

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

A computer performs the following functions –

- **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.

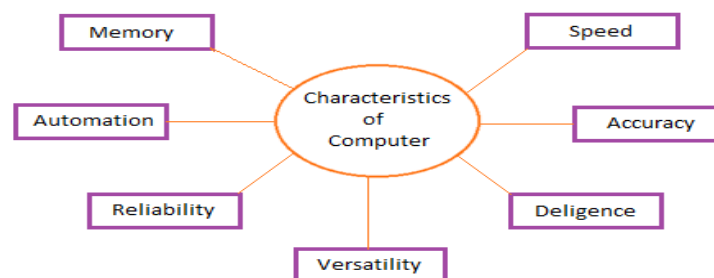
- **Storing the information**

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.

The characteristics/Features of the computer system are as follows –



Computer has the following features:

1. High speed
2. Accuracy
3. Storage Capability
4. Diligence
5. Versatility
6. Reliability
7. Automation
8. Reduction in Paperwork and Cost

1. High Speed

- Computer is a very fast machine.
- Computers are capable of calculating huge amounts of data.
- Computer can do Millions of Calculations in a matter of time, for which a simple person takes a lot of time to do the work; a computer can do that work very well in a very short time.

2. Accuracy

- Computers are very fast as well as very accurate.
- The calculation done by the computer is 100% correct and the error is negligible.
- The computer works with 100% accuracy if the user input is correct.

3. Storage Capability

- Computer can store a large amount of data, which is the biggest feature of a computer.
- Inside the computer, we can store many types of data such as images, videos, text, audio, files, etc.
- Computer can store a lot more data than a human.

4. Diligence

- Computers never tired like humans.
- The computer can work continuously without stopping, without tiredness, and without any error and boredom.
- Computers can perform one or more tasks continuously with great accuracy and same speed.

5. Versatility

- Computer is a very flexible machine; it is very easy to run.
- Computer is a machine whose are used in various areas to solve a wide range of problems.
- Somewhere it is used in Calculation and somewhere it is used for playing games.

6. Reliability

- Computers are reliable machines due to their large storage capacity and accuracy.
- Computers are designed to make everyday tasks easier.

7. Automation

A computer is an automatic machine. A computer performs all its functions automatically. This means once the computer starts a task; it does the work without any human intervention.

8. Reduction in Paperwork and Cost

In big companies, computers are used to reduce paperwork. There are many such works, which can cost more over time if work is done by the workers, but time and money are saved by doing the same work by the computer.

Despite all these features, there are some limitations of computers. Let's know about these limitations of computers.

Limitations of Computer

- **No Intelligence**
- **Dependency**
- **No feeling**

1. No Intelligence

Computer is a machine that cannot take any decision on its own, due to which if we have to do any work with the help of computer, then we have to tell the computer all the things step by step.

2. Dependency

Computer is dependent on humans because if we have to do any work with the help of computer, then it has to be explained step by step. Also, even if there is no electricity in the computer, the computer cannot work, in this way, it depends on electricity to work.

3. No feeling

Unlike humans, computers cannot make decisions based on taste, experience, and knowledge. There is no emotion inside the computer. The way we humans learn from our experiences, the computer cannot learn from their experiences.

Although the computer does not have the ability to make decisions. But today to make the ability of decisions in computers is being developed by Artificial intelligence. So that they can make their own decisions and learn from their experiences.

Generations of Computers

1. First Generation Computers

In the period of the year **1946-1959**, it was referred to as the period of the first generation of computers. These machines are slow, huge, and expensive. In this generation of computers, **vacuum tubes were used as the basic components of CPU and memory**. Also, they were mainly dependent on the batch operating systems and punch cards. Magnetic tape and paper tape were used as output and input devices. For example ENIAC (**Electronic Numerical Integrator and Computer**), UNIVAC-1(**Universal Automatic Computer**), EDVAC (**Electronic Discrete Variable Automatic Computer**), etc.



Characteristics of First Generation Computer Vacuum Tubes

1. Sizes of these computers were as large as the size of a room.
2. Vacuum Tubes to perform calculation.
3. Use capacitors to store binary data and information.
4. They use punched card for communication of input and output data and information.
5. They generated a lot of heat.

Features of First Generation Computers

1. Vacuum tube technology.
2. Supported machine language only.
3. Very costly.
4. Generates a lot of heat.
5. Huge size.
6. Need of AC.
7. Non-portable.
8. Consumes lot of electricity.

2. Second Generation Computers

In the period of the year, **1959-1965** was referred to as the period of the second generation of computers. It was the time of the transistor computers. In the second generation of computers, **transistors** (which were cheap in cost) are used. Transistors are also compact and consume less power. Transistor computers are faster than first-generation computers. For primary memory, magnetic cores were used, and for secondary memory magnetic disc and tapes for storage purposes. In second-generation computers, COBOL and FORTRAN are used as Assembly language and programming languages, and Batch processing and multiprogramming operating systems were used in these computers.

For example IBM 1620, IBM 7094 etc.

Second Generation of Computers



Transistor

Characteristics of Second Generation Computer

1. The computers were still large, but smaller than the first generation of computers.
2. They use transistors in place of Vacuum Tubes to perform calculations.
3. Possession of magnetic tapes for data storage.
4. They were using punch cards as input and output of data and information. The use of the keyboard as an input device was also introduced.
5. These computers were still generating a lot of heat in which an air conditioner is needed to maintain a cold temperature.

Features of Second Generation Computers

1. Use of transistors.
2. Smaller size as compared to first-generation computers.
3. Generates less heat as compared to first-generation computers.
4. Consumed less electricity as compared to first-generation computers.
5. Faster than first-generation computers.
6. Still very costly.
7. AC required.
8. Supported machine and assembly languages.

3. Third Generation Computers

The period of **1965-1971** was mainly the time of Third generation computers. In the third generation of computers, integrated circuits (ICs) were used instead of transistors (in the second generation). A single IC consists of many transistors which increased the power of a computer and also reduced the cost. The third generation computers are more reliable, efficient, and smaller in size. It used remote processing, time-sharing, and multiprogramming as operating systems. FORTRON-II TO IV, COBOL, and PASCAL PL/1 were used which are high-level programming languages.

