MODULE 1 : INTRODUCTION TO COMPUTERS

Definition

- The term computer is derived from the word *compute*, which means to *calculate*.
- A **computer** is an electronic machine, devised for performing calculations and controlling operations that can be expressed either in logical or numerical terms.
- Computer is an electronic device that performs diverse operations with the help of instructions to process the data in order to achieve desired results.
- The literal meaning of computer is a device that can calculate. However, modern computers can do a lot more than calculate.
- **Computer** is an electronic device that receives input, stores or processes the input as per user instructions and provides output in desired format.

## General features of a computer

Input-Process-Output Model

- Computer input is called **data** and the output obtained after processing it, based on user's instructions is called **information**. Raw facts and figures which can be processed using arithmetic and logical operations to obtain information are called **data**.

Simplest Workflow of Computer

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 −
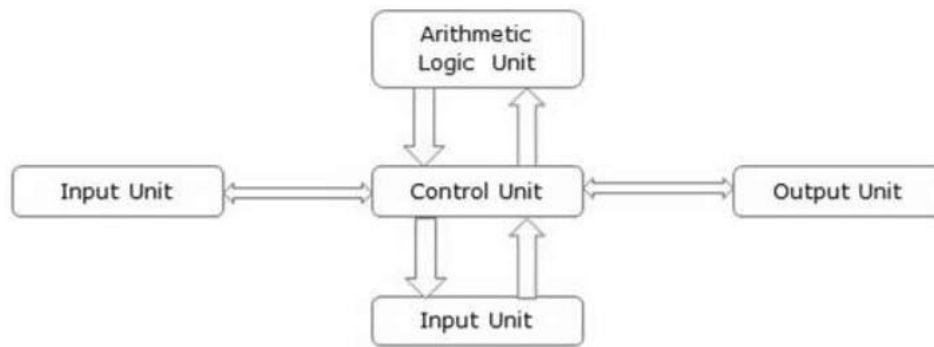
The basic parts of a computer are as follows −

1. **Input Unit** − Devices like keyboard and mouse that are used to input data and instructions to the computer are called input unit.

2. **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.

3. **Control Unit** − This unit controls all the functions of the computer. All devices or parts of computer interact through the control unit.

4. **Arithmetic Logic Unit** − This is the brain of the computer where all arithmetic operations and logical operations take place.

5. **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 see or touch software. Both hardware and software are necessary for working of a computer.

Characteristics of Computer

- **Speed** − The computers process data at an extremely fast rate, at millions or billions of instructions per second. A computer can perform a huge task in a few seconds that otherwise a normal human being may

take days or even years to complete. The speed of a computer is calculated in MHz (Megahertz), that is, one million instructions per second. At present, a powerful computer can perform billions of operations in just one second. 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. The level of accuracy depends on the instructions and the type of machines being used. Since the computer is capable of doing only what it is instructed to do, faulty instructions for data processing may lead to faulty results. This is known as **GIGO** (**Garbage In Garbage Out**). **Versatility** − Computers can carry out a wide range of work from data entry and ticket booking to complex mathematical calculations and continuous astronomical observations. If you can input the necessary data with correct instructions, computer will do the processing.

- **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. Generally, reliability is the measurement of the performance of a computer, which is measured against some predetermined standard for operation without any failure. The major reason behind the reliability of computers is that, at hardware level, it does not require any human intervention between its processing operations. Moreover, computers have built-in diagnostic capabilities, which help in continuous monitoring of the system.

- **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. Computers can store large amounts of data and can recall the required information almost instantaneously. The main memory of the computer is relatively small and it can hold only a certain amount of data, therefore, the data is stored on secondary storage devices such as magnetic tape or disks. Small sections of data can be accessed very quickly from these storage devices and brought into the main memory, as and when required, for processing.

- **Versatility** − Computers can carry out a wide range of work from data entry and ticket booking to complex mathematical calculations and continuous astronomical observations. If you can input the necessary data with correct instructions, computer will do the processing.For example, at one moment it can be used to draft a letter, another moment it can be used to play music and in between, one can print a document as

well. All this work is possible by changing the program (computer instructions).

- **Resource Sharing** - In the initial stages of development, computers used to be isolated machines. With the tremendous growth in computer technologies, computers today have the capability to connect with each other. This has made the sharing of costly resources like printers possible. Apart from device sharing, data and information can also be shared among groups of computers, thus creating a large information and knowledge base.

- **Diligence** - Computer, being a machine, does not suffer from the human traits of tiredness and lack of concentration. If four million calculations have to be performed, then the computer will perform the last, four-millionth calculation with the same accuracy and speed as the first calculation.

