

## What is computer? Characteristics and Limitations of Computer

### What is a computer?

The word "computer" comes from the word "compute" which means to calculate. So a computer is normally considered to be a calculating device that performs arithmetic operations at enormous speed. More accurately, a computer may be defined as a device that operates upon information or data.

**Modern Definition of computers:** A computer is an electronic device which is used to perform operation on raw data as per instruction given by user. All the Plugged with computer system( e.g. keyboard, mouse, printer,CPU etc) is called hardware, the language , instruction, data are the called software.

### Characteristics or Features of Computer

1. **Speed:** A computer is a very fast device. The computer takes a fraction of seconds to perform any operation. The speed of computer is measured in micro seconds ( $10^{-9}$ ), Milliseconds ( $10^{-6}$ ), nanoseconds ( $10^{-9}$ ) and even Picoseconds ( $10^{-12}$ ).A powerful computer is capable of performing about 3-4 million simple operations per second.
2. **Accuracy:** The accuracy of computer is very high and the degree of a particular computer depends upon its design. But for a particular computer, each and every calculation is performed with the same accuracy. Errors can occur in a computer but these are mainly due to human rather than technological weakness.
3. **Storage Capacity:** Computers can store data and instruction with a lot of volume and very high efficiency.
4. **Diligence:** unlike human being a computer is free from monotony, tiredness, lack of concentration etc. and hence can work for hours together without creating any error. A computer can perform the last calculation with exactly the same accuracy and speed as the first one.
5. **Automation:** Once a Program is in the computer's memory, CPU follows the instructions until it meets the last instruction. Though the program concept many tasks can be performed simultaneously, some on foreground and some on background. Thus automation bring the program execution fast
6. **Reliability:** Because, computer is an electronic device thus it perform all operations with 100 % accuracy and reliability. Reliability can affect only error prone by human mind.
7. **Versatility:** versatility is one of the most wonderful things about the computer. One moment it can do any one operation and next moment if can perform any other operation. A computer is capable of performing almost any task according to given instructions.

### Limitation or Drawback of Computer

1. **No I.Q.:** Computer is not a magical device. It performs only those works which man can does but the main difference is that computer can work those operations with very high speed and reliable accuracy. It has no any intelligence quality or thinking power
2. **No Feeling:** because computer is only a machine, it has no feeling like human being. It has no brain for thinking as man can does. Man had successes to make computer memory be different inventions of technology but he couldn't make heart.
3. **Data Machine Readable:** Computer data is read by machine, meaning data obtained from the computer can be read by the computer itself.
4. It required power to operate.
5. Problem may occur due to system breakdown.



## **Q2. Types of Computer**

We can categorize computer in two ways: on the basis of data handling capabilities and size.

**On the basis of data handling capabilities**, the computer is of *three* types:

- [Analogue Computer](#)
- [Digital Computer](#)
- [Hybrid Computer](#)

### **1) Analogue Computer**

Analogue computers are designed to **process analogue data**. Analogue data is continuous data that changes continuously and cannot have discrete values. We can say that analogue computers are used where we don't need exact values always such as speed, temperature, pressure and current.

Analogue computers directly accept the data from the measuring device without first converting it into numbers and codes. They measure the continuous changes in physical quantity and generally render output as a reading on a dial or scale. **Speedometer** and **mercury thermometer** are examples of analogue computers.

**Advantages of using analogue computers:**

- It allows real-time operations and computation at the same time and continuous representation of all data within the range of the analogue machine.
- In some applications, it allows performing calculations without taking the help of transducers for converting the inputs or outputs to digital electronic form and vice versa.
- The programmer can scale the problem for the dynamic range of the analogue computer. It provides insight into the problem and helps understand the errors and their effects.

**Types of analogue computers:**

- **Slide Rules:** It is one of the simplest types of **mechanical analogue computers**. It was developed to perform **basic mathematical calculations**. It is made of two rods. To perform the calculation, the hashed rod is slid to line up with the markings on another rod.
- **Differential Analysers:** It was developed to perform **differential calculations**. It performs integration using wheel-and-disc mechanisms to solve differential calculations.
- **Castle Clock:** It was invented by **Al-Jarazi**. It was able to save programming instructions. Its height was around 11 feet and it was provided with the display of time, the zodiac, and the solar and lunar orbits. This device also could allow users to set the length of the day as per the current season.



- **Electronic Analogue Computer:** In this type of analogue computer, electrical signals flow through capacitors and resistors to simulate physical phenomena. Here, the mechanical interaction of components does not take place. The voltage of the electrical signal generates the appropriate displays.

## 2) Digital Computer

Digital computer is designed to perform calculations and logical operations at high speed. It accepts the raw data as input in the form of digits or binary numbers (0 and 1) and processes it with programs stored in its memory to produce the output. All modern computers like laptops, desktops including smartphones that we use at home or office are digital computers.

**Advantages of digital computers:**

- It allows you to store a large amount of information and to retrieve it easily whenever you need it.
- You can easily add new features to digital systems more easily.
- Different applications can be used in digital systems just by changing the program without making any changes in hardware
- The cost of hardware is less due to the advancement in the IC technology.
- It offers high speed as the data is processed digitally.
- It is highly reliable as it uses error correction codes.
- Reproducibility of results is higher as the output is not affected by noise, temperature, humidity, and other properties of its components.

## 3) Hybrid Computer

Hybrid computer has features of both analogue and digital computer. It is **fast like an analogue** computer and has memory and **accuracy like digital computers**. It can process both continuous and discrete data. It accepts analogue signals and convert them into digital form before processing. So, it is widely used in specialized applications where both analogue and digital data is processed. For example, a processor is used in petrol pumps that converts the measurements of fuel flow into quantity and price. Similarly, they are used in airplanes, hospitals, and scientific applications.

**Advantages of using hybrid computers:**

- Its computing speed is very high due to the all-parallel configuration of the analogue subsystem.
- It produces precise and quick results that are more accurate and useful.
- It has the ability to solve and manage big equation in real-time.
- It helps in the on-line data processing.

**On the basis of size**, the computer can be of **five** types:

## 1) Supercomputer



Supercomputers are the **biggest and fastest computers**. They are designed to process huge amount of data. A supercomputer can **process trillions of instructions in a second**. It has thousands of interconnected processors.

Supercomputers are particularly used in **scientific and engineering applications** such as weather forecasting, scientific simulations and nuclear energy research. The first supercomputer was developed by **Roger Cray in 1976**.

Characteristics or applications of supercomputers:

- It has the ability to decrypt your password to enhance protection for security reasons.
- It produces excellent results in animations.
- It is used for virtual testing of nuclear weapons and critical medical tests.
- It can study and understand climate patterns and forecast weather conditions. It can run in NOAA's system (National Oceanic and Atmospheric Administration) that can execute any type of simple and logical data.
- It helps in designing the flight simulators for pilots at the beginner level for their training.
- It helps in extracting useful information from data storage centres or cloud system. For example, in insurance companies.
- It has played a vital role in managing the online currency world such as stock market and bitcoin.
- It helps in the diagnosis of various critical diseases and in producing accurate results in brain injuries, strokes, etc.
- It helps in scientific research areas by accurately analysing data obtained from exploring the solar system, satellites, and movement of Earth.
- It also used in a smog control system where it predicts the level of fog and other pollutants in the atmosphere.

## 2) Mainframe computer

Mainframe computers are designed to support hundreds or thousands of users simultaneously. They can support multiple programs at the same time. It means they can execute different processes simultaneously. These features of mainframe computers make them ideal for big organizations like banking and telecom sectors, which need to manage and process high volume of data.

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Characteristics of Mainframe Computers:

- It can process huge amount of data, e.g. millions of transactions in a second in the banking sector.
- It has a very long life. It can run smoothly for up to 50 years after proper installation.
- It gives excellent performance with large scale memory management.



- It has the ability to share or distribute its workload among other processors and input/output terminals.
- There are fewer chances of error or bugs during processing in mainframe computers. If any error occurs it can fix it quickly without affecting the performance.
- It has the ability to protect the stored data and other ongoing exchange of information and data.