For example IBM-360 series, Honeywell-6000 series, IBM-370/168, etc.

Characteristics of Third Generation Computer Integrated Circuits

1. They used large-scale integrated circuits, which were used for both data processing and storage.
2. They were reduced in size compared to the previous generation.
3. The keyboard and mouse were used for input while the monitor was used as an output device.
4. Use of programming languages like COBOL and FORTRAN were developed.

Features of Third Generation Computers

1. IC used more reliable in comparison to the previous two generations.
2. Smaller size.
3. Generated less heat.
4. Faster.
5. Costly.
6. AC required.
7. Consumed lesser electricity.
8. Supported high-level language.

4. Fourth Generation Computers

The period of **1971-1980** was mainly the time of fourth generation computers. It used VLSI (Very Large Scale Integrated) circuits. VLSI is a chip containing millions of transistors and other circuit elements and because of these chips; the computers of this generation are more compact, powerful, fast, and affordable (low in cost). Real-time, time-sharing and distributed operating systems are used by these computers. C and C++ are used as the programming languages in this generation of computers.

For example STAR 1000, PDP 11, CRAY-1, CRAY-X-MP, etc.

Characteristics of fourth generation computer Microprocessors:

- Uses of microprocessor which performs all the task of a computer system use today.
- The size of computers and cost was reduced.
- Increase in speed of computers.
- Very-large-scale (VLS) integrated circuits were used.

Features of fourth generation computer:

1. VLSI technology used.
2. Very cheap.
3. Use of PCs.
4. Very small size.
5. No AC required.
6. The concept of the internet was introduced.
7. Computers became easily available.

5. Fifth Generation Computers

From 1980 – to till date these computers are used. The ULSI (Ultra Large Scale Integration) technology is used in fifth-generation computers instead of the VLSI technology of fourth-generation computers. Microprocessor chips with ten million electronic components are used in these computers. Parallel processing hardware and AI (Artificial Intelligence) software are also used in fifth-generation computers. The programming languages like C, C++, Java, .Net, etc. are used.

For example Desktop, Laptop, Notebook, Ultra Book, etc.

Characteristics of fifth generation of computer present and beyond:

1. Consists of extremely large-scale integration.
2. Parallel processing
3. The ability of computers to mimic human intelligence, e.g. voice recognition, facial face detector, thumbprint.
4. Satellite links, virtual reality.

Features of Fifth Generation Computer:

- ULSI Technology (Ultra Large Scale Integration Technology)
- Development of true artificial intelligence
- Advancement in Parallel Processing
- More user-friendly interfaces with multimedia features
- Availability of very powerful and compact computers at cheaper rates

Computer Generations	Main electronic component	Programming language	Main memory	Input/output devices	Speed and size
First Generation (1946-1959)	Vacuum tube.	Machine language	Magnetic tapes and magnetic drums.	Magnetic tapes and magnetic drums.	Very slow and very large in size (often taking up entire room).
Second Generation (1959-1965)	Transistor.	Machine language and assembly language.	Magnetic core and magnetic tape/disk.	Magnetic tape and punched cards.	Smaller in size, low power consumption, and generated less heat
Third Generation (1965-1971)	Integrated circuits (ICs)	High-level language (COBOL and FORTRAN)	Large magnetic core, magnetic tape/disk	Magnetic tape, monitor, keyboard, printer, etc.	Faster and reduced in size compared to the previous generation
Fourth Generation (1971-1980)	Very large-scale integration (VLSI) and the microprocessor (VLSI has thousands of transistors on a single microchip).	C and C++	Semiconductor memory (such as RAM, ROM, etc.)	pointing devices, optical scanning, keyboard, monitor, printer, etc.	Increase in speed of computers.
Fifth Generation (1980 – to till)	Based on artificial intelligence, uses the Ultra Large-Scale Integration (ULSI) technology and parallel processing method (ULSI has millions of transistors on a single microchip and Parallel processing method use two or more microprocessors to run tasks simultaneously).	Understand natural language (human language). (C, C++, Java, .Net, etc. are used.)	Biochip made up of protein fiber Gallium Arsenide (GA) WILL BE USED AS A MEMORY DEVICE	Trackpad (or touchpad), touchscreen, pen, speech input (recognize voice/speech), light scanner, printer, keyboard, monitor, mouse, etc.	Portable and small in size.

History of Computers

The first counting device was used by the primitive people. They used sticks, stones and bones as counting tools. As human mind and technology improved with time more computing devices were developed. Some of the popular computing devices starting with the first to recent ones are described below;

Abacus

The history of computer begins with the birth of abacus which is believed to be the first computer. It is said that Chinese invented Abacus around 4,000 years ago.

It was a wooden rack which has metal rods with beads mounted on them. The beads were moved by the abacus operator according to some rules to perform arithmetic calculations. Abacus is still used in some countries like China, Russia and Japan. An image of this tool is shown below;



Pascaline

Pascaline is also known as Arithmetic Machine or Adding Machine. It was invented between 1642 and 1644 by a French mathematician-philosopher Blaise Pascal. It is believed that it was the first automatic calculator.

Pascal invented this machine to help his father, a tax accountant. It could only perform addition and subtraction. It was a wooden box with a series of gears and wheels. When a wheel is rotated one revolution, it rotates the neighboring wheel. A series of windows is given on the top of the wheels to read the totals. An image of this tool is shown below;



Difference Engine

In the early 1820s, it was designed by Charles Babbage who is known as "Father of Modern Computer". It was a mechanical computer which could perform simple calculations. It was a steam driven calculating machine designed to solve tables of numbers like logarithm tables.



Analytical Engine

This calculating machine was also developed by Charles Babbage in 1830. It was a mechanical computer that used punch-cards as input. It was capable of solving any mathematical problem and storing information as a permanent memory.