Advantages of Using Computer

Now that we know the characteristics of computers, we can see the advantages that computers offer :

- Computers can do the same task repetitively with same accuracy.
- Can store vast amounts of information and reduce waste
- Helps sort, organize, and search through information
- Keeps you connected
- Save time
- Computers can take up routine tasks while releasing human resource for more intelligent functions.

Limitations of Computer

Despite so many advantages, computers have some disadvantages of their own –

- 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.

- A computer can only perform what it is programmed to do.
- The computer needs well-defined instructions to perform any operation. Hence, computers are unable to give any conclusion without going through intermediate steps.

- A computer's use is limited in areas where qualitative considerations are important. For instance, it can make plans based on situations and information but it cannot foresee whether they will succeed.

History of Computer

Until the development of the first generation computers based on vacuum tubes,there had been several developments in the computing technology related to the mechanical computing devices.The key developments that took place till the first computer was developed are as follows:

. **1. Calculating Machines**

- ABACUS was the first mechanical calculating device for counting of large numbers.
- The word ABACUS means calculating board
- It consists of bars in horizontal positions on which sets of beads are inserted. The horizontal bars have 10 beads each, representing units, tens, hundreds etc.
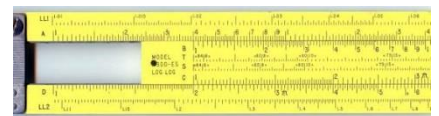
2. Napier's Bones

Mechanical device built for the purpose of multiplication in 1617 by an English Mathematician John Napier.

3. Slide Rule

- Developed by an English Mathematician Edmund Gunter in the 16th century.
- Using the slide rule, one could perform operations like addition, subtraction, multiplication and division.
- It was used extensively till late 1970s.

4. Pascal's Adding and Subtraction Machine

- Developed by Blaise Pascal for addition and subtraction operation.
- Machine consisted of wheels , gears and cylinders.

5. Leibniz's Multiplication and Dividing Machine

- Mechanical device that could both multiply and divide.
- German Philosopher and Mathematician Gottfried Leibniz built it around 1673
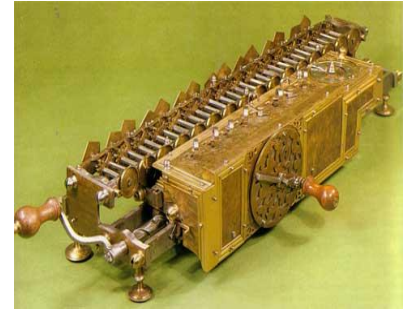
6. Punch Card System

- Developed by Jacquard to control the power loom in 1801.
- He invented the punch card reader that could recognize the presence of hole in the punched card as binary one and the absence of hole as binary zero
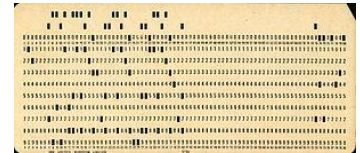
7. Babbage's Analytical Engine

- Built by Charles Babbage in 1823 to do complex mathematical calculations
- The machine was called *difference engine*
- Later Charles Babbage and Lady Ada Lovelace developed a general-purpose calculating machine,the *analytical engine.*
- Charles Babbage is also called the *father of computer*
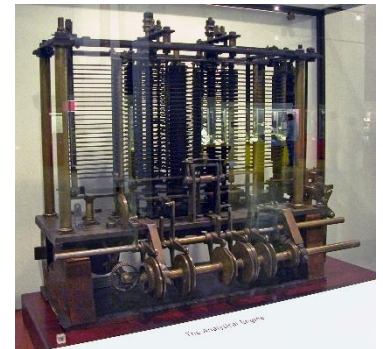
8. Hollerith's Punched Card Tabulating Machine

- Invented by Herman Hollerith
- The machine could read the information from a punched card and process it electronically

GENERATION OF COMPUTERS

The history of computer development is often discussed with reference to the different generations of computing devices. In computer terminology, the word **generation** is described as a stage of technological development or innovation. A major technological development that fundamentally changed the way computers operate, resulting in increasingly smaller, cheaper, more powerful and more efficient and reliable devices, characterises each generation of computer. According to the technology used, there are five generations of computers, which are discussed in the following sections.

FIRST GENERATION (1940–56): VACUUM TUBES

First generation computers were vacuum tubes/thermionic valve based machines. These computers used vacuum tubes for circuitry and magnetic drums for memory. Input was based on punched cards and paper tape and output was displayed in the form of printouts.

First generation computers relied on binary-coded language (language of 0s and 1s) to perform operations and were able to solve only one problem at a time. Each machine was fed with different binary codes and hence were difficult to program. This resulted in lack of versatility and speed. In addition, to run on different types of computers, instructions must be rewritten or recompiled.