#### **Applications of mainframe computers:**

- In **health care**, it enabled hospitals to maintain a record of their millions of patients in order to contact them for treatment or related to their appointment, medicine updates or disease updates.
- In the **field of defence**, it allows the defence departments to share a large amount of sensitive information with other branches of defence.
- In the **field of education**, it helps big universities to store, manage and retrieve data related to their courses, admissions, students, teachers, employees and affiliated schools and colleges.
- In the **retail sector**, the retail companies that have a huge customer base and branches use mainframe computers to handle and execute information related to their inventory management, customer management, and huge transactions in a short duration.

### **3) Miniframe or Minicomputer**

It is a **midsize multiprocessing computer**. It consists of two or more processors and can support **4 to 200 users at one time**. Miniframe computers are used in institutes and departments for tasks such as billing, accounting and inventory management. A minicomputer **lies between the mainframe and microcomputer** as it is smaller than mainframe but larger than a microcomputer.

#### **Characteristics of miniframe or minicomputer:**

- It is light weight that makes it easy to carry and fit anywhere.
- It is less expensive than mainframe computers.
- It is very fast compared to its size.
- It remains charged for a long time.
- It does not require a controlled operational environment.

#### **Applications of minicomputers:**

A minicomputer is mainly used to perform three primary functions, which are as follows:

- **Process control:** It was used for process control in manufacturing. It mainly performs two primary functions that are collecting data and feedback. If any abnormality occurs in the process, it is detected by the minicomputer and necessary adjustments are made accordingly.

- **Data management:** It is an excellent device for small organizations to collect, store and share data. Local hospitals and hotels can use it to maintain the records of their patients and customers respectively.
- **Communications Portal:** It can also play the role of a communication device in larger systems by serving as a portal between a human operator and a central processor or computer.

#### 4) Workstation

Workstation is a **single user computer** that is designed for **technical or scientific applications**. It has a faster microprocessor, a large amount of RAM and high speed graphic adapters. It generally **performs a specific job with great expertise**; accordingly, they are of different types such as graphics workstation, music workstation and engineering design workstation.

**Characteristics of workstation computer:**

- It is a high-performance computer system designed for a single user for business or professional use.
- It has larger storage capacity, better graphics, and more powerful CPU than a personal computer.
- It can handle animation, data analysis, CAD, audio and video creation and editing.

Any computer that has the following **five features**, can be termed as a workstation or can be used as a workstation.

- **Multiple Processor Cores:** It has more processor cores than simple laptops or computers.
- **ECC RAM:** It is provided with Error-correcting code memory that can fix memory errors before they affect the system's performance.
- **RAID (Redundant Array of Independent Disks):** It refers to multiple internal hard drives to store or process data. RAID can be of different types, for example, there can be multiple drives to process data or mirrored drives where if one drive does not work than other starts functioning.
- **SSD:** It is better than conventional hard-disk drives. It does not have moving parts, so the chances of physical failure are very less.
- **Optimized, Higher end GPU:** It reduces the load on CPU. E.g., CPU has to do less work while processing the screen output.

#### 5) Microcomputer

Microcomputer is also known as a personal computer. It is a general-purpose computer that is designed for individual use. It has a microprocessor as a central processing unit, memory, storage area, input unit and output unit. Laptops and desktop computers are examples of microcomputers. They are suitable for personal work that may be making an assignment, watching a movie, or at office for office work.



**Characteristics of a microcomputer:**

- It is the smallest in size among all types of computers.
- A limited number of software can be used.
- It is designed for personal work and applications. Only one user can work at a time.
- It is less expensive and easy to use.
- It does not require the user to have special skills or training to use it.
- Generally, comes with single semiconductor chip.
- It is capable of multitasking such as printing, scanning, browsing, watching videos, etc.

### **Q3. Explain Each Briefly:-**

## **What is a Sound Card?**



Inside the computer, a **sound card** is an **expansion component** that is also referred to as a **soundboard**, **audio output device**, or **audio card**. It offers **audio input and output capabilities in computers**, which can be heard with the help of speakers or headphones. Although it is not necessary for the computer to have a sound card, every machine includes it as either built into the motherboard (onboard) or in an expansion slot. Through a device driver and a software application, sound cards make capable of configuring and utilizing.

Usually, an input device, a microphone, is attached to receive audio data, while speakers or headphones are generally used to output audio data. Most headphones use the size of 3.5 mm minijacks, which are the size of the connector. Through an optical audio port like a Toslink connector or with the help of a standard TRS (tip-ring-sleeve) connection, digital audio input and output are supported by some sound cards. The conversion of incoming digital audio data into analog audio is the primary function of a sound card through which speakers make capable of playing sound. In the reverse case, from the microphone, the analog audio data is converted into digital data by the sound card. These data can be hold on the computer device as well as modified with the help of using audio software.

While many machines may contain an actual card that exists in a PCI slot, but the sound card is also part of the motherboard in some computers. Also, you can install a new sound card (professional sound card) if you really need to enhance more audio capabilities to your computer. Professional sound cards may have more inputs and outputs and have the capability of supporting advanced sampling rates, like 192 kHz rather than 44.1 kHz. Instead of 3.5 mm, some sound cards may include 1/4 in. connectors that accommodate most instrument outputs.

However, to enhance more audio capabilities of your computer, you can install professional sound cards. For multi-channel recording, you can also use another option breakout box. Typically, this box comprises numerous

audio connections and a built-in sound card; it is called an external box. For instance, 16 channels of audio are supported by a breakout box that cannot be fit on a single card. Some breakout boxes are specifically designed to connect with the box, though most breakout boxes connect to a Firewire or [USB](#) port.

## Sound Card Description

A sound card is hardware in rectangular shape that contains different ports on the side to connect audio devices, like a speaker, and also has multiple contacts on the bottom of the card. As the motherboard, peripheral cards and case are designed with compatibility in mind; therefore, at the time of installing the sound card it just fits outside the back of the case. This makes it capable of easily available for use. You also have an option with a sound card to plug microphones, headphones, and also other audio devices into your computer; because there are also [USB](#) sound cards available. Also, you can plug it directly into a [USB](#) port with the help of a small adapter.

In the past time, when using a narrow range of frequencies, computers were originally only able to produce beeps. Mainly, these beeps were used in the form of warning alarms.

Over time, for both professional and entertainment reasons, the need for high-quality sound increased by increasing growth in multimedia. A sound card AdLib was created to fill this need. In the AdLib sound card, the percussion mode and a 9-voice mode features were available that made programmable audio possible.

For computers, most of the motherboard manufacturers provide built-in sound cards. However, advanced users, instead of generic, built-in cards, commonly use expansion cards selected to meet their particular requirements.

## Types of Sound Cards

The sound card is an expansion component in the computer that makes capable you to hear the sound, which comes from video files, mp3 file, and more other. In the late 1980s and early 1990s, sound cards first started to enter the mainstream. In modern times, almost all computers come with one. Mainly, sound cards have three types, and all contain their own advantages.

### Motherboard Sound Chips

The sound cards were costly add-on cards when they were introduced for the first time. Its cost was hundreds of dollars. When the computer sound technology became available at a low price, miniaturization technology allowed computer hardware manufacturers to produce sound into a single chip. In modern times, there is a rare chance to find a computer not containing motherboard sound chip. Even if they only contain a separate sound card. The motherboard sound chips made sound card affordable for all computer owners. You can identify if your system has a motherboard sound chip.

### Standard Sound Cards

Inside the computer, a standard sound card connects to one of the slots. Using a sound card rather than motherboard sound chip, offer a benefit as it contains its own processor chips. And, a motherboard sound chip produce sound on the basis of the computer processor. When playing games, a standard sound card offers better performance as it creates less of a load on the main processor.

### External Sound Adapters

An external sound adapter has all the same features like standard sound card. It is a small box that enables connection to computer with the help of USB or FireWire port, instead of an internal expansion slot. Sometimes, it contains a feature that is not included by a standard sound card, such as physical volume control knobs and extra inputs and outputs. As compared to the standard sound card, it is much easier to move an external sound



adapter to a new computer. Also, with USB or FireWire expansion slots, it is the only way to upgrade the sound of a laptop.

## Uses of a sound card

The primary use of a sound card is to provide sound that you hear from playing music with varying formats and degrees of control. The source of the sound may be in the form of streamed audio, a file, [CD](#) or [DVD](#), etc. There are many applications of a computer where a sound card can be used, which areas are as follows:

- Games.
- Voice recognition.
- Watch movies.
- Creating and playing MIDI.
- Educational software.
- Audio and video conferencing.
- Business presentations.
- Record dictations.
- Audio CDs and listening to music.