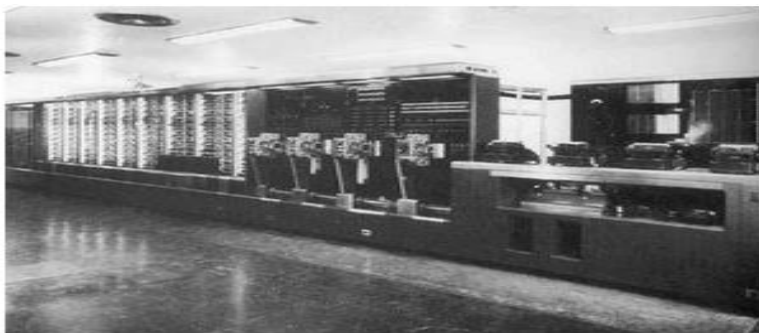
Differential Analyzer

It was the first electronic computer introduced in the United States in 1930. It was an analog device invented by Vannevar Bush. This machine has vacuum tubes to switch electrical signals to perform calculations. It could do 25 calculations in few minutes.



Mark I

The next major changes in the history of computer began in 1937 when Howard Aiken planned to develop a machine that could perform calculations involving large numbers. In 1944, Mark I computer was built as a partnership between IBM and Harvard. It was the first programmable digital computer.



Uses of Computer

Computers are playing a vital role in almost every field and making our day-to-day tasks more manageable. Computers were only used to perform complex numerical calculations in a previous time, but they have reached too far and now perform many different roles. They are now performing diverse set functions from complicated calculations to generating business reports, bill generation to education, programming or development to entertainment, etc.

Because of their characteristics and powerful functionalities, computers are used in various fields, such as homes, businesses, government offices, research organizations, educational institutions, medical, entertainment, etc. Computers have taken industries and businesses to a whole new level. In this article, we have elaborated the most common uses of computers in different fields:

Business

Currently, computers can be seen in almost every business. Computers are almost part of a business setup because they increase productivity and help race in a competitive environment. In businesses, computers are primarily used to store and manage accounts and personal data, maintain projects, track inventory status, and make reports and presentations. Besides, computers are best suited for transaction processing because they are more accurate and faster than humans.

Science

Scientists are amongst one of those people who use computers as their primary work tool. In science, research and engineering, computers are best suited for collecting, analyzing, categorizing, and storing the data. They also help scientists to exchange data with each other both internally and internationally. Computers enable scientists from different locations (such as different countries) to work together on the same project with cloud support. Besides, computers play a crucial role in launching, maintaining, controlling spacecraft, and operating many other technologies.

Government

In the government sector, computers are beneficial. They are getting used to performing various functions in different departments and improving their services' quality, efficiency, and productivity. Some examples of such services are city planning, traffic control, law enforcement, infrastructure developments, and tourism.

Health and Medical

Computers are radically changing the methods of diagnosis in hospitals. They are used for maintaining patients' information, records, live monitoring of patients, X-rays, and more.

Everything is being digitized with the help of computers. Computers help configure lab-tools, monitor heart rate, and blood pressure, etc. Doctors get extra advantages in treating patients with proper drugs and medicines. Additionally, computers enable doctors to exchange patient's data easily with other medical specialists. Besides, advanced surgical devices are based on robotics that helping surgeons to conduct complex operations and surgeries remotely.

Education

Computers are broadly getting used in the education field. They help people get different educational materials (such as images, videos, e-books, etc.) in one place. All such information can be accessed through the Internet. Additionally, computers are best suited for online classes, online tutoring, online examinations, and creating assignments and projects. Apart from this, they can also be used to maintain and monitor student performance and other information.

Banking

Banking has become so advanced in the past few years. Most countries use online banking systems where customers can access their data directly using computers and the Internet. People can check their account balance, transfer money, and pay online bills, including credit cards. Besides, Banks use computers to perform transactions and store customer data, transaction records, etc. Banks have reduced the number of manual errors, number of employees, and costs to a great extent by using computers. ATMs are the best example of computers that are helping people to withdraw and deposit the money themselves.

Entertainment

Computers nowadays are one of the best mediums for entertainment. Computers can be used to watch movies, play games, listen to music, etc. Computers combined with MIDI instruments can be used to record audio through artificial instruments. Besides, people can also enjoy recording their videos with webcam and apply several entertaining AI effects. Several Photo editor programs are also available with fabulous powerful features.

Training

Most companies use computers to provide training to their employees. Computer-based training helps companies save their time, money, and increase productivity. Also, computer-based training can be used to train employees for large distances in various locations. This will eliminate travel time and costs, making the training process much more comfortable and smoother.

Sports

In today's technologically developed world, computers are being used in almost every sport. There are many sports activities where computers are making things possible. In sports, computers are mainly used to maintain scoreboards, records, and other statistics. Furthermore, they are used to analyze player movements and make various in-game decisions. Computers help make complex in-game decisions (especially in umpiring), which cannot be seen by human eyes.

Safety and Security

Computers are capable of working together with different equipment, tools, and technologies. When it comes to safety, computers are widely being used with the security camera. Almost every private and government organizations are equipped with security cameras to monitor people and goods. Also, these cameras are helping security intelligence agencies to identify terrorists or criminals in public places. Computers attached with a fingerprint scanner and face-recognition technology have made it harder for fraudsters to use fake identities and take government benefits using someone else's identity. Security systems have become so powerful with the introduction of computer technology and the Internet.