Hardware Technology : Vacuum tubes for circuitry and magnetic drums for memory. Input to the computer was through punch cards and paper tapes. Output is displayed as printouts.

Software Technology : The instructions were written in machine language. They can solve one problem at a time.

Computing Characteristics : Computation time was in Milliseconds

Physical Appearance : The computers were enormous in size and required a large room for installation.

Application : Used for scientific applications as they were the fastest computing devices on their time.

Examples: Electronic Numerical Integrator and Calculuter(ENIAC), Elcetronic Discrete Variable Automatic Computer(EDVAC), and UNIVersal Automatic Computer(UNIVAC).

Characteristics of First Generation Computers

- These computers were based on vacuum tube technology.

- These were the fastest computing devices of their times (computation time was in milliseconds).
- These computers were very large, and required a lot of space for installation.
- Since thousands of vacuum tubes were used, they generated a large amount of heat. Therefore, air conditioning was essential.
- These were non-portable and very slow equipments.
- They lacked in versatility and speed.
- They were very expensive to operate and used a large amount of electricity.
- These machines were unreliable and prone to frequent hardware failures. Hence, constant maintenance was required.
- Since machine language was used, these computers were difficult to program and use.
- Each individual component had to be assembled manually. Hence, commercial appeal of these computers was poor.
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SECOND GENERATION (1956–63): TRANSISTORS

Second generation computers used transistors, which were superior to vacuum tubes. A transistor is made up of semiconductor material like germanium and silicon. It usually had three leads and performed electrical functions such as voltage, current or power amplification with low power requirements. Computers became smaller, faster, cheaper, energy-efficient and more reliable than their predecessors. In second generation computers, magnetic cores were used as primary memory and magnetic disks as secondary storage devices. However, they still relied on punched cards for input and printouts for output.

One of the major developments of this generation includes the progress from machine language to assembly language. Assembly language used mnemonics (abbreviations) for instructions rather than numbers, for example, ADD for addition and MULT for multiplication. As a result, programming became less cumbersome. Early high-level programming languages such as COBOL and FORTRAN also came into existence in this period.

Hardware Technology - It uses transistors which is made up of semiconductor material like germanium and silicon.

- It usually had three leads and performed electrical functions such as voltage, current or power amplification with low power requirements.

- Since transistor is a small device, the physical size of computers was greatly reduced. Computers became smaller, faster, cheaper, energy-efficient and more reliable than their predecessors.
- In second generation computers, magnetic cores were used as primary memory and magnetic disks as secondary storage devices. However, they still relied on punched cards for input and printouts for output.

Software Technology - Progress from machine language to assembly language. As a result, programming became less cumbersome. Early high-level programming languages such as COBOL and FORTRAN also came into existence in this period.

Computing Characteristics : Computation time was in microseconds

Physical Appearance : Transistors are smaller in size compared to vacuum tubes thus, size of the computer is also reduced.

Application : The cost of commercial production of these computers was very high

Examples: PDP-8, IBM 1401 and IBM 7090.

Characteristics of Second Generation Computers

- These machines were based on transistor technology.
- These were smaller as compared to the first generation computers.
- The computational time of these computers was reduced to microseconds from milliseconds.
- These were more reliable and less prone to hardware failure. Hence, such computers required less frequent maintenance.
- These were more portable and generated less amount of heat.
- Assembly language was used to program computers. Hence, programming became more time-efficient and less cumbersome.
- Second generation computers still required air conditioning.
- Manual assembly of individual components into a functioning unit was still required.

THIRD GENERATION (1964 - EARLY 1970S) : INTEGRATED CIRCUITS

The development of the integrated circuit was the trait of the third-generation computers. Also called an IC, an integrated circuit consists of a single chip (usually silicon) with many components such as transistors and resistors fabricated on it. Integrated circuits replaced several individually wired transistors. This development made computers smaller in size, reliable, and efficient.

Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with operating system. This allowed the device to run many different applications at one time with a central program that monitored the memory. For the first time, computers became accessible to mass audience because they were smaller and cheaper than their predecessors.

Hardware Technology - Use of integrated circuits(IC) which consists of a single chip (usually silicon) with many components such as transistors and resistors fabricated on it.

- ➨ It replaced several individually wired transistors. This development made computers smaller in size, reliable, and efficient.
- ➨ Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with operating system.
- ➨ This allowed the device to run many different applications at one time with a central program that monitored the memory. For the first time, computers became accessible to mass audience because they were smaller and cheaper than their predecessors.

Software Technology : Keyboard and monitor were interfaced through operating system.