## History of the sound card

The sound card, capable of 4-voice music synthesis, Gooch Synthetic Woodwind is considered the first sound card. It was used by PLATO terminals, which was invented by Sherwin Gooch in 1972.

AdLib was one of the first companies that began to manufacture sound cards or IBM PC-compatible computers. In 1987, on the basis of the Yamaha YM3812 sound chip, AdLib developed the Music Synthesizer Card.

Although until 1988, sound cards were very uncommon for the IBM PC. For the majority of IBM PC users to produce sound and music, the internal PC speaker was the only way. Consequently, basing "beeps and boops," sound was described that was led to the common nickname "beeper. At the time sounds were played, there was a need to stop all other processing.

The Consumer Electronics Show that the PC's were unable to become the leading home computer as they only had limited sound, it was stated by a panel of computer-game CEOs in 1988. As compared to current products, it required a \$49-79 sound card with better capability. In **1989**, it was founded in a Computer Gaming World survey that AdLib, six Roland and Covox, and seven Creative Music System/Game Blaster were planned 18 of 25 game companies to support.

## Sound card connections



The image is shown on the right-side describing sound card audio ports or audio jacks, which connectors are found back of your computer. This picture is an example of sound card audio ports.

- With surround sound or loudspeakers, digital out is used (white or yellow; words: "Digital" or "Digital Out").
- Connection for external audio sources, such as tape recorder, record player, or CD player, sound in or line in (blue; Arrow pointing into waves).
- The connection is for headphones or microphones, Mic or Microphone (pink)
- For your speakers or headphones, the primary sound connection, sound out or line out (green; Arrow pointing out of waves). The second (black) and third (orange) sound-out connectors are also contained by this sound card.
- For digital video cameras and other devices, some high-quality sound cards are used, FireWire (not pictured).
- For connecting MIDI keyboard or joystick, MIDI or joystick (15 pins yellow connector) is used with older sound cards.

## Sound Cards and Audio Quality

Instead of having a sound expansion cards, many modern cards have the same technology integrated directly onto the motherboard. These cards are known as on-board sound cards. But this configuration makes slightly less powerful audio system and allows for a less expensive computer. Almost, this way is appropriate for all computer users. Usually, dedicated sound cards are necessary for the serious audio professional. To share a common ground wire, since most of the desktop computers are set up for the front-facing headphone jacks and ports. So, if you also have USB devices plugged in, you may hear static in your headphones.

## A Computer has no Sound

Although, it may happen the sound card or speakers are no longer communicating with each other as it is possible that they have disconnected from their ports/power. Usually, it can be an issue related to software that preventing the sound from playing. First, you make sure the volume of the song, movie, video, or which you are going to listen to.

A sound could be from a missing or corrupt device driver, which can be another reason for not delivering the sound. With the help of using any free driver updater tools, installing the sound card driver is the best way to overcome this problem.

If you have checked everything that described above and your computer still is not able to play a sound. Now, you need to check if you have installed proper software for media playback.

## Buying a Sound Card

The are many sound cards available, but popular cards are Turtle Beach, Creative Labs (Sound Blaster), and Diamond Multimedia. The process of installing a sound card is comparatively easy. However, in contrast to peripheral devices, a sound card is connected on the inside if it is not attached properly.



## II. What is a Video Card?

A video card is a PC component that connects to a computer motherboard, also known as a video controller, display adapter, video board, graphics card, or video adapter. It is an expansion card, controls and calculates an image's appearance on the screen and used to improve the picture quality to show on display. Even you cannot see this page without a video card. It accelerates the video throughput as it is an intermediate device. The below picture is an instance of the video card.



More clearly, inside the computer, it is a piece of hardware that process the graphics portion of the processing load, and normally [CPU](#) handles most of the task. Due to extra processing power and video ram, gamers use the video card instead of integrated graphics. Almost, it is able to run all programs more efficiently as in modern times most of the programs are graphically oriented.

The video card has the ability to speed up both 2D and 3D graphics rendering. Like web browsers and photo editors' programs may benefit from 2D acceleration, and video games and CAD design programs will likely advantage from the card's 3D acceleration.

The libraries, like OpenGL and DirectX, are supported by most video cards. For manipulating graphics, these libraries have commands that programmers can use in their code. Some commands from among these may be used for casting light, morphing polygons, moving or rotating an object, and creating shadows. To create graphically-oriented programs, the OpenGL or DirectX standards provide an easier way for developers. For the computer, it also makes it compulsory to involve a supported video card in terms of running programs. The components contained by the graphics card are given below:

- GPU
- DVI
- Video-BIOS
- Video-memory

Video cards were not very sophisticated at the early times of computer graphics. They were only able to send output data that come from the processor to the display. Due to the output in text format, this worked well. As a result, early operating systems did not have color and complex graphics.

In modern times, video cards are similar to co-processors. It means that, instead of forwarding a simple signal onto the display, video cards add some processing power. Furthermore, video cards have the capability of checking the quality of the output.

### Important Video Card Facts

Only a limited range of video card formats are supported by each motherboard. Therefore, before making a purchase, always check with your motherboard manufacturer.

Many modern computers have on-board video - GPUs integrated directly onto the motherboard and do not include video expansion cards. It makes the computer a less powerful graphics system, but also less expensive. This option is appropriate for users who have no interest in the latest gams or additional graphics tasks. Most of the motherboards

that come with on-board video; provide the ability for BIOS to disable the chip through which a video card can be installed to an expansion slot.

## How to check what Video Card I Have?

In Windows, users can use Device Manager to check video cards; it is the easiest way to see what video card users have. Under the Display adapters section, the list of video card can be found. Also, the tool like Speccy can be used to see what graphics card you have, which is a free system information tool. It helps to identify the bus interface, amount of memory, device ID, temperature, manufacturer, BIOS version, model, and some other video card information.

Another way to see video card on the system is a computer case, which need to open the computer case then you can see what video card is installed on the system. If you need to replace the video card, opening the computer case is a required option. But if you only want to see the video card information, it will be better to use the software mentioned above.

## Components of Video card or Graphics card

Here are some essential components of a video card:

### GPU (Graphics Processing Unit)

Every graphics card has a [GPU](#), which is the heart of the Graphics card. It is the primary component of the graphics card that handles the mathematical computations needed to create visuals. Usually, it is placed underneath a fan or heatsink because when performing calculations, the processor can get extremely hot. Some of the GPU processors provide advanced functionalities, such as offer 3D graphics that look smoother through full-scene anti-aliasing.

### Memory

[Memory](#) is needed for storing the complete information that can be accessed quickly when the time is right. Although GPU is figuring out how to display images, memory is the place that stores all the complex textures, which is needed until it's ready to be used. In this situation, the RAM is a memory that comes in handy. GPU fetches the textures from memory and forwards them to [RAM](#) after processing them, and then RAMDAC accepts it from the RAM and then forwards them to your monitor or [LCD](#) screen for display. RAMDAC converts the image to the analog signal as it is a Random-Access Memory Digital to Analog Converter and then sends them to your monitor or LCD screen with the help of a display cable. As compared to memory use in Desktop or Laptop, graphics card Memory or RAM is much faster.

### Internal Interface

The primary function of internal interface is to connect a graphics card to the motherboard. In the early time, AGP (Accelerated Graphics Port) interface was used by graphics cards to connect to the motherboard, but now graphics cards use PCI Express 2.0 x16 interface to connect to the motherboard, which is much faster and efficient as compared to AGP. Also, if the PCI Express x16 slot is contained by your motherboard, you cannot use the card.

### DVI / HDMI / VGA Ports

The external interface of the graphics card is formed by the DVI, [HDMI](#), or [VGA](#) Ports. With the help of relevant cable, they connect Monitor or LCD Screen to Graphics Card. Both types of interfaces, DVI and [HDMI \(High-Definition Multimedia Interface\)](#) are included in the high-end graphics cards, while low-end ones contain only VGA and DVI (Digital Video Interface) ports. In addition to all these major components, resistors, capacitors, diodes, and more are also some other components are presented on a graphics card.

## Different Types of Graphic Cards

If you add a separate video card to your computer, it will enhance the speed of the video and video games. But there are many types of graphics cards available on the market; you should know which kind of card is better for your computer.