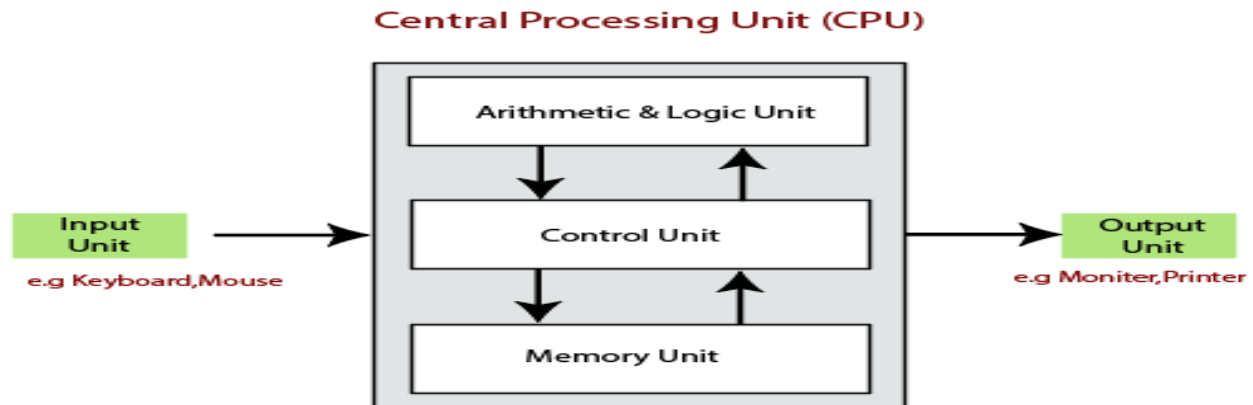
Weather Forecasting

Weather forecasting is never easy for humans because it depends on many factors that are continually changing. It is almost impossible for humans to predict the weather without using a computer. The weather forecasting process involves complex computation and monitoring of data from satellites and many other technological devices. The computer has made it a little easier to predict weather conditions because it can process information from different sources and make complex calculations related to it, which are necessary for forecasting. Computers process enormous amounts of meteorological information during weather forecasting.

Communication

Computers have become one of the primary sources of communication. Modern computers come with a built-in webcam and microphone to make use of communication easier. People can use software like Skype and Hangout to connect with other people over the Internet. Because of the videoconferencing feature, people can connect with audio and video. Computers help families connect to their relatives, businesses to organize meetings, and companies to take interviews, between two different locations that are too far. Apart from this, older communications methods such as emails are also still used widely.

Block Diagram of Computer



Input

All the data received by the computer goes through the input unit. The input unit comprises different devices. Like a mouse, keyboard, scanner, etc. In other words, each of these devices acts as a mediator between the users and the computer.

The data that is to be processed is put through the input unit. The computer accepts the raw data in binary form. It then processes the data, and produces the desired output.

The 3 major functions of the input unit are-

- Take the data to be processed by the user.
- Convert the given data into machine-readable form.
- And then, transmit the converted data into the main memory of the computer.

CPU – Central Processing Unit

Central Processing Unit or the CPU is the brain of the computer. It works the same way a human brain works. As the brain controls all human activities, the CPU too controls all tasks.

Moreover, the CPU conducts all the arithmetical and logical operations in the computer.

Now the CPU comprises of two units, namely – ALU (Arithmetic Logic Unit) and CU (Control Unit). The CPU processes the data as a whole.

ALU – Arithmetic Logic Unit

The Arithmetic Logic Unit is made of two terms, arithmetic and logic. There are two major functions that this unit performs.

1. Data inserted through the input unit into the primary memory. Performs the basic arithmetical operation on it. Like addition, subtraction, multiplication, and division. It performs all sorts of calculations required on the data. Then sends back data to the storage.
2. The unit is also responsible for performing logical operations like, AND, OR, Equal to, Less than, etc. In addition to this it conducts merging, sorting, and selection of the given data.

CU – Control Unit

The control unit as the name suggests is the controller of all the activities/tasks and operations.

The control unit is a part of the Central Processing Unit (CPU).

The control unit generates the appropriate timing and control signals to all the operations involved with a computer. The flow of data between the processor, memory, and other peripherals is controlled using the timing signals of the control unit.

The main function of a control unit is to fetch the data from the main memory, determine the devices and the operations involved with it, and produce control signals to execute the operations.

Memory Unit

All the data that has to be processed or has been processed is stored in the memory unit. The memory unit acts as a hub of all the data. It transmits it to the required part of the computer whenever necessary.

The memory unit works in sync with the CPU. This helps in faster accessing and processing of the data. Thus, making tasks easier and faster.

There are two types of computer memory-

1. **Primary memory** – This type of memory cannot store a vast amount of data. Therefore, it is only used to store recent data. The data stored in this is temporary. It can get erased once the power is switched off. Therefore, is also called temporary memory or the main memory.

RAM stands for Random Access Memory (**Volatile in nature**). It is an example of primary memory. This memory is directly accessible by the CPU. It is used for reading and writing purposes. For data to be processed, it has to be first transferred to the RAM and then to the CPU.

2. **Secondary memory** – As explained above, the primary memory stores temporary data. Thus it cannot be accessed in the future. For permanent storage purposes, secondary memory is used. It is also called the permanent memory or the auxiliary memory. The hard disk is an example of secondary memory. Even in a power failure data does not get erased easily.

Output

There is nothing to be amazed by what the output unit is used for. All the information sent to the computer once processed is received by the user through the output unit. Devices like printers, monitors, projector, etc. all come under the output unit.

The output unit displays the data either in the form of a soft copy or hard copy. The printer is for the hard copy. The monitor is for the display. The output unit accepts the data in binary form from the computer. It then converts it into a readable form for the user.

What are the Types of Computer

We can categorize computers in three ways -:

- Based on Data Handling Capacity
- Based on Size
- Based on Purpose

Based on Data Handling Capacity, computers are of three types -:

- Analogue Computer
- Digital Computer
- Hybrid Computer

1) Analogue Computer

Analog computers process Analog data. Analog data is continuous data that changes continuously and does not have discrete values. We can say that we use Analogue Computer when we do not need exact values such as temperature, speed, pressure, and current, etc.

Analog computers accept data directly from a measuring device without converting it to numbers and codes.

Analog Computers measure continuous changes in physical quantities. Speedometer and mercury thermometers are examples of analog computers.



Uses and benefits of Analogue computers:

- Analogue Computer allows real-time operations and computation at the same time.
- The programmer can minimize or maximize the problem for the dynamic range of Analogue Computer.

2) Digital Computer

Digital computers are designed to rapidly perform calculations and logical operations. It accepts raw data as digits or binary numbers (0 and 1) as input and processes it with programs stored in its memory to produce output. All modern computers like laptops, desktops, Smartphone's which we use at home and offices are all digital computers.



Uses and benefits of Digital Computer:

- This allows you to store a large amount of information and extract it easily.
- Easily you can add new features to digital systems.
- Various applications can be used in digital systems by changing the program without making any changes in the hardware.
- Hardware costs have come down due to advances in IC technology.
- This provides high speed as the data is processed digitally.
- It is highly reliable because it uses error correction codes.