- ➨ OS allows different applications to run at the same time
- ➨ High level languages were used extensively for programming

Computing Characteristics : Computation time was in nanoseconds

Physical Appearance : The size of these computers was quite small compared to second generation

Application : Computer became accessible to mass audience.

➨ Computer produced commercially.
➨ Were smaller and cheaper

Examples: NCR 395 and B6500.

## Characteristics of Third Generation Computers

- These computers were based on integrated circuit (IC) technology.
- They were able to reduce computational time from microseconds to nanoseconds.
- They were easily portable and more reliable than the second generation.
- These devices consumed less power and generated less heat. In some cases, air conditioning was still required.
- The size of these computers was smaller as compared to previous computers.
- Since hardware rarely failed, the maintenance cost was quite low.
- Extensive use of high-level languages became possible.
- Manual assembling of individual components was not required, so it reduced the large requirement of labour and cost. However, highly sophisticated technologies were required for the manufacture of IC chips.
- Commercial production became easier and cheaper.

FOURTH GENERATION(EARLY 1970S-TILL DATE): MICROPROCESSORS

The fourth generation is an extension of third generation technology. The Intel 4004 chip, which was developed in 1971, took the integrated circuit one step further by locating all the components of a computer (central processing unit, memory, and input and output controls) on a *minuscule* chip. A microprocessor is built onto a single piece of silicon, known as **chip**. It is about 0.5 cm along one side and no more than 0.05 cm thick.

The fourth generation computers led to an era of *Large Scale Integration* (LSI) and *Very Large Scale Integration* (VLSI) technology. LSI technology allowed thousands of transistors to be constructed on one small slice of silicon material whereas VLSI squeezed hundreds of thousands of components on to a single chip. Ultra-large scale integration (ULSI) increased that number into millions. This way computers became smaller and cheaper than ever before.

The fourth generation computers became more powerful, compact, reliable, and affordable. As a result, it gave rise to the personal computer (PC) revolution. During this period, magnetic core memories were substituted by semiconductor memories, which resulted in faster random access main memories. Moreover, secondary memories such as
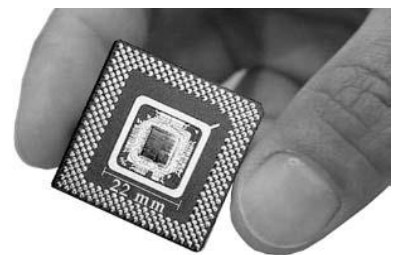
hard disks became economical, smaller, and bigger in capacity. The other significant development of this era was that these computers could be linked together to form networks, which eventually led to the development of the Internet. This generation also saw the development of the GUIs (Graphical User Interfaces), mouse, and handheld devices. Despite many advantages, this generation required complex and sophisticated technology for the manufacturing of CPU and other components.

Hardware Technology :

- Also based on the integrated circuit but ICs have been made readily available to us because of the development of the microprocessor (circuits containing millions of transistors). Inter 4004 wa the first microprocessor
- This generation led to an era of *Large Scale Integration* (LSI) and *Very Large Scale Integration* (VLSI) technology. Thousands of components to be integrated in a small chip.
- Semiconductor memory resulted fast random access to memory
- Formation of network and Internert
- This generation also saw the development of pointing devices like mouse, and handheld devices.
- Despite many advantages, this generation required complex and sophisticated technology for the manufacturing of CPU and other components.

Software Technology :

- Development of OS like MS-DOS and MS Windows
- development of the GUIs (Graphical User Interfaces)
- High level languages

Computing Characteristics : Computation time in picoseconds

Physical Appearance : Smaller than previous generation.Handheld

Application : Available for commercial purposes.Personal Computers became available to home user.IBM introduced the first computer for home use

Examples: Apple II, Altair 8800, and CRAY-1.

Characteristics of Fourth Generation Computers

- Fourth generation computers are microprocessor-based systems.
- These computers are very small.

- Fourth generation computers are the cheapest among all the other generations.
- They are portable and quite reliable.
- These machines generate negligible amount of heat, hence they do not require air conditioning.
- Hardware failure is negligible, so minimum maintenance is required.
- The production cost is very low.
- GUI and pointing devices enable users to learn to use the computer quickly.
- Interconnection of computers leads to better communication and resource sharing.

FIFTH GENERATION (PRESENT AND BEYOND): ARTIFICIAL INTELLIGENCE

The dream of creating a human-like computer that would be capable of reasoning and reaching a decision through a series of "what-if-then" analyses has existed since the beginning of computer technology. Such a computer would learn from its mistakes and possess the skill of experts. These are the objectives for creating the fifth generation of computers. The starting point for the fifth generation of computers has been set in the early 1990s. The process of developing fifth generation of computers is still in the development stage. However, the expert system concept is already in use. The **expert system** is defined as a computer information system that attempts to mimic the thought process and reasoning of experts in specific areas.

Characteristics of Fourth Generation Computers

- **Mega Chips**: Fifth generation computers will use *Super Large Scale Integrated* (*SLSI*) chips, which will result in the production of microprocessor having millions of electronic components on a single chip. In order to store instructions and information, fifth generation computers require a great amount of storage capacity. Mega chips may enable the computer to approximate the memory capacity of the human mind.
- **Parallel Processing**: Most computers today access and execute only one instruction at a time. This is called **serial processing**. However, a computer using parallel processing accesses several instructions at once and works on them at the same time through the use of multiple central processing units.
- **Artificial Intelligence (AI)**: It refers to a series of related technologies that tries to simulate and reproduce human behaviour, including thinking, speaking and reasoning. AI comprises a group of related technologies:

expert systems (ES), natural language processing (NLP), speech recognition, vision recognition, and robotics.

CLASSIFICATION OF COMPUTERS

i)	Based on Hardware design	a) Analog b) Digital c) Hybrid
ii)	Based on Utility	a) General purpose computers b) Special purpose computers
iii)	Based on Size and Capacity	a) Micro computer b) Mini computer c) Mainframe computer d) Super computer
iv)	Based on Mode of use	a) Palmtop PCs b) Laptop PCs c) Personal computer d) Work station e) Mainframe system f) Clients and Server

Based on Hardware Design : Analog Computers

- Represents data as variable across a continuous range of values
- Used for measuring parameters that vary continuously in real time, such as temperature, pressure and voltage
- More flexible but less precise
- It operates by measuring

Based on Hardware Design : Digital Computers

- Uses distinct values to represent data internally. All information are represented using 0s and 1s.
- It operates by counting.

- High speed and more accurate

Based on Hardware Design : Hybrid Computers

- In Hybrid Computer, an attempt is made to combine the qualities of both analog and digital computer
- Measuring functions are performed by the analog way, while control and logic functions are digital in nature

Difference between Analog and Digital Computers

S.No.	Analog Computers	Digital Computers
1.	It operates by measuring.	It operates by counting.
2.	It requires physical analog.	It functions on discrete numbers.
3.	The calculations are first converted to equation and later converted into electrical signals.	The calculations are converted into binary numbers (1's and 0's)
4.	The output is in the form of graph.	The output is in the form of discrete values.
5.	Less accurate.	More accurate.
6.	Less speed.	High speed.
7.	Limited memory.	More memory.
8.	Lack of flexibility.	Highly flexible.
9.	Cannot process alphanumeric information.	Can process alphanumeric information.
10.	Limited applications.	Many number of applications.
11.	Not suitable for Business applications.	Highly suitable to business application.

Based on Utility : General Purpose Computer

- Designed and constructed to cater almost all the needs of the society.

- Able to perform according to the programs created to meet different needs
- Eg : financial accounting, mathematical calculation, designing textile prints, controlling machinery etc.

Based on Utility : Special Purpose Computer

- Designed to preform special functions. In such devices instructions are permanently programmed.
- The instructions needed to perform the particular task are incorporated into the internal memory of the computer
- Eg : Aircraft control system, electronic voting machine

Based on Mode of Use : Palmtop Computer

- Accepts handwritten inputs using an electronic pen
- These have small disk storage and can be connected to a wireless network.
- One has to train the system on user's handwriting before it can be used
- Also can be used as a mobile phone, email, fax
- Microsoft Operating System used – Windows CE

Based on Mode of Use : Laptop Computer

- Also known as Notebook Computers
- Small in size ,portable, has battery backup and has all the functionalities of a desktop
- They use a keyboard, flat screen liquid crystal display, and a Pentium processor
- Can be connected to network

Based on Mode of Use :Personal Computers

- Designed to meet the personal computing requirements of users at working place or at home
- It is a stand-alone, Non-portable, general purpose computer that can be placed on the desk
- The personal computers configuration varies from one PC to another PC depending on their use.
- Externally, it consists of three units—keyboard, monitor, and a system unit containing the CPU, memory, hard disk drive, etc.
- It is not very expensive and is suited to the needs of a single user at home, small business units, and organizations.
- Apple, Microsoft, HP, Dell and Lenovo are some of the PC manufacturers. .
- IBM was the first computer to introduce and popularize use of desktops.

Based on Mode of Use : Work Stations

- Powerful desktop computer designed to meet the computing need of users or clients with better processing, high storage capacity and with efficient and effective graphics display facility.
- Looks similar to a personal computer and can be used by only one person at a time through LAN

- used for engineering applications (CAD/CAM), desktop publishing, software development, and other such types of applications which require a moderate amount of computing power and relatively high-quality graphics capabilities.
- Workstations generally come with a large, high-resolution graphics screen, a large amount of RAM, inbuilt network support, and a graphical user interface. Most workstations also have mass storage device such as a disk drive, but a special type of workstation, called diskless workstations, comes without a disk drive

- Common operating systems for workstations are UNIX and Windows NT. Like PC, workstations are also single-user computers like PC but are typically linked together to form a local area network, although they can also be used as stand-alone systems.

Based on Mode of Use : Mainframe Computers

- Commonly used for handling an environment where a large no.of users need to share a common computing facility.
- It is housed in a central location with several user terminals and peripherals connected to it.
- The user terminals are connected with the host processor for accessing as and when required.
- Used by organizations like banks, airlines and railways to handle millions and trillions of online transactions per second.
- Some examples of mainframes are CDC 6600 and IBM ES000 series.

- multi-user, multiprogramming and high performance computers.
- They operate at a very high speed, have very large storage capacity and can handle the workload of many users.
- Large and powerful systems generally used in centralized databases.
- The user accesses the mainframe computer via a terminal that may be a dumb terminal, an intelligent terminal or a PC. A *dumb terminal* cannot store data or do processing of its own. It has the input and output device only. An *intelligent terminal* has the input and output device, can do processing, but, cannot store data of its own. The dumb and the intelligent terminal use the processing power and the storage facility of the mainframe computer. Mainframe computers are used in organizations like banks or companies, where many people require frequent access to the same data.
- 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

Based on Mode of Use : Clients and Servers

- With the increased gain of computer networks, it is possible to interconnect several computers for communicating over the networks to share the several resources or services among the multiple user.
  - Server – A large computer that manages a shared resources and provides a set of shared user services to the client
  - Client – A single user personal computer or workstation and supports a user friendly interface to the end user.It sends request to the server and then gain access with the server.
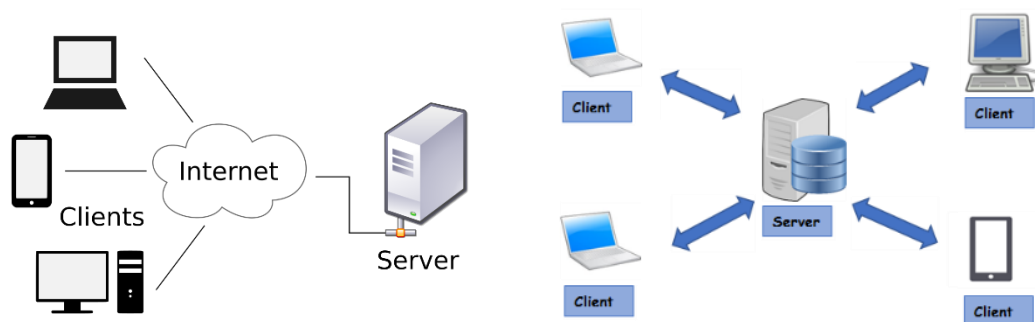
Based on Size and Capacity : Micro Computers

- Small, low-cost, single user, digital computers consists of CPU, input unit, output unit, storage unit and software
- They can be connected together to create network of computers that can serve more than one user. Eg : IBM PC based on Pentium processor,Apple Macintosh
- Types of Microcomputer :-

  1. Desktop Computer/Personal Computer(PC)
  2. Notebook Computers/Laptop

3. Netbook- Smaller notebooks optimized forlow weight and low cost and are designed to accessing web-based applications like video streaming,email,web surfing and instant messaging
4. Tablet Computer – has features of the notebook but it can accept input from a stylus or a pen
5. Handheld Computer / Personal Digital Assistant(PDA)

   o Small computer that can be held on the top of the palm.
   o Uses stylus or a pen instead of keyboard.
   o Does not have disk drive.
   o Have limited memory and less powerful
   o Can be connected to internet vis wireless connection.
   o Over last few years PDAs are merged into mobile phones to create smart phones
   o Eg : Casio,Apple

6. Smart Phones

   o Cellular phones that function both as a phone and a small PC
   o May use stylus or a pen or have a small keyboard
   o Accessibility to internet

| Desktop PC | Laptop/notebook PC | Netbook PC |
| Tablet PC | PDA | Smartphone |

7.

Based on Size and Capacity : Mini Computers

- Digital computers generally used in multi-user systems
- High storage capacity, high processing speed than micro computers
- Support 4-200 users simultaneously
- Users can access mini computer through their PCs or terminals
- Used for real time applications in industry,research centres etc.
- Eg : PDP 11,IBM(8000 Series)

Based on Size and Capacity : Supercomputers

- Fastest,costliest and most powerful computers available on Earth.
- Used for carrying out complex, fast and time intensive calculations for scientific and engineering applications.
- Supercomputer's speed/ 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, solve multi-variant mathematical problems of existent physical processes, such as aerodynamics, metrology, and plasma physics and for military strategists to simulate defence scenarios.
- Super computers are the special purpose machines, which are specially designed to maximise the numbers of FLOPS (Floating Point Operation Per Second). Any computer below one gigaflop/sec is not considered a super computer.
- It basically contains a number of CPUs that operate in parallel to make it faster. Its processing speed lies in the range of 400–10,000 MFLOPS (Millions of Floating Point Operation Per Second). Due to this feature, super computers help in many applications such as information retrieval computer-aided design.
- A super computer can process a great deal of information and make extensive calculations very, very quickly. They can resolve complex mathematical equations in a few hours, which would have taken a. Cinematic specialists use them to produce sophisticated movie animations. Scientists build complex models and simulate them in a super computer.
- Examples of super computers are CRAY–3, Cyber 205, and PARAM.
- PARAM is a series of supercomputer assembled in India by C-DAC in Pune.Param Padma is the latest machine in this series. It has 1 Tera FLOP computing power.

Applications of Computer

1. **Office Automation**
2. Essential requirements of today's office environment are
    o   To reduce cost of administrative overhead;
    o   To increase the efficiency of office tasks;
    o   To provide better service to the customers;
    o   To provide accurate information to the management;
    o   To provide best and fastest way of communication.
3. The basic functions, which are needed to be automated in any office are
    o   Document Generation: Typewriters, computers and printers are widely used in automating this routine task of offices.
    o   Document Processing- word processing, desktop publishing etc. are used to perform this task.
    o   Document Distribution: All offices require an electronic distribution system for transferring documents and data within and outside the organization. Eg: Photocopiers, Teletax and Fax machines.
    o   Archival Storage: The office documents are also needed to be stored for a long period, so that they can be retrieved when required. This task is achieved by the use of different storage devices like tapes, disks etc.

2. Data Processing

-   Data processing is the collection and manipulation of items of data to produce meaningful information.
-   Computerized data processing, or Electronic data processing represents a later development, with a computer used instead of several independent pieces of equipment.

- Data processing, Manipulation of data by a [computer](). It includes the conversion of raw data to machine-readable form, flow of data through the [CPU]() and memory to output devices, and formatting or transformation of output. Any use of computers to perform defined operations on data can be included under data processing. In the commercial world, data processing refers to the processing of data required to run organizations and businesses.

3.Information processing

- Information processing refers to the manipulation of digitized information by computers and other digital electronic equipment
- Information processing systems include business software, operating systems, computers, networks and mainframes. Whenever data needs to be transferred or operated upon in some way, this is referred to as information processing
- Information processing began decades ago as businesses and governments sought to be able to process large amounts of data, often statistical or calculated from gathered data.

4. Engineering/Architecture/Manufacturing

- The architects and engineers are extensively using computers in designing and drawings. Computers can create objects that can be viewed from all the three dimensions. By using techniques like virtual reality, architects can explore houses that have been designed but not built. The manufacturing factories are using computerized robotic arms in order to perform hazardous jobs. Besides, Computer Aided Manufacturing (CAM) can be used in designing the product, ordering the parts, and planning production. Thus, computers help in coordinating the entire manufacturing process.

5.Commercial Use

- Communication: E-mail or Electronic Mail is one of the communication media in which computer is used. Through e-mail, messages and reports are passed from one person to one or more persons with the aid of computer and telephone line. The advantage of this service is that while transferring the messages it saves time, avoids wastage of paper, and so on. Moreover, the person who is receiving the messages can read the messages whenever he is free and can save it, reply it, forward it or delete it from the computer.

- Business Application: This is one of the important uses of the computer. Initially, computers were used for batch processing jobs, where one does not require the immediate response from the computer. Currently, computers are mainly used for real time applications (like at the sales counter) that require immediate response from the computer. There are various concerns for which computers are used such as in business forecasting, to prepare pay bills and personal records, in banking operations and data storage, in various types of Life Insurance Business, and as an aid to management. Businesses are also using the networking of computers, where a number of computers are connected together to share the data and the information. Use of e-mail and Internet has changed the ways of doing business.

- Banking: In the field of banking and finance, computers are extensively used. People can use the ATM (Automated Teller Machine) services 24 hours of the day in order to deposit and withdraw cash. When the different branches of the bank are connected through the computer networks, the inter branch transactions such as cheque and draft can be performed by the computers without any delay.

6.Medicine and Health Care

- There has been an increasing use of computers in the field of medicine. Now, doctors are using computers right from diagnosing the illness to monitoring a patient's status during complex surgery. By using automated imaging techniques, doctors are able to look inside a person's body and can study each organ in detail (such as CAT scans or MRI scans), which was not possible few years ago. There are several examples of special purpose computers that can operate within the human body such as a cochlear implant, a special kind of hearing aid that makes it possible for deaf people to hear.

7.Education

- Computers have also revolutionized the whole process of education. Currently, the classrooms, libraries, and museums are utilizing computers to make the education much more interesting. Unlike recorded television shows, Computer Aided Education (CAE) and Computer Based Training (CBT) packages are making learning much more interactive.

8.Entertainment

- Computers are finding greater use in entertainment industry. They are used to control the images and sounds. The special effects, which mesmerise the

audience, would not have been possible without the computers. In addition, computerised animation and colourful graphics have modernised the film industry.

- **9.Other Applications**
- Science: Scientists have been using computers to develop theories, to analyse, and test the data. The fast speed and the accuracy of the computer allow different scientific analyses to be carried out. They can be used to generate detailed studies of how earthquakes affect buildings or pollution affects weather pattern. Satellite-based applications have not been possible without the use of computers. It would also not be possible to get the information of our solar system and the cosmos without computers.
- Publishing: Computers have created a field known as DTP (Desktop Publishing). In DTP, with the help of computer and a laser printer one can perform the publishing job all by oneself. Many of the tasks requiring long manual hours such as making table of contents and index can be automatically performed using the computers and DTP software.
- Sports: A computer can be used to watch a game, view the scores, improve the game, play games (like chess, etc.) and create games. They are also used for the purposes of training players.
- Advertising: Computer is a powerful advertising media. Advertisement can be displayed on different websites, electronic-mails can be sent and reviews of a product by different customers can be posted. Computers are also used to create an advertisement using the visual and the sound effects. For the advertisers, computer is a medium via which the advertisements can be viewed globally. Web advertising has become a significant factor in the marketing plans of almost all companies. In fact, the business model of Google is mainly dependent on web advertising for generating revenues

S.No.	Area	Applications
1.	General Business	Payroll Accounts Receivable and Payables General Ledger Inventory Control and Management Tax Preparation Human Resource Development Office Automation Customer Records Time Sharing
2.	Process Manufacturing	Database Order Processing Purchasing Accounting Inventory Control Process Control Simulation Revenue Models
3.	Discrete Manufacturing	Accounting Order Entry and Processing Purchasing Forecasting Numeric Control Design Automation Production Scheduling Market Analysis Standard Costing Production Planning CAD/CAM Accounting

S.No.	Area	Applications
4.	Banking	Deposit Accounting Cost Control Proof and Transit Operations Automatic Teller Machine system (ATMs) Portfolio Analysis Electronic Fund Online Transactions Centralized File System Cash Flow Analysis
5.	Retail Sales	Customer Billing Sales Analysis Accounting Inventory Reporting Sales Forecasting Merchandising Cash Flow Analysis
6.	Government	Budgeting Tariff Analysis Tax Collection, Reporting and Accounting Licence and Permit Elections Administration and Accounting Welfare Pollution Control Central Data Bank Intelligence
7.	Insurance	Customer Billing Premium Accounting External Reports Reserve Calculating Investment Analysis Cash Flow Analysis Claims Processing Commissions and Agency Reporting

S.No.	Area	Applications
8.	Transportation	Reservation System Vehicle Maintenance Rate Calculation Accounting Cost Analysis Automatic Rating Traffic Analysis
9.	Public Utilities	Customer Billing Meter Reading Rate Analysis Operational Simulation Accounting
10.	Education	Attendance Counting Computer Based Training Computer Assisted Instructions Grading and Scoring Alumni Records Online Library Students History
11.	Distribution	Order Processing Inventory Control Purchasing Warehouse Control Vehicle Scheduling Forecasting
12.	Printing and Publishing	Circulation Accounting Classified Advertisements Automatic Typesetting Media Analysis Word Processing Computer Aided Design / Graphics Page Formatting

S.No.	Area	Applications
13.	Health Care / Medicine	Patient Accounting Diagnosis Patient History Health Care Statistics Intensive Care Lab/ Operation Scheduling
14.	Entertainment	Video Games Synthesized Music Movies Editing Music Visualization