## On-Board

With an expansion slot, the on-board graphics card is included on most budget-based PCs in lieu of separate graphics cards. Usually, for decoding high-quality video and playing graphics-intensive games, the on-board card is not more powerful. On-board graphics cannot remove physically. Therefore, if you need to replace on-board graphics with an add-on graphics card, you will have to disable the on-board graphics in the computer's BIOS to install an add-on graphics card.

## PCI Express

The PCI Express is a standard in video cards as of 2009. Only two manufacturers, NVIDIA and ATI produce PCI Express graphics cards. With the latest being PCI Express 3.0, it comprises three architectures.

## AGP

In the early to mid-2000s, AGP was the standard graphics card type, which stands for Accelerated Graphics Port. In modern times, these cards have been replaced by PCI Express and are not widely available. Also, AGP ports are not included by most hardware manufacturers in their systems. In **2008**, a Radeon HD 4000 series was introduced by ATI; however, a new card has not been released till now.

## External Graphics Cards

Since manufacturers of laptop computers have stopped including space for an add-on graphics card on the laptops, some manufacturers started to produce external graphics cards for improving graphics capabilities.

## Legacy Graphics Cards

Graphics cards like PCI, VESA local bus, and ISA graphics cards are not widely used in the modern times. These graphics cards are not compatible with the current versions of Windows. Therefore, the aforementioned cards are not more popular.

## Graphics Card History and Standards

Often, a printer port was included in the graphics card since the printer would print information on a lower resolution "green" screen.

In **1987**, a new graphics standard came into being when the Video Graphics Array (VGA) was introduced by IBM. At resolutions up to 720x400, a VGA display could have the ability to support 256 colors. Perhaps, VGA was analog that is the difference between the preceding formats and the VGA, while displays had been digital up. Although it may be an older option if you take an action from digital to analog, as compared to the strict on/off nature of digital, it offers the ability to vary the signal for possible combination. Now, all-digital display solutions are offered by manufacturers of graphics-card that have the same features that analog adapters have.

Over time, SVGA cards were designed on the basis of VGA, but the manufacturer of each card increased color depth and added resolutions in different ways. Lastly, SVGA provided 1280x1024 resolution and up to 16.8 million colors.

Graphics cards follow industry standards that make users capable of selecting cards for their PC among a variety of graphics cards. Comparing the basic VGA specification, you can buy any card that can offer you higher colors and resolution.

GeForce 6 Series 6600 and 6800 were released by Nvidia in **2004**. The 6800 was the original card that was popular among overclockers. Overclockers are the programs that use this program known as Riva Tuner. SLI supports multi-video cards and PureVideo technology, which provides better video quality. GTX 8800 was introduced by GeForce in **2006**. Radeon HD 5970 was released by AMD and also took over ATI in **2009**.

## What does a Video Card Do?

There are more than a million individual pixels included on the average computer monitor, which has the ability to display a particular color to create complex pictures. However, between the CPU (central processing unit) and the screen, computers need a video card to serve as a middleman.

CPU sends a request to the video card when it needs to be something displayed. Then, the video card figures out exactly how to visualize the instructions. The pixels function as the video card's canvas in this analogy. With a cable, such as VGA, S-Video, or DVI, it sends information to the monitor to make visuals display on the screen.

The video card must first start with a basic wireframe when it comes to translating binary data into 3D visuals. Then, include lighting effects, textures, and complex colors. This process needs to be repeated about 60 times per second to get optimal performance, or the visuals will start to look sluggish.

## Video card ports

There are various types of video ports used with video cards, which are as follows:

- DVI
- S-Video
- VGA
- HDMI

**DVI:** Digital Video Interface (DVI) is a video display interface developed for the PC industry to transmit digital video content to display devices. It has the ability to transmit video content at resolutions as high as 2560 x 1600. From the computer to the monitor, DVI virtually eliminates signal loss and keeps data in digital form. Some TVs also use a DVI connection, as DVI cables can transmit audio signals. Therefore, HDMI can be more common as it can transmit both audio/video signals.



**S-Video:** S-video is an analog video connection standard, which stands for Super Video. It is a video transmission format that transmits electrical signals over wires to represent the original video. It is a kind of connection found on video devices, which uses a round connector interface and cable. It is also used for connecting VCRs, TVs, video cameras, computers as well as DVD players.



**VGA:** VGA is a popular display standard, which stands for Video Graphics Adapter or Array. It is developed by IBM and introduced in 1987. It is a connection for devices like monitors and projectors that offers 640 x 480 resolution color display screens. In this, 256 colors are shown if the resolution is lowered to 320 x 200. VGA cable is only capable of lower

quality display and lower resolutions on screens as it uses analog signals. The below image is an example of a VGA cable, port, or connector.



**HDMI:** HDMI is an interface or connector, which is mainly used in devices like DVD player, Blu-ray player, Projector, and HDTV. It stands for High-Definition Multimedia Interface that is widely used for audio-visual equipment for transmitting high-quality and high-bandwidth streams of audio and video between devices.

### III. Network Interface Card (NIC)

Network Interface Card (NIC) is a **hardware component** that is present on the computer. It is used to **connect different networking devices** such as computers and servers to share data over the connected network. It provides functionality such as support for I/O interrupt, Direct Memory Access (DMA) interfaces, partitioning, and data transmission.

NIC is important for us to establish a wired or wireless connection over the network.

Network Interface Card is also known as **Network Interface Controller**, **Network Adapter**, **Ethernet card**, **Connection card**, and **LAN (Local Area Network) Adapter**.

#### Functions of the Network Interface Card

A list of functions of the Network Interface Card is given below -

1. NIC is used to convert data into a digital signal.
2. In the OSI model, NIC uses the physical layer to transmit signals and the network layer to transmit data packets.
3. NIC offers both wired (using cables) and wireless (using Wi-Fi) data communication techniques.
4. NIC is a middleware between a computer/server and a data network.
5. NIC operates on both physical as well as the data link layer of the OSI model.

#### Components of Network Interface Card

Network Interface Card contains the following essential components -

##### 1. Memory

Memory is one of the most important components of the NIC. It is used to store the data during communication.

##### 2. Connectors

Connectors are used to connect the cables to the Ethernet port.

##### 3. Processor

Processor is used for converting the data message into a suitable form of communication.

##### 4. Jumpers

Jumpers are the small device that is used to control the communication operations without the need of any software. It is also used to determine settings for the interrupt request line, I/O address, upper memory block, and type of transceiver.

## 5. Routers

To provide wireless connectivity, routers are used.

## 6. MAC address

MAC address is also referred to as a **physical network address**. It is a unique address that is present to the network interface card where ethernet packets are communicated with the computer.

# Types of Network Interface Cards

There are the following two types of NICs -

## 1. Ethernet NIC

Ethernet NIC was developed by **Robert Metcalf in 1980**. It is made by ethernet cables. This type of NIC is most widely used in the LAN, MAN, and WAN networks.

**Example:** TP-LINK TG-3468 Gigabit PCI Express Network Adapter.

## 2. Wireless Networks NIC

It is a wireless network that allows us to connect the devices without using the cables. These types of NICs are used to design a Wi-Fi connection.

**Example:** Intel 3160 Dual-Band Wireless Adapter

# Advantages of NIC

A list of advantages of NIC is given below -

1. As compared to the wireless network card, NIC provides a secure, faster, and more reliable connection.
2. NIC allows us to share bulk data among many users.
3. It helps us to connect peripheral devices using many ports of NIC.
4. Communication speed is high.
5. Network Interface cards are not expensive.
6. NICs are easy to troubleshoot.

# Disadvantages of NIC

A list of disadvantages of NIC is given below -

1. NIC is inconvenient as compared to the wireless card.
2. For wired NIC, a hard-wired connection is required.
3. NIC needs a proper configuration to work efficiently.
4. NIC cards are not secure, so the data inside NIC is not safe.

## Q4. Differentiate the following:

- OMR&OCR

### Main Difference

OMR stands for Optical mark recognition and turns right into a course of through which we get the human-marked information from quite a few paperwork along with survey and question along with draw back and assessments. Another determine used for such type of optical mark finding out. On the other hand, OCR stands for Optical Character Recognition computer performs to detect the printed or written textual content material and the characters used inside a paper. Different methods flip into part of the strategy the place photo-scanning or textual content material happens character by character, analysis of scanned pictures, and translation of pictures.