3) Hybrid Computer

Hybrid Computers have both Analog Computer and Digital Computer features. Hybrid Computers, fast like analog computers and like digital computers, have memory and accuracy. It can process both Continuous and Discrete data.

It accepts Analog Signals and converts them into digital form before processing. Hybrid computers are widely used in applications where both analog and digital data are processed.

For example, a processor is used in petrol pumps that convert the measurement of fuel flow into quantity and price. Similarly, Hybrid Computers are also used in airplanes, hospitals, and scientific applications.

Ultrasound Machine

Monitoring Machine

Uses and Benefits of Hybrid Computers

- It produces accurate and quick results that are more useful.
- It has the ability to solve and manage large equations in real-time.
- This helps in online data processing.

Based on Size

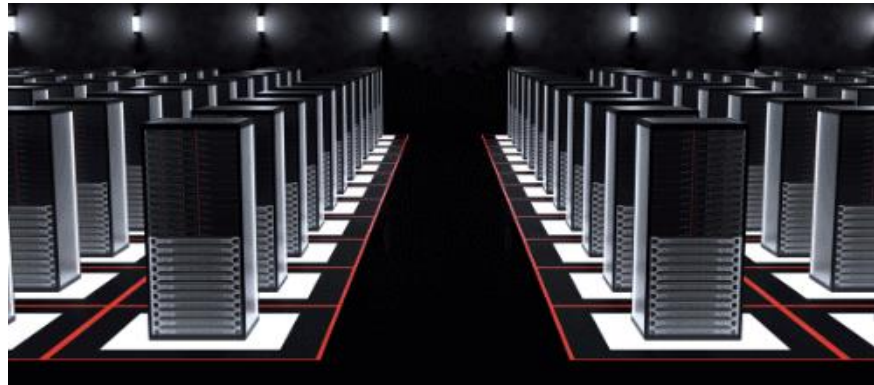
Depending on the size, computers are of 4 types:

- Super-computer
- Main-Frame computer
- Mini-computer
- Micro-computer

1) Super Computer

Supercomputers are very fast, big, and very expensive computers. Supercomputers are very powerful computers, which can perform Trillions of instructions in a few seconds.

Supercomputers can store large amounts of data. Super Computer solves difficult and complex problems in a nanosecond, hence it is called Supercomputer. PARAM, C-DAC, ANURAG are the supercomputers of India.



Supercomputers

Uses and benefits of Super Computer:

- Super Computer is used for weather forecasting and for retrieving global climate information.
- This is used in military research and defense systems.
- Automobile is used for aircraft, and spacecraft designing.
- Supercomputers are heavily used in digital filmmaking.

2) Main Frame computer

Mainframe computers are large computers that take up 1000 square feet of space. Mainframe computers are general-purpose computers designed to process large amounts of data.

Mainframe computers take a large amount of data from different terminals and can also process it at the same time.

More than 100 users can use a mainframe computer simultaneously. Mainframe computers are used in large organizations when need to handle a lot of people simultaneously.

Examples of mainframe computers – IBM S / 390, IBM S / 709, ICL 39 |

Uses and benefits of Mainframe Computer:

- It is used in the bank.
- It is also used in marketing.
- Main-Frame computers are also used in air traffic control.

3) Mini Computer

A mini-computer is a middle-size computer. Mini-computer is very popular due to its size. It is also a multiuser computer which provides the facility of working to more than 12 people simultaneously. They are more expensive than microcomputers.

Examples of Mini-computers – Multimedia, Graphics, 3D Graphic gaming computer, etc.

Uses and benefits of Minicomputer:

- It is used to process complex data in university and middle-class businesses.
- For data monitoring and data control in the industry.

4) Micro-Computer

Today, more and more computers, which we use for general-purpose, are all micro-computers. This is a very popular computer that is used to use higher-level applications very easily at home.

Examples of Micro-computer – IBM PCs, Apple Mac, etc.

Based on Purpose

Depending on the purpose, computers are of 2 types:

- General purpose computer
- Special Purpose Computer

1) General Purpose Computer

The general-purpose computer can store various programs and it can be used in countless applications. A general-purpose computer can perform any type of task with equal efficiency by changing the application program stored in the main memory.



General Purpose Computer

2) Special Purpose Computer

Special Purpose Computer is designed to perform only a specific task. The program or instruction is permanently stored in such a machine. Thermometers to test temperature, generators to manage electricity are examples of Special Purpose Computer.

These computers are often used for Special purposes. It cannot be used for any other purpose.

What are the Different Types of Computer Memory?

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address.

Memory is primarily of three types –

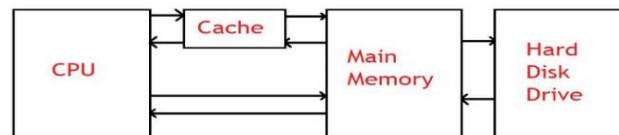
- Cache Memory
- Primary Memory/Main Memory
- Secondary Memory

Cache Memory

Cache memory is a very high speed semiconductor memory which can speed up the CPU. It acts as a buffer between the CPU and the main memory. It is used to hold those parts of data and program which are most frequently used by the CPU. The parts of data and programs are transferred from the disk to cache memory by the operating system, from where the CPU can access them.



Cache Memory block diagram



<https://helphindime.in/>

Advantages

The advantages of cache memory are as follows –

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows –

- Cache memory has limited capacity.
- It is very expensive.

- **Primary Memory (Main Memory)**

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. The data and instruction required to be processed resides in the main memory. It is divided into two subcategories RAM and ROM.

Characteristics of Main Memory

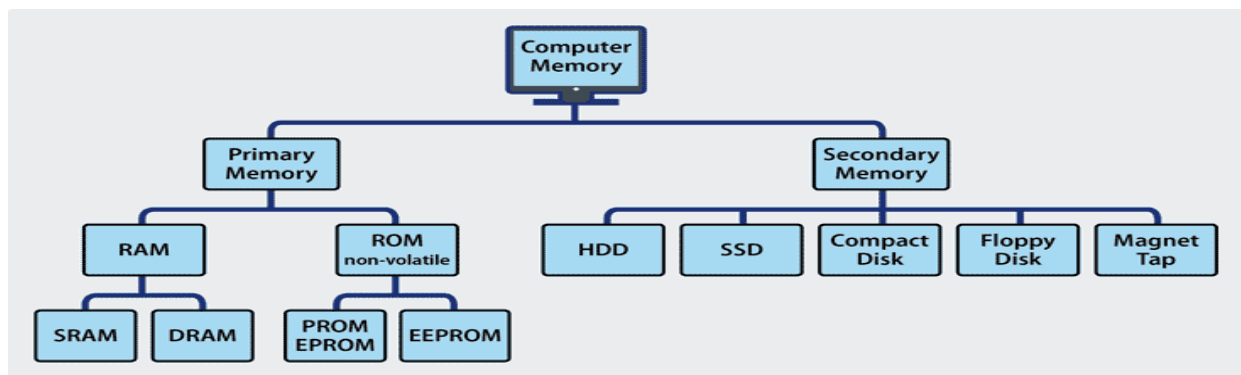
- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

Secondary Memory

This type of memory is also known as external memory or non-volatile. It is slower than the main memory. These are used for storing data/information permanently. CPU directly does not access these memories; instead they are accessed via input-output routines. The contents of secondary memories are first transferred to the main memory, and then the CPU can access it. For example, disk, CD-ROM, DVD, etc.

Characteristics of Secondary Memory

- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.



Primary Memory Types: RAM and ROM

There are two key types of primary memory:

1. **RAM, or random access memory**
2. **ROM, or read-only memory**

Let's look in-depth at both types of memory.

1) RAM, or random access memory

RAM (Random Access Memory) is the internal memory of the CPU for storing data, program, and program result. It is a read/write memory which stores data until the machine is working. As soon as the machine is switched off, data is erased.

RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure. Hence, a backup Uninterruptible Power System (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold.

Types of RAM

- **Static RAM (SRAM)**

The word **static** indicates that the memory retains its contents as long as power is being supplied. However, data is lost when the power gets down due to volatile nature. SRAM need not be refreshed on a regular basis.

Characteristic of Static RAM

- No need to refresh
 - Faster
 - Used as cache memory
 - Large size
 - Expensive
 - High power consumption
-
- **Dynamic RAM (DRAM)**

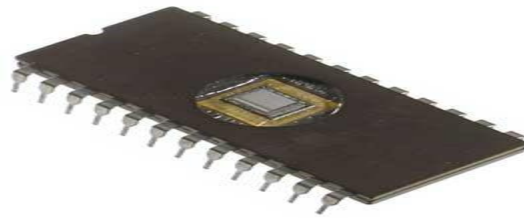
DRAM, unlike SRAM, must be continually **refreshed** in order to maintain the data. This is done by placing the memory on a refresh circuit that rewrites the data several hundred times per second. DRAM is used for most system memory as it is cheap and small. All DRAMs are made up of memory cells, which are composed of one capacitor and one transistor.

Characteristics of Dynamic RAM

- Needs to be refreshed continuously
- Slower as compared to SRAM
- Used as RAM
- Smaller in size
- Less expensive
- Less power consumption

2) ROM, or read-only memory

ROM stands for **Read Only Memory**. The memory from which we can only read but cannot write on it. This type of memory is **non-volatile**. The information is stored permanently in such memories during manufacture. A ROM stores such instructions that are required to start a computer. This operation is referred to as **bootstrap**. ROM chips are not only used in the computer but also in other electronic items like washing machine and microwave oven.



Types of ROM

ROM is available in several different types, including PROM, EPROM, and EEPROM.

- **PROM (Programmable Read Only Memory)**
PROM is read-only memory that can be modified only once by a user. The user buys a blank PROM and enters the desired contents using a PROM program. Inside the PROM chip, there are small fuses which are burnt open during programming. It can be programmed only once and is not erasable.
- **EPROM**
EPROM stands for Erasable Programmable Read-Only Memory, and as the name suggests, data stored in an EPROM can be erased and the EPROM reprogrammed. Erasing an EPROM involves removing it from the computer and exposing it to ultraviolet light before re-burning it.
- **EEPROM (Electrically Erasable and Programmable Read Only Memory)**
EEPROM is programmed and erased electrically. It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond). In

EEPROM, any location can be selectively erased and programmed. EEPROMs can be erased one byte at a time, rather than erasing the entire chip. Hence, the process of reprogramming is flexible but slow.

Advantages of ROM

The advantages of ROM are as follows –

- Non-volatile in nature
- Cheaper than RAMs
- Static and do not require refreshing
- Contents are always known and can be verified

SECONDARY MEMORY

Secondary memory comprises many different storage media which can be directly attached to a computer system. These include:

- **Hard disk drives**

A hard disk drive (HDD) is a non-volatile computer storage device containing magnetic disks or platters rotating at high speeds. It is a secondary storage device used to store data permanently, random access memory (RAM) being the primary memory device. Non-volatile means data is retained when the computer is turned off.

A hard disk drive is also known as a hard drive.

Hard disk, also called **hard disk drive** or **hard drive**, magnetic storage medium for a computer. Hard disks are flat circular plates made of aluminum or glass and coated with a magnetic material. Hard disks for personal computers can store terabytes (trillions of bytes) of information. Data are stored on their surfaces in concentric tracks. A small electromagnet, called a magnetic head, writes a binary digit (1 or 0) by magnetizing tiny spots on the spinning disk in different directions and reads digits by detecting the magnetization direction of the spots. A computer's hard drive is a device consisting of several hard disks, read/write heads, a drive motor to spin the disks, and a small amount of circuitry, all sealed in a metal case to protect the disks from dust.

Hard Disk Drive Definition: It is also called HDD, "disk drive," (*hard drive*) or **hard disk** is a non-volatile. The **hard disk drive** is the primary storage unit of the computer. This is where your data, programs and the Windows system that is used to make your computer are physically saved in a digital form (string composed of 0s and 1s). There hard disk capacity is expressed in gigabytes (GB). More *hard disk drive* will have a large capacity, the more you can install programs or store documents in your computer.

- **Solid state drives (SSDs):- Solid-state drive.** SSDs replace traditional hard disk drives (HDDs) in computers and perform the same basic functions as a hard drive.

- **Optical Disk: (CD or DVD) drives**

An optical disk is any computer disk that uses optical storage techniques and technology to read and write data. It is a computer storage disk that stores data digitally and uses laser

beams (transmitted from a laser head mounted on an optical disk drive) to read and write data.

Compact Disk (CD) – The terminology CD used for audio stands for Compact Disks. For use in digital computers similar terminology is used. The disks used for data storage are known as Compact Disk Read-Only Memory (CD-ROM). A compact disk is a round disk of clear polycarbonate plastic, coated with a very thin reflective layer of aluminum. During the manufacturing process of this 4.8 inches disk. A typical CD can store data up to 700MB. Such high storage capacity is only possible due to a very high data density.

Types of Compacts Disks

There are three types of CDs which are as follows –

- **WORM disks** – WORM means write once and read many. The audio CDs that purchase from the market are WORM disks which are recorded by the company and can be played many times.
- **CD-Rewritable** – These are the compact disks, which can be recorded, erased, and then re-recorded. These disks are used to store files that are frequently modified. These disks also provide a good means for the transportation of data. Once the data is transferred to the destination, the contents are deleted from the disk to make it empty again.
- **DVD Disks** – DVD-ROM is a high-density medium capable of saving a complete-length movie on an individual disk. Its size is equal to the size of a CD. DVD-ROM produces such high storage capacities by using both sides of the disk, by using unique data-compression technologies, and by using intensely small tracks for saving information.
- **Magnetic Tape**
It is similar to audio tape containing a plastic strip coated with magnetic material. The data is encoded on the magnetic material in the form of electric current. Conduction state (ON) represent ONE (1) and non conduction state (OFF) represent ZERO (0).
The type of data encoding is called binary data storage. Magnetic tapes are with large storage capacity and inexpensive, it can store data from 60 MB to 24 GB.
A **magnetic tape**, in computer terminology, is a storage medium that allows for data archiving, collection, and backup. At first, the tapes were wound in wheel-like reels, but then cassettes and cartridges came along, which offered more protection for the tape inside.

Differences between RAM and ROM

RAM	ROM
RAM is a volatile memory which could store the data as long as the power is supplied.	ROM is a non-volatile memory which could retain the data even when power is turned off.
Data stored in RAM can be retrieved and altered.	Data stored in ROM can only be read.
Used to store the data that has to be currently processed by CPU temporarily.	It stores the instructions required during bootstrap of the computer.
It is a high-speed memory.	It is much slower than the RAM.
The CPU can access the data stored on it.	The CPU cannot access the data stored on it ..
Small size with less capacity.	Large size with higher capacity.
Costlier	Cheaper than RAM.

SRAM	DRAM
It can store data as long as electricity is available.	It saves data for as long as the power is on or for a few moments if the power is turned off.
SRAM has a storage capacity of 1 MB to 16 MB in most cases.	DRAM, which is often found in tablets and smartphones, has a capacity of 1 GB to 2 GB.
The storage capacity of SRAM is low.	The storage capacity of DRAM is higher than SRAM.
SRAM is more expensive than DRAM.	DRAM is less expensive than SRAM.
It is comparatively faster.	It is comparatively slower.
SRAM is used in cache memories.	DRAM is used in main memories.

Computer - Memory Units

Memory unit is the amount of data that can be stored in the storage unit. This storage capacity is expressed in terms of Bytes.

The following table explains the main memory storage units –

S.No.	Unit & Description
1	Bit (Binary Digit) A binary digit is logical 0 and 1 representing a passive or an active state of a component in an electric circuit.
2	Nibble A group of 4 bits is called nibble.
3	Byte A group of 8 bits is called byte. A byte is the smallest unit, which can represent a data item or a character.

S.No.	Unit & Description
1	4Bits = 1 Nibble
2	8 Bits =1 Byte
3	Kilobyte (KB) 1KB=1024 Bytes
4	Megabyte (MB) 1 MB = 1024 KB
5	GigaByte (GB) 1 GB = 1024 MB
6	TeraByte (TB) 1 TB = 1024 GB
7	PetaByte (PB) 1 PB = 1024 TB

Input Device

Definition: A piece of equipment/hardware which helps us enter data into a computer is called an input device. For example keyboard, mouse, etc.

List of Input Devices

Given below is the list of the most common input devices along with brief information about each of them.

1. Keyboard

The keyboard is the most frequent and widely used input device for entering data into a computer. Although there are some additional keys for performing other operations, the keyboard layout is similar to that of a typical typewriter. Generally, keyboards come in two sizes: 84 keys or 101/102 keys, but currently keyboards with 104 keys or 108 keys are also available for Windows and the Internet.



The above keyboard design is called QWERTY design because of its first six letters across in the upper-left-hand corner of the keyboard.

Types of Keys

- **Numeric Keys:** It is used to enter numeric data or move the cursor. It usually consists of a set of 17 keys.
- **Typing Keys:** The letter keys (A-Z) and number keys (09) are among these keys.
- **Control Keys:** These keys control the pointer and the screen. There are four directional arrow keys on it. Home, End, Insert, Alternate (Alt), Delete, Control (Ctrl), etc., and Escape are all control keys (Esc).
- **Special Keys:** Enter, Shift, Caps Lock, Num Lock, Tab, etc., and Print Screen are among the special function keys on the keyboard.
- **Function Keys:** The 12 keys from F1 to F12 on the topmost row of the keyboard.

2. Mouse

Mouse is most popular Pointing device. It is a very famous cursor-control device. It is a small palm size box with a round ball at its base which senses the movement of mouse and sends corresponding signals to CPU on pressing the buttons.



Generally it has two buttons called left and right button and scroll bar is present at the mid. Mouse can be used to control the position of cursor on screen, but it cannot be used to enter text into the computer.

Advantages

- Easy to use
- Not very expensive
- Moves the cursor faster than the arrow keys of keyboard.

3. Joy Stick

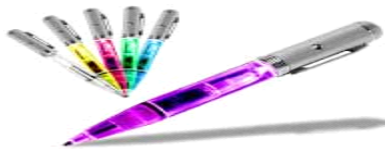
- It is a device which comprises a stick which is attached at an angle to the base so that it can be moved and controlled
- Mostly used to control the movement in video games



4. Light Pen

A light pen is a type of pointing device that looks like a pen. It can be used to select a menu item or to draw on the monitor screen. A photocell and an optical system are enclosed in a tiny tube.

When the tip of a light pen is moved across a monitor screen while the pen button is pushed, the photocell sensor element identifies the screen location and provides a signal to the CPU.



- It is light-sensitive

5. Scanner

- This device can scan images or text and convert it into a digital signal
- When we place any piece of a document on a scanner, it converts it into a digital signal and displays it on the computer screen

Output Device Definition: A piece of equipment/hardware which gives out the result of the entered input, once it is processed (i.e. converts data from machine language to a human-understandable language), is called an output device. For example printer, monitor, etc.

List of Output Device

The commonly used output devices have been listed below with a brief summary of what their function is and how they can be used.

1. Monitor

- The device which displays all the icons, text, images, etc. over a screen is called the Monitor
- When we ask the computer to perform an action, the result of that action is displayed on the monitor

2. Plotter

Plotter is an O/P device that is used to produce graphical O/P on papers. It uses single color or multi color pens to draw pictures as blue print etc.

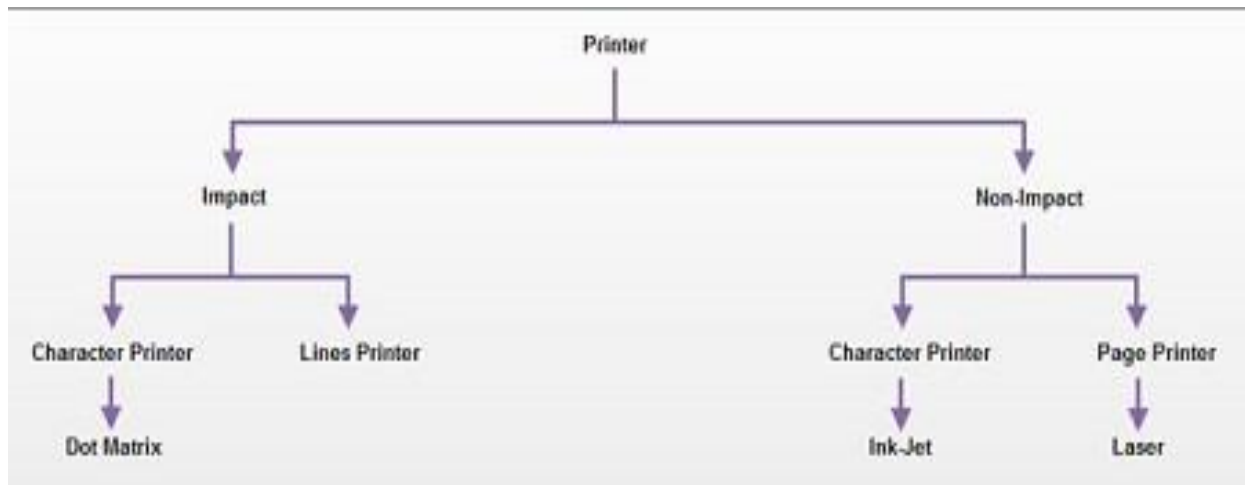
A plotter is a device that prints graphics in a variety of color formats with high-quality images. It's similar to a printer, but with more advanced capabilities. Plotter allows us to create pictures, 3D postcards, advertising signs, charts, and various designs of the internal structure of building machines, as well as print large maps, architectural drawings, large-format printing, and create pictures, 3D postcards, advertising signs, charts, and various designs of the internal structure of building machines.



3. Printer

Printer is the most important output device, which is used to print information on paper.

There are two types of printers



1. **Impact Printers**
2. **Non-Impact Printers**

Impact Printers

The printers that print the characters by striking against the ribbon and onto the paper are called impact printers.

Characteristics of Impact Printers are following

- Very low consumable costs
- Impact printers are very noisy
- Useful for bulk printing due to low cost
- There is physical contact with the paper to produce an image

These printers are of two types

- I. Character printers
- II. Line printers

I. Character Printers:

Character Printers are printers which print one character at a time.

a) Dot Matrix Printer

It prints characters as combination of dots. Dot matrix printers are the most popular among serial printers. These have a matrix of pins on the print head of the printer which form the character. The computer memory sends one character at a time to be printed by the printer. There is a

carbon between the pins & the paper. The words get printed on the paper when the pin strikes the carbon. There are generally 24 pins.



Advantages

- Inexpensive
- Widely Used
- Other language characters can be printed

Disadvantages

- Slow Speed
- Poor Quality

2. Line Printers

A line printer is a high-speed impact printer that prints an entire line at a time. The speed of a line printer is measured by the number of lines per minute (lpm) it can print.

Non-impact Printers

The printers that print the characters without striking against the ribbon and onto the paper are called Non-impact Printers. These printers print a complete page at a time, also called as Page Printers.

These printers are of two types

- a. Laser Printers**
- b. Inkjet Printers**

Characteristics of Non-impact Printers

- Faster than impact printers.
- High quality.
- Support many fonts and different character size.

a. Laser Printers

These are non-impact page printers. They use laser lights to produce the dots needed to form the characters to be printed on a page.



Advantages

- Very high speed.
- Very high quality output.
- Give good graphics quality.
- Support many fonts and different character size.

Disadvantage

- Cannot be used to produce multiple copies of a document in a single printing.

Inkjet Printers

Inkjet printers are non-impact character printers based on a relatively new technology. They print characters by spraying small drops of ink onto paper. Inkjet printers produce high quality output with presentable features.



3. Speakers

- A device through which we can listen to a sound as an outcome of what we command a computer to do is called a speaker

- Speakers are attached with a computer system and also are a hardware device which can be attached separately
- With the advancement in technology, speakers are now available which are wireless and can be connected using Bluetooth or other applications

4. Projector

- An optical device which presents an image or moving images onto a projection screen is called a projector
- Most commonly these projectors are used in auditoriums and movie theatres for the display of the videos or lighting
- If a projector is connected to a computer, then the image/video displayed on the screen is the same as the one displayed on the computer screen