful and processed data. To process the data and convert into information, a computer is used.

# Functions of Computers

- **Receiving Input**

Data is fed into computer through various input devices like keyboard, mouse, digital pens, etc. Input can also be fed through devices like CD-ROM, pen drive, scanner, etc.

- **Processing the information**

Operations on the input data are carried out based on the instructions provided in the programs.

- **Storing the information**

After processing, the information gets stored in the primary or secondary storage area.

- **Producing output**

The processed information and other details are communicated to the outside world through output devices like monitor, printer, etc.

# History of Computers

## First Generation (1940-1956)

The first generation computers had the following features and components –

### Hardware

The hardware used in the first generation of computers was: **Vacuum Tubes** and **Punch Cards**.

### Features

- It supported machine language.
- It had slow performance
- It occupied large size due to the use of vacuum tubes.
- It had a poor storage capacity.
- It consumed a lot of electricity and generated a lot of heat.

First Generation Computers



## **Memory**

The memory was of 4000 bits.

## **Data Input**

The input was only provided through hard-wired programs in the computer, mostly through punched cards and paper tapes.

## **Examples**

ENIAC( Electronic Numeric Integrated and Calculator)

UNIVAC (Universal Automatic Computer)

IBM 701

## Second Generation (1956-1963)

Several advancements in the first-gen computers led to the development of second generation computers

### Hardware

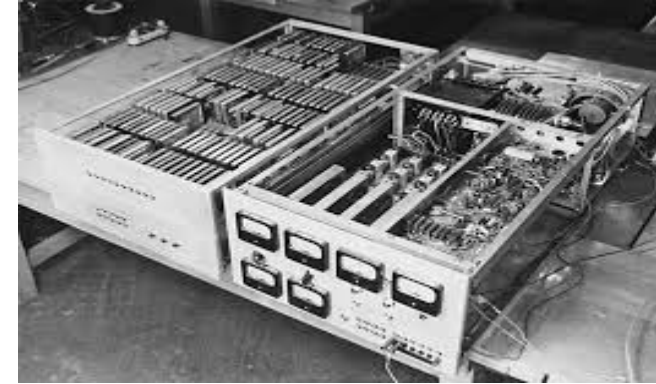
The hardware used in the second generation of computers were –

Transistors

Magnetic Tapes

### Features

- Batch operating system
- Faster and smaller in size
- Reliable and energy efficient than the previous generation
- Less costly than the previous generation



## **Memory**

The capacity of the memory was 32,000 bits.

## **Data Input**

The input was provided through punched cards.

## **Examples**

Honeywell 400

CDC 1604

IBM 7030

## **Third Generation (1964-1971)**

### **Hardware**

Integrated Circuits made from semi-conductor materials

Large capacity disks and magnetic tapes

### **Features**

- Supports time-sharing OS
- Faster, smaller, more reliable and cheaper than the previous generations
- Easy to access

### **Memory**

The capacity of the memory was 128,000 bits.

## **Data Input**

The input was provided through keyboards and monitors.

## **Examples**

IBM 360/370

CDC 6600

PDP 8/11



## **Fourth Generation (1972-2010)**

### **Hardware**

ICs with Very Large Scale Integration (VLSI) technology

Semiconductor memory

Magnetic tapes and Floppy

### **Features**

- Multiprocessing & distributed OS
- Object-oriented high level programs supported
- Small & easy to use; hand-held computers have evolved
- No external cooling required & affordable
- This generation saw the development of networks and the internet
- It saw the development of new trends in GUIs and mouse

## **Memory**

The capacity of the memory was 100 million bits.

## **Data Input**

The input was provided through improved hand held devices, keyboard and mouse.

## **Examples**

Apple II

VAX 9000

CRAY 1 (super computers)

## **Fifth Generation (2010-Present)**

These are the modern and advanced computers. Significant changes in the components and operations have made fifth generation computers handy and more reliable than the previous generations.

### **Hardware**

Integrated Circuits with VLSI and Nano technology

Large capacity hard disk with RAID support

Powerful servers, Internet, Cluster computing

### **Features**

- Powerful, cheap, reliable and easy to use.
- Portable and faster due to use of parallel processors and Super Large Scale Integrated Circuits.
- Rapid software development is possible.

## **Memory**

The capacity of the memory is unlimited.

## **Data Input**

The input is provided through CDROM, Optical Disk and other touch and voice sensitive input devices.

## **Examples**

IBM

Pentium

PARAM

# Characteristics of Computer

## Speed

A computer works with much higher speed and accuracy compared to humans while performing mathematical calculations. Computers can process millions (1,000,000) of instructions per second. The time taken by computers for their operations is microseconds and nanoseconds.

## Accuracy

Computers perform calculations with 100% accuracy. Errors may occur due to data inconsistency or inaccuracy.

## Diligence

A computer can perform millions of tasks or calculations with the same consistency and accuracy. It doesn't feel any fatigue or lack of concentration. Its memory also makes it superior to that of human beings.

## **Versatility**

Versatility refers to the capability of a computer to perform different kinds of works with same accuracy and efficiency.

## **Reliability**

A computer is reliable as it gives consistent result for similar set of data i.e., if we give same set of input any number of times, we will get the same result.

## **Automation**

Computer performs all the tasks automatically i.e. it performs tasks without manual intervention.

## **Memory**

A computer has built-in memory called primary memory where it stores data. Secondary storage are removable devices such as CDs, pen drives, etc., which are also used to store data.

# Classification of Computers

The computer systems can be classified on the following basis:

1. On the basis of size.
2. On the basis of functionality.
3. On the basis of data handling.

## **1. On the basis of Size**

### **Super computers :**

- The super computers are the most high performing system.
- A supercomputer is a computer with a high level of performance compared to a general-purpose computer.
- All of the world's fastest 500 supercomputers run Linux-based operating systems.
- Supercomputers actually play an important role in the field of computation, and are used for intensive computation tasks in various fields, including quantum mechanics, weather forecasting, climate research, oil and gas exploration, molecular modeling, and physical simulations.
- The notion of a supercomputer first arose in the 1960s when an electrical engineer named Seymour Cray, embarked on creating the world's fastest computer. Cray, considered the "father of supercomputing," had left his post at business computing giant Sperry-Rand to join the newly formed Control Data Corporation so that he can focus on developing scientific computers.

## **Mainframe computers :**

These are commonly called as big iron, they are usually used by big organisations for bulk data processing such as statics, census data processing, transaction processing and are widely used as the servers as these systems has a higher processing capability as compared to the other classes of computers, most of these mainframe architectures were established in 1960s, the research and development worked continuously over the years and the mainframes of today are far more better than the earlier ones, in size, capacity and efficiency.

Eg: IBM z Series, System z9 and System z10 servers.

**Mini computers :** These computers came into the market in mid 1960s and were sold at a much cheaper price than the main frames, they were actually designed for control, instrumentation, human interaction, and communication switching as distinct from calculation and record keeping, later they became very popular for personal uses with evolution.

In the 60s to describe the smaller computers that became possible with the use of transistors and core memory technologies, minimal instructions sets and less expensive peripherals such as the ubiquitous Teletype Model 33 ASR. They usually took up one or a few inch rack cabinets, compared with the large mainframes that could fill a room, there was a new term “MINICOMPUTERS” coined

Eg: Personal Laptop, PC etc.



**Micro computers** : A microcomputer is a small, relatively inexpensive computer with a microprocessor as its CPU. It includes a microprocessor, memory, and minimal I/O circuitry mounted on a single printed circuit board. The previous to these computers, mainframes and minicomputers, were comparatively much larger, hard to maintain and more expensive. They actually formed the foundation for present day microcomputers and smart gadgets that we use in day to day life.

Eg: Tablets, Smartwatches.

## 2. On the basis of Functionality

**Servers** : Servers are nothing but dedicated computers which are set-up to offer some services to the clients. They are named depending on the type of service they offered. Eg: security server, database server.

**Workstation** : Those are the computers designed to primarily to be used by single user at a time. They run multi-user operating systems. They are the ones which we use for our day to day personal / commercial work.

**Information Appliances** : They are the portable devices which are designed to perform a limited set of tasks like basic calculations, playing multimedia, browsing internet etc. They are generally referred as the mobile devices. They have very limited memory and flexibility and generally run on “as-is” basis.

**Embedded computers** : They are the computing devices which are used in other machines to serve limited set of requirements. They follow instructions from the non-volatile memory and they are not required to execute reboot or reset. The processing units used in such device work to those basic requirements only and are different from the ones that are used in personal computers- better known as workstations.

### 3. On the basis of Data Handling

**Analog** : An analog computer is a form of computer that uses the continuously-changeable aspects of physical fact such as electrical, mechanical, or hydraulic quantities to model the problem being solved.

Analog computers are in use for some specific applications, like the flight computer in aircraft, ships, submarines, and some appliances in our daily life such as refrigerator, speedometer, etc.

**Digital** : A computer that performs calculations and logical operations with quantities represented as digits, usually in the binary number system of “0” and “1”, “Computer capable of solving problems by processing information expressed in discrete form.

Digital computers are used to store photos, video, music files etc.

**Hybrid** : A computer that processes both analog and digital data, Hybrid computer is a digital computer that accepts analog signals, converts them to digital and processes them in digital form.

These hybrid computers are capable to resolve more complicated set of differential equations. Examples are – freedom space flights, chemical reaction kinetics, human immunosuppressive system, food processing plants, and more.

# **Basic Applications of Computer**

## **Scientific Research**

Scientific research was the first application of computer, as computer was first used to perform this job, that is scientific research. At that time to now, the speed and accuracy of computer enabled scientific analysis carried out too fast.

## **Medical Field**

Computers are used in hospitals to maintain a database of patients' history, diagnosis, X-rays, live monitoring of patients, etc. Surgeons nowadays use robotic surgical devices to perform delicate operations, and conduct surgeries remotely. Virtual reality technologies are also used for training purposes.

## **Industry**

Computers are used to perform several tasks in industries like managing inventory, designing purpose, creating virtual sample products, interior designing, video conferencing, etc.

## **Business**

Nowadays, computers are totally integrated into business. The main objective of business is transaction processing, which involves transactions with suppliers, employees or customers. Online marketing has seen a great revolution in its ability to sell various products to inaccessible corners like interior or rural areas.

## **Education**

Computers are used in education sector through online classes, online examinations, referring e-books, online tutoring, etc. They help in increased use of audio-visual aids in the education field.

## **Government**

In government sectors, computers are used in data processing, maintaining a database of citizens and supporting a paperless environment. The country's defense organizations have greatly benefitted from computers in their use for missile development, satellites, rocket launches, etc.

## **Banking**

In the banking sector, computers are used to store details of customers and conduct transactions, such as withdrawal and deposit of money through ATMs. Banks have reduced manual errors and expenses to a great extent through extensive use of computers.

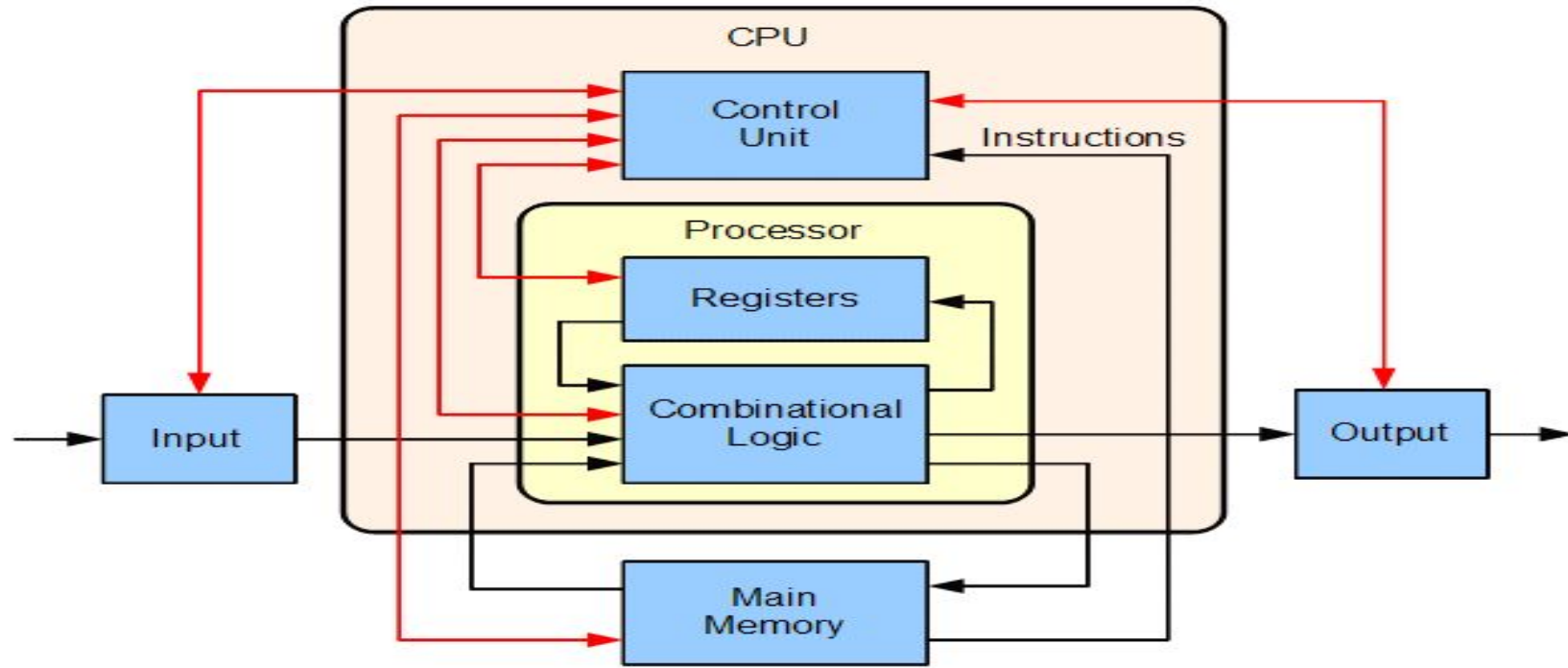
## **Accounting Purposes**

Computers are highly used for accounting purposes to handle company financial accounts and inventory management using some accounting software like Tally. With the use of computer the task of maintaining accounts become very easy.

# Computer System Architecture

A computer system is basically a machine that simplifies complicated tasks. It should maximize performance and reduce costs as well as power consumption. The different components in the Computer System Architecture are Input Unit, Output Unit, Storage Unit, Arithmetic Logic Unit, Control Unit.

In 1945, Professor J. von Neumann, who was then working at the Moore School of Engineering in Philadelphia, where the E.N.I.A.C. had been built, issued on behalf of a group of his co-workers, a report on the basic logical design of digital computers and that design is known as the computer architecture.



## Input Unit

The Computer accepts coded information through input unit by the user. It is a device that is used to give required information to the computer. e.g., keyboard, mouse, etc.

## Output Unit

The output sends the processed results to the user. It is Mainly used to display the desired results to the user. It is mainly used to display the desired result to the user as per input instruction. e.g , video monitor, printer and plotter, etc.



## Central Processing Unit(CPU)

The central processing unit consists set of register, arithmetic and control circuits, which together interpret and execute instructions in assembly language. The primary functions of the CPU are

The CPU transfers instructions and input data from main memory to registers. ie., internal memory.

The CPU executes the instructions in the stored sequence.

When necessary, CPU transfers output data from registers to main memory.

Central Processing Unit (CPU) is often called the **brain of computer**. The CPU is fabricated as a single Integrated Circuit(IC) chip and is also known as **Microprocessor** . A CPU controls all the internal and external devices and performs arithmetic and logic operations.

The CPU consists of three main subsystems

Arithmetic Logic Unit (ALU),

Controls Unit(CU)

registers

- **Arithmetic Logic Unit(ALU)**

The arithmetic logic unit contains the electronic circuitry that executes all arithmetic and logical operations on the available data. It is used to perform all arithmetic calculations (addition, subtraction, multiplication and division) and logical calculation (<, >, +, AND, OR, etc). Logical unit performs comparison of numbers, letters and special characters. ALU uses registers to hold the data that is being processed.

- **Registers**

Registers are special purpose and high speed temporary memory units. Registers are not referenced by their address, but are directly accessed and manipulated by the CPU during execution. Essentially, they hold the information that the CPU is currently working on. Registers store data, instructions, address and intermediate results of processing.

- **Control Unit(CU)**

Control Unit coordinates with the input and output devices of a computer. It directs the computer to carry out stored program instructions by communicating with the ALU and the registers. It organises the processing of data and instructions.

# Storage Unit

Storage unit contains many computer components that are used to store data. It is traditionally divided into primary storage and secondary storage. Primary storage is also known as the **main memory** and is the memory directly accessible by the CPU. Secondary or external storage is not directly accessible by the CPU. The data from secondary storage needs to be brought into the primary storage before the CPU can use it. Secondary storage contains a large amount of data permanently.

# Peripheral devices

- Computer peripheral is any input-output device or any of various devices (including sensors) used to enter information and instructions into a computer for further processing and also used to store the data for future use.
- Peripherals are commonly divided into three kinds: input devices, output devices, and storage devices.
- An **input device** converts incoming data and instructions into a pattern of electrical signals in binary code that are comprehensible to a digital computer.
- An **output device** reverses the process, translating the digitized signals into a form intelligible to the user. At one time punched-card and paper-tape readers were extensively used for inputting, but these have now been supplanted by more efficient devices.
- Most auxiliary **storage devices** is used to store the data for further use for example, CD-ROM and DVD drives, flash memory drives, and external disk drives, pen drive, portable hard disk.
- Even devices such as smartphones, tablet computers, and wearable devices like fitness trackers and smartwatches can be considered as peripherals

**Thank You**