### Comparison Chart

Basis	OMR	OCR
Name	Optical Mark Recognition.	Optical Character Recognition.
Definition	A course of through which we get the human-marked information from quite a few paperwork along with survey and question along with draw back and assessments.	An movement that computer performs to detect the printed or written textual content material and the characters used inside a paper.
Purpose	Helps with determining the place the mark exists and finds the exact location of the alphabet or character.	Helps with determining what the mark represents and due to this fact, determines the exact nature.
Applications	It has its capabilities inside the topic of grading and tabulation.	Becomes used for altering paperwork from the printable mannequin to straightforward mannequin.

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### What is OMR?

OMR stands for Optical mark recognition and turns right into a course of through which we get the human-marked information from quite a few paperwork along with survey and question along with draw back and assessments. Another determine used for such type of optical mark finding out. Numerous customary OMR units work with a faithful scanner gadget that sparkles a lightweight emission onto the physique paper. The differentiating reflectivity at foreordained positions on an

internet web page is then used to acknowledge these checked zones since they replicate a lot much less mild than the precise ranges of the paper. Some OMR units take advantage of frames which might be preprinted onto “trans optic” paper and measure the measure of sunshine which matches through the journal. Short for Optical stamp acknowledgment, the innovation of electronically extricating anticipated knowledge from checked fields, as an example, checkboxes and fill-in fields, on printed shapes. OMR innovation examines written the form and peruses predefined positions and data the place imprints made on the physique. This change is efficient for capabilities by which expansive parts of hand-filled buildings should prepare rapidly and with superior exactness, as an example, analysis, reply taking part in playing cards, polls, and tallies. A typical OMR utility is the utilization of “air pocket sheets” for quite a few decision assessments utilized by colleges. OMR takes into consideration the coping with of tons of or a whole bunch of archives for every hour. For event, understudies may take assessments or overviews the place they stuffed in rises on paper (indicated acceptable) with a pencil. Once the shape had accomplished, an educator or trainer’s affiliate would keep the taking part in playing cards proper right into a framework that evaluations or assembles information from them.

### What is OCR?

OCR stands for Optical Character Recognition computer performs to detect the printed or written textual content material and the characters used inside a paper. Different methods flip into part of the strategy the place photo-scanning or textual content material happens character by character, analysis of scanned pictures, and translation of pictures. OCR is the acknowledgment of printed or composed content material materials characters by a PC. It consists of scanning of the content material materials character-by-character, investigation of the checked inside the picture, and after that interpretation of the character image into character codes, as an example, ASCII, generally utilized as a part of knowledge coping with. It is broadly used as a type of information half from printed paper knowledge data, regardless of whether or not or not worldwide ID archives, solicitations, monetary establishment proclamations, digital receipts, enterprise taking part in playing cards, mail, printouts of static knowledge, or any acceptable documentation. It is a typical method for digitizing printed messages with the intention that they’re typically electronically altered, regarded, put away additional minimalistic all, confirmed on-line, and utilized as a part of machine procedures, as an example, psychological processing. An OCR Framework empowers you to take a e guide or article, encourage it straightforwardly into an digital PC report, and afterward alter the doc utilizing a phrase processor. All OCR frameworks incorporate an optical scanner for perusing content material materials. The performance of OCR frameworks is gigantic on account of they empower customers to type out the ability of PCs to get to printed data. OCR is as of now being utilized broadly within the exact calling, the place appears that when required hours or days can now be skilled in a short time flat.

### Key Differences

1. OMR stands for Optical mark recognition, then once more, OCR stands for Optical Character Recognition.
2. OMR turns right into a course of through which we get the human-marked information from quite a few paperwork along with survey and question along with draw back and assessments. On the other hand, OCR turns into an movement that computer performs to detect the printed or written textual content material and the characters used inside a paper.
3. Different methods flip into part of the strategy of OCR the place photo-scanning or textual content material happens character by character, analysis of scanned pictures, and translation of pictures. On the other hand, the methods used for OMR are superior nevertheless just a few resembling image recognition and textual content material outputs.
4. OMR helps with determining the place the mark exists and finds the exact location of the alphabet or character. On the other hand, OCR helps with determining what the mark represents and due to this fact, determines the exact nature.

5. OMR has its capabilities inside the topic of grading and tabulation which makes it less complicated to mark down objects. On the other hand, OCR turns into used for altering paperwork from the printable mannequin to straightforward mannequin.
6. The processes used for OMR hold pure, then once more, the processes involved in OMR have a flowery nature.

- MICR & Bar code reader

## Difference between Optical Character Recognition (OCR) and Magnetic Ink Character Reader (MICR)

Difficulty Level : [Basic](#)

Last Updated : 05 Sep, 2019

### Optical Character Recognition (OCR):

OCR is the mechanical-electronic that converts the images into machine-encoded text. In other words, it is the use of technology to distinguish printed or handwritten text characters inside digital images of physical documents, such as a scanned paper document.

### Magnetic Ink Character Reader (MICR):

It is a character-recognition technology that is used by the banking industry to streamline the processing and clearance of cheques and other documents. In other words, it is a technology used to verify the originality of paper documents.

### **Difference between Optical Character Recognition (OCR) and Magnetic Ink Character Reader (MICR):**

#### OCR

OCR is a scanner that scans the pages comprised of texts.

It can scan any type of printed text

It supports variety of shapes of fonts

All type of ink are used in OCR

In OCR, Scanned data is used for editing or printing.

For example, If one wants to convert a multipage document into a digital image, he can load the document into an OCR program, which converts the document to an editable text file after recognizing the original text. .

#### MICR

MICR is a character scanning technology but it utilizes a magnetic ink and special characters.

It can scan the special information present in cheques.

It supports only Pre-defined fonts like E-138 and CMC-7.

In MICR, only special type – magnetic ink created using iron oxide are used.

In MICR, Scanned data is used for processing the cheques.

For Example, If one has an account in sector 62, Noida branch of Punjab National Bank (PNB). What would be its MICR code? City code for Noida: 110 ; Bank code for PNB: 032 ; Branch code for Sector 62: 013.  
Thus, the MICR code is: 110032013

<https://www.geeksforgeeks.org/difference-between-optical-character-recognition-ocr-and-magnetic-ink-character-reader-micr/>

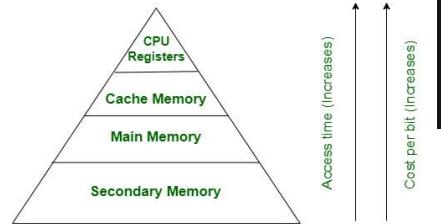
## Barcode Reader

Barcode is a set of small bars of varying thickness and spacing printed on the packages of products, on the back coverpages of books, tags etc. The barcode reader uses an optical scanner to read product code and converts it into electrical pulses. The device is connected to a computer and the information read is passed to the computer in digital form for automatic bill generation and updating of files. Thus, it is a direct data entry device and there is no need for an operator to key in sales transaction data.

## Magnetic Ink Character Recognition

Magnetic Ink Character Recognition (MICR) uses highly stylised character shapes printed in a special ink containing particles that can be magnetized. This ink induces a current in a reading circuit, which is proportional to the area of ink being scanned. The patterns of the varying currents can be compared with and selected as bit patterns of the selected number e.g., the number on a cheque). The MICR reader can only identify characters. Banking industry uses this device for sorting of cheques. The MICR codes read from the cheques are transmitted to an online computer for sorting and processing automatically.

## Difference between Primary and Secondary Memory



- CPU register
  - Cache memory
  - Primary / Main memory
  - Secondary Memory / Mass Storage
- They can be represented in an hierarchical form as:

### 1. Primary / Main memory:

Primary memory is the computer memory that is directly accessible by CPU. It is comprised of DRAM and provides the actual working space to the processor. It holds the data and instructions that the processor is currently working on.

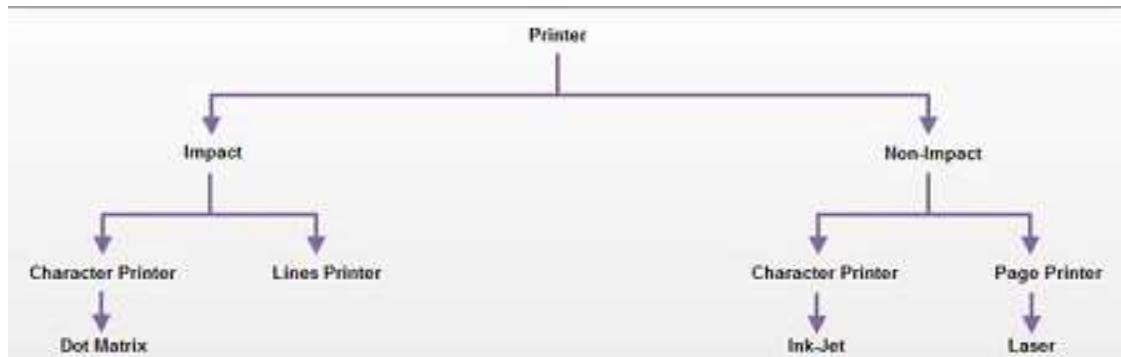
### 2. Secondary Memory / Mass Storage:

The contents of the secondary memory first get transferred to the primary memory and then are accessed by the processor, this is because the processor does not directly interact with the secondary memory. Now, Let's see the difference between Primary memory and Secondary memory:

Sr.No.	Primary memory	Secondary memory
1.	Primary memory is temporary.	Secondary memory is permanent.
2.	Primary memory is directly accessible by Processor/CPU.	Secondary memory is not directly accessible by the CPU.
3.	Nature of Parts of Primary memory varies, RAM- volatile in nature. ROM- Non-volatile.	It's always Non-volatile in nature.
4.	Primary memory devices are more expensive than secondary storage devices.	Secondary memory devices are less expensive when compared to primary memory devices.
5.	The memory devices used for primary memory are semiconductor memories.	The secondary memory devices are magnetic and optical memories.
6.	Primary memory is also known as Main memory or Internal memory.	Secondary memory is also known as External memory or Auxiliary memory.
7.	Examples: RAM, ROM, Cache memory, PROM, EPROM, Registers, etc.	

## What are printer and its type? And explain each.

**Printers** are Output devices used to prepare permanent Output devices on paper. Printers can be divided into two main categories :



**Impact Printers** : In this hammers or pins strike against a ribbon and paper to print the text. This mechanism is known as electro-mechanical mechanism. They are of two types.

**Character Printer** : It prints only one character at a time. It has relatively slower speed. Eg. Of them are Dot matrix printers.

**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.

**Laser Printer** is a type of printer that utilizes a laser beam to produce an image on a drum. The light of the laser alters the electrical charge on the drum wherever it hits. The drum is then rolled through a reservoir of toner, which is picked up by the charged portions of the drum. Finally, the toner is transferred to the paper through a combination of heat and pressure.

This is also the way copy machines work. Because an entire page is transmitted to a drum before the toner is applied, laser printers are sometimes called page printers. There are two other types of page printers that fall under the category of laser printers even though they do not use lasers at all. One uses an array of LEDs to expose the drum and the other uses LCDs. Once the drum is charged, however, they both operate like a real laser printer. One of the chief characteristics of laser printers is their resolution – how many dots per inch (dpi) they lay down.

The available resolutions range from 300 dpi at the low end to 1,200 dpi at the high end. In addition to text, laser printers are very adept at printing graphics, so you need significant amounts of [memory](#) in the printer to print high-resolution graphics. To print a full-page graphic at 300 dpi, for example, you need at least 1 MB (megabyte) of printer RAM. For a 600 dpi graphic, you need at least 4MBRAM. Because laser printers are non-impact printers, they are much quieter than dot matrix or daisy-wheel printers. They are also relatively fast, although not as fast as some dot-matrix or daisy-wheel printers. The speed of laser printers ranges from about 4 to 20 pages of text per minute (ppm). A typical rate of 6ppm is equivalent to about 40 characters per second (cps).

**Non-Impact Printers** : These printers use non-Impact technology such as ink-jet or laser technology. These printers provide better quality of O/P at higher speed. These printers are of two types :

**Ink-Jet Printer** : It prints characters by spraying patterns of ink on the paper from a nozzle or jet. It prints from nozzles having very fine holes, from which a specially made ink is pumped out to create various letters and shapes. The ink comes out of the nozzle in a form of vapors. After passing through a reflecting plate, it forms the desired letter/shape at the desired place.

A [page printer](#) is a computer printer which processes and prints a whole page at a time, as opposed to printers which print one line or character at a time such as [line printers](#) and [dot matrix printers](#). Page printers are often all incorrectly termed "laser printers" – although virtually all laser printers are page printers, other page printing technologies also exist

page printer A type of printer that prints a complete page of output in one cycle. It is generally a [nonimpact printer](#), such as a [laser](#) or [inkjet printer](#), in which the printing process requires continuous movement of the paper. The information for one page of output is usually accumulated within a buffer in the printer before the printing process is started. Compare [line printer](#), [serial printer](#).

# What are monitor and its type?

## What is a Monitor?



A monitor is an electronic output device that is also known as a **video display terminal** (VDT) or a **video display unit** (VDU). It is used to display images, text, video, and graphics information generated by a connected computer via a computer's video card. Although it is almost like a TV, its resolution is much higher than a TV. The first computer monitor was introduced on **1 March 1973**, which was part of the Xerox Alto computer system.

Older monitors were built by using a fluorescent screen and Cathode Ray Tube (CRT), which made them heavy and large in size and thus causing them to cover more space on the desk. Nowadays, all monitors are made up by using flat-panel display technology, commonly backlit with LEDs. These modern monitors take less space on the desk as compared to older CRT displays.

## History of Monitors

- In **1964**, the Uniscope 300 machine included a built-in CRT display, which was not a true computer monitor.
- Johnson invented the touch screen technology in **1965**.
- On **1 March 1973**, Xerox Alto computer was introduced, which had the first computer monitor. This monitor included a monochrome display and used CRT technology.
- In **1975**, George Samuel Hurst introduced the first resistive touch screen display, although it was used only before **1982**.
- In **1976**, the Apple I and Sol-20 computer systems were introduced. These systems had a built-in video port that allowed them to run a video screen on computer monitor.
- In **1977**, James P. Mitchell invented LED display technology. But even 30 years later, these monitors were not easily available to buy in the market.
- In June **1977**, the Apple II was released, allowing for color display on a CRT monitor.
- In **1987**, IBM released the IBM 8513, first VGA monitor.
- In **1989**, VESA defined the SVGA standard for the display of computers.
- In the late-**1980s**, the color CRT monitors were able to support  $1024 \times 768$  resolution display.
- Eizo Nanao manufactured the Eizo L66, the first LCD monitors for desktop computers, and released it in the middle-**1990s**.
- In **1997**, the color LCD monitors were started developing by IBM, Viewsonic, and Apple that provide better quality and resolution than CRT monitors.
- In **1998**, the color LCD monitors for desktop computers were manufactured by Apple.
- Later in **2003**, CRT monitors outsell for the first time by LCD monitors. Till **2007**, CRT monitors consistently outsell by LCD monitors, so they become more popular computer monitor.

- In 2006, Jeff Han released the first interface-free, touch-based monitor at TED.
- In 2009, the LED monitor MultiSync EA222WMe was released by NEC company. It was the first monitor released by NEC.
- AMD and Intel announced to end support for VGA in December 2010.
- In 2017, touch screen LCD monitors became more affordable for the customers as they started to decrease the price.

## Types of Monitors

There are several types of monitors; some are as follows:

### 1. Cathode Ray Tube (CRT) Monitors

It is a technology used in early monitors. It uses a beam of electrons to create an image on the screen. It comprises the guns that fire a beam of electrons inside the screen. The electron beams repeatedly hit the surface of the screen. These guns are responsible for generating RGB (Red, Green, Blue) colors, and more other colors can be generated with the help of combining these three colors. Today's Flat Panel Monitors replace the CRT monitors.



### 2. Flat Panel Monitors

These types of monitors are lightweight and take less space. They consume less power as compared to CRT monitors. These monitors are more effective as they do not provide harmful radiation. These monitors are more expensive than CRTs. The flat-panel monitors are used in PDA, notebook computers, and cellular phones. These monitors are available in various sizes like 15", 17", 18" & 19" and more. The display of a flat-panel monitor is made with the help of two plates of glass. These plates contain a substance, which is activated in many ways.



**Flat-panel monitor screens use two types of technologies, which are given below:**

- **Liquid Crystal Display:** LCD (Liquid crystal display) screen contains a substance known as liquid crystal. The particles of this substance are aligned in a way that the light located backside on the screens, which allow to generate an image or block. Liquid crystal display offers a clear picture as compared to CRT display and emits less radiation. Furthermore, it consumes less power and takes less space than a CRT display.

- **Gas Plasma Display:** This display uses gas plasma technology, which uses a layer of gas between 2 plates of glass. When voltage is applied, the gas releases ultraviolet light. By this ultraviolet light, the pixels on the screen glow and form an image. These displays are available in different sizes of up to 150 inches. Although it offers effective colors as compared to the LCD monitor, it is more expensive. That's why it is less used.



### 3. Touch Screen Monitors

These monitors are also known as an input device. It enables users to interact with the computer by using a finger or stylus instead of using a mouse or keyboard. When users touch the screen by their finger, it occurs an event and forward it to the controller for processing. These types of screens include pictures or words that help users to interact with the computer. It takes input from the users by touching menus or icons presented on the screen.

There are different types of touch screen monitors; three common types are given below:

- **Resistive Touch Screen:** Generally, this screen includes a thin electrically conductive and resistive layer of metal. When the touch is pressed, a change in the electrical current occurs that is sent to the controller. Nowadays, these screens are widely in use. These monitors are more reliable as they cannot be affected by liquids or dust.
- **Surface Wave Touch Screens:** These monitors process the input through ultrasonic waves. When a user touches the screen, the wave is processed and absorbed by the computer. It is less reliable as they can be damaged by water or dust.
- **Capacitive Touch Screen:** This screen includes a cover with an electrically-charged material. This material continuously flows the current over the screen. It is mainly used by the finger rather than a stylus. These monitors contain better clarity and do not damage by dust. Nowadays, capacitive touch screen is mostly used in smartphones.



### 4. LED Monitors

It is a flat screen computer monitor, which stands for light-emitting diode display. It is lightweight in terms of weight and has a short depth. As the source of light, it uses a panel of LEDs. Nowadays, a wide number of electronic devices, both large and small devices such as laptop screens, mobile phones, TVs, computer monitors, tablets, and more, use LED displays.

It is believed that James P. Mitchell invented the first LED display. On 18 March 1978, the first prototype of an LED display was published to the market at the SEF (Science and Engineering Fair) in Iowa. On 8 May 1978, it was shown again in Anaheim California, at the SEF. This prototype received awards from NASA and General Motors.

#### Advantages of LED Monitor:

- It includes a broader dimming range.
- It is a more reliable monitor.
- It is often less expensive.
- It consumes less power (20 watts), and run on a lower temperature.
- It has a more dynamic contrast ratio.

#### Comparison between LCD and LED monitors:

Resolution 1920 x 1080	LCD Monitors	Led Monitors
<b>Brightness</b>	250 cd / m <sup>2</sup>	250 cd / m <sup>2</sup>
<b>Energy Star Certified</b>	No	Yes
<b>Weight</b>	2.4 kg	2.4 kg
<b>Contrast Ratio</b>	12,000,000: 1	100,000,000: 1



## 5. OLED Monitors

It is a new flat light-emitting display technology, which is more efficient, brighter, thinner, and better refresh rates feature and contrast as compared to the LCD display. It is made up of locating a series of organic thin films between two conductors. These displays do not need a backlight as they are emissive displays.

Furthermore, it provides better image quality ever and used in tablets and high-end smartphones.

Nowadays, it is widely used in laptops, TVs, mobile phones, digital cameras, tablets, VR headsets. The demand for mobile phone vendors, more than 500 million AMOLED screens were produced in 2018. The Samsung display is the main producer of the AMOLED screen. For example, Apple is using AMOLED OLED panel made by SDC in its 2018 iPhone XS - a 5.8" 1125x2436. Additionally, iPhone X is also using the same AMOLED display.



## 6. DLP Monitors

DLP stands for **Digital Light Processing**, developed by Texas Instruments. It is a technology, which is used for presentations by projecting images from a monitor onto a big screen. Before developing the DLP, most of the computer projection systems produced faded and blurry images as they were based on LCD technology. DLP technology utilizes a digital micromirror device, which is a tiny mirror housed on a special kind of microchip. Furthermore, it offers better quality pictures that can also be visible in a lit room normally.



## 7. TFT Monitors

It is a type of LCD flat panel display, which stands for a thin-film transistor. In TFT monitors, all pixels are controlled with the help of one to four transistors. The high-quality flat-panel LCDs use these transistors. Although the TFT-based monitors provide better resolution of all the flat-panel techniques, these are highly expensive.

The LCDs, which use thin-film transistor (TFT) technology, are known as active-matrix displays. The active-matrix displays offer higher quality as compared to older passive-matrix displays.

## 8. Plasma Screen Monitors



A plasma screen is a thin, flat-panel, and capable of hanging on a wall like LCD and LED televisions. It is a brighter screen as compared to LCD displays and thinner than CRT displays. It can be used to either display modes of digital computer input or analog video signals, and sometimes, it is marketed as 'thin-panel' displays. Plasma displays have wide viewing angles, high contrast ratios, and high refresh rates, which is used to reduce a blur video. Additionally, it provides better quality pictures as it supports high resolutions of up to 1920 x 1080.

The plasma screen also includes some disadvantages such as the **chance of screen burn-in, consumes more power, loss of brightness with time, can be heavier in weight.**

## Types of monitor connector

Computer monitors require one of the following kinds of connectors to connect with a computer.

- VGA
- Thunderbolt
- HDMI
- USB-C
- DVI
- DisplayPort



**VGA:** It is a popular display standard, stands for **Video Graphics Array** or **Video Graphics Adapter**. It was introduced in 1987 after being developed by [IBM](#). It is used to connect a computer with a projector, monitor, or TV. It offers a 640 x 480 resolution color display, including 16 colors display and a refresh rate of 60 Hz at a time. If the resolution is less than 320 x 200, it displays 256 colors. It is only able to show lower quality, and lower resolutions display on the screens as it uses analog signals. The [VGA](#) connector and cable are less found with today's projectors, monitors, computers, and TVs. These connectors are being replaced by [HDMI](#) and DVI cable and connectors.



Thunderbolt Cable

**Thunderbolt:** It is a [hardware](#) interface, which was marketed under the name Light Peak and developed by Intel in collaboration with Apple. On 24 February 2011, it was first sold as part of a consumer product. It is used for connecting peripheral devices such as a mouse, keyboard, printer, scanner, and more to a computer. It is capable of carrying DC power and has the ability to transfer the data on long-distance over cheaper cables. The first two versions of Thunderbolt are capable of transferring the data at a rate of up to 20 Gb in a second. The 3rd iteration is capable to use a USB Type-C connector and can transfer data at a rate of up to 40 Gb per second.

### What materials are used to make a Thunderbolt cable?

The two types of Thunderbolt cables are available where one uses optical wiring, and another uses copper wiring. Although Thunderbolt cables were designed to use as fiber optic cables, those versions were released in fewer numbers. Copper wiring allows the cables to supply power, and it is less expensive, that's why it was widely used. Afterall, intel intends to use the power of copper wiring to provide faster bandwidth speeds of optical by combining both optical and copper wiring.



**HDMI:** It is a cable and connector developed by several companies, including Toshiba, Sony, Hitachi, and Philips. It stands for High Definition Multimedia Interface. It has the ability to transmit the high-bandwidth and high-quality streams of audio and video between devices. It is used with Projector, HDTV, Blu-ray player, or DVD player.

A single HDMI cable provides an easier way to connect two devices together for transmitting audio and video signals by replacing the three-composite audio/video cables. Furthermore, it is able to transmit up to 8-channels of digital audio signals, including enhanced, standard, and high-definition video signals. The HDMI cable is available in various length of up to 50 feet. Although, it is not recommended to purchase a cable of length more than 25 feet because it may occur a problem of signal loss or degradation.

**USB-C:** It is a plug and play interface, stands for **Universal Serial Bus**. It allows the computer to communicate with peripheral and other devices. It is also able to send power to certain devices like tablets and smartphones, including charging their batteries. In January 1996, the first version of the Universal Serial Bus was released. Then, this technology was followed by Compaq, Intel, Microsoft, and other companies.

Nowadays, there are several [USB](#) devices that can be connected to a computer such as Digital Camera, [Keyboard](#), [Microphone](#), Mouse, [Printer](#), Scanner, and more. Furthermore, USB connectors are available in different shapes and sizes. The length of a USB cable used for high-speed devices is **16 feet 5 inches** (its maximum length), and **9 feet 10 inches** is used for low-speed devices.

**DVI:** It is a video display interface, stands for **Digital Visual Interface**. It is used to transmit Digital Visual Interface and display devices at high 2560 x 1600 resolutions. Computer monitors and projectors are the common devices that use the DVI connection. It can also be used by some TVs; however, HDMI is most common because only some DVI cables have the ability to transmit audio signals.



The DVI connector supports one of three names on the basis of the signals: DVI-D (support the only digital), DVI-A (support the only analog), or DVI-I (support both analog and digital). If your GPU and monitor have the capability to support both VGA and DVI, it is suggested to use DVI cable. The DVI cable always provides picture quality at least equal to VGA and better if possible.

**DisplayPort:** It is a digital audio and video interface that connects to a projector, monitor, or TV cable. It is created by VESA. There are two types of connections in DisplayPort one is standard, and the second is the Mini DisplayPort. They have different size, but both

connections types are able to transmit identical signals. Nowadays, VGA, HDMI, and DVI are the most common types of display ports.

### DisplayPort Cable



## Difference between LCD and LED

The below table contains several differences between LCD and LED:

LCD	LED
It stands for <b>Liquid Crystal Display</b> .	Short for <b>Light-Emitting Diodes</b> .
LCD monitors are not a subset of LED monitors.	LED monitors are subset of LCD monitors.
It primarily uses fluorescent lights.	It mainly uses light-emitting diodes.
In LCDs, usually fluorescent lights are located at the backside of the screen.	Usually, light-emitting diodes are located around the edges or backside of the screen.
LCDs are less energy efficient than LEDs and are thicker in size.	LEDs are more energy-efficient and are much thinner in size as compared to LCDs.
Its resolution is low.	Its resolution is high.
Its contrast ratio is high.	Its contrast ratio is low.
Direct current can reduce the span life of LCDs.	Direct current does not have any effect on LEDs.
LCDs display area is large.	LEDs display area is small.
The switching time of LCD is slow.	The switching time of LED is fast.

# What do you mean by computer memory define types of memory

## Classification of Memory

In computers, **memory** is the most essential component of the normal functioning of any system. The computer system categorizes the memory for different purposes and uses. In this section, we have discussed the **classification of memory** in detail. Also, we will discuss **types of memory, features of memory, RAM, ROM, SRAM, DRAM**, and its advantages and disadvantages.

## What is computer memory?

**Computer memory** is any physical device, used to store data, information or instruction temporarily or permanently. It is the collection of storage units that stores binary information in the form of bits. The memory block is split into a small number of components, called cells. Each cell has a unique address to store the data in memory, ranging from zero to memory size minus one. For example, if the size of computer memory is 64k words, the memory units have  $64 * 1024 = 65536$  locations or cells. The address of the memory's cells varies from 0 to 65535.

## Why do we need a computer memory?

In the computer system, we need computer memory to store various types of data like text, images, video, audio, documents, etc. We can retrieve it when the data is required. For example, when we write and execute any computer program, it is initially stored in primary memory. If the processor does not need particular items for a longer time, the program or data is automatically saved into the permanent or secondary memory. Then the data is called from secondary memory to main memory and performs the execution of codes.

## Features of Memory

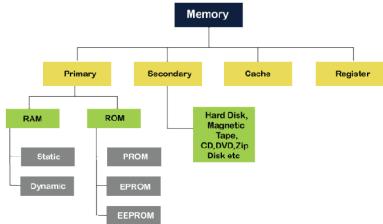
Following are the different features of the memory system that includes:

1. **Location:** It represents the internal or external location of the memory in a computer. The internal memory is inbuilt in computer memory. It is also known as primary memory. The example of primary memory are registers, cache and main memory. Whereas, external memory is the separate storage device from the computer, such as disk, tape, USB pen drive.
2. **Capacity:** It is the most important feature of computer memory. Storage capacity can vary in external and internal memory. External devices' storage capacity is measured in terms of bytes, whereas the internal memory is measured with bytes or words. The storage word length can vary in bits, such as 8, 16 or 32 bits.
3. **Access Methods:** Memory can be accessed through four modes of memory.
  - o **DMA:** As the name specifies, Direct Memory Address (DMA) is a method that allows input/output (I/O) devices to access or retrieve data directly or from the main memory.
  - o **Sequential Access Method:** The sequential access method is used in a data storage device to read stored data sequentially from the computer memory. Whereas, the data received from random access memory (RAM) can be in any order.
  - o **Random Access Method:** It is a method used to randomly access data from memory. This method is the opposite of SAM. For example, to go from A to Z in random access, we can directly jump to any specified location. In the Sequential method, we have to follow all intervening from A to Z to reach at the particular memory location.
  - o **Associative Access Method:** It is a special type of memory that optimizes search performance through defined data to directly access the stored information based on a memory address.

4. **Unit of transfer:** As the name suggests, a unit of transfer measures the transfer rate of bits that can be read or write in or out of the memory devices. The transfer rate of data can be different in external and internal memory.
- **Internal memory:** The transfer rate of bits is mostly equal to the word size.
  - **External memory:** The transfer rate of bit or unit is not equal to the word length. It is always greater than a word or may be referred to as **blocks**.
5. **Performance:** The performance of memory is majorly divided into three parts.
- **Access Time:** In random access memory, it represents the total time taken by memory devices to perform a read or write operation that an address is sent to memory.
  - **Memory Cycle Time:** Total time required to access memory block and additional required time before starting second access.
  - **Transfer rate:** It describes the transfer rate of data used to transmit memory to or from an external or internal memory device. Bit transfer can be different for different external and internal devices.
6. **Physical types:** It defines the physical type of memory used in a computer such as magnetic, semiconductor, magneto-optical and optical.
7. **Organization:** It defines the physical structure of the bits used in memory.
8. **Physical characteristics:** It specifies the physical behavior of the memory like volatile, non-volatile or non-erasable memory. Volatile memory is known as RAM, which requires power to retain stored information, and if any power loss has occurred, stored data will be lost. Non-volatile memory is a permanent storage memory that is used to obtain any stored information, even when the power is off. Non-erasable memory is a type of memory that cannot be erased after the manufactured like ROM because at the time of manufactured ROM are programmed.

## Classification of Memory

The following figure represents the classification of memory:



### Primary or Main Memory

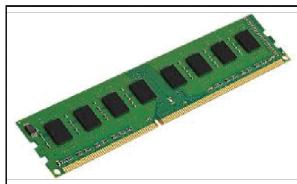
Primary memory is also known as the computer system's main memory that communicates directly within the [CPU](#). Auxiliary memory and the Cache memory. Main memory is used to kept programs or data when the processor is active to use them. When a program or data is activated to execute, the processor first loads instructions or programs from secondary memory into main memory, and then the processor starts execution. Accessing or executing of data from primary memory is faster because it has a cache or register memory that provides faster response, and it is located closer to the [CPU](#). The primary memory is volatile, which means the data in memory can be lost if it is not saved when a power failure occurs. It is costlier than secondary memory, and the main memory capacity is limited as compared to secondary memory.

The primary memory is further divided into two parts:

1. RAM (Random Access Memory)
2. ROM (Read Only Memory)

### Random Access Memory (RAM)

[Random Access Memory \(RAM\)](#) is one of the faster types of main memory accessed directly by the CPU. It is the hardware in a computer device to temporarily store data, programs or program results. It is used to read/write data in memory until the machine is working. It is volatile, which means if a power failure occurs or the computer is turned off, the information stored in [RAM](#) will be lost. All data stored in computer memory can be read or accessed randomly at any time.



There are two types of RAM:

- SRAM
- DRAM

**DRAM:** DRAM (**D**ynamic **R**andom-**A**ccess **M**emory) is a type of RAM that is used for the dynamic storage of data in RAM. In DRAM, each cell carries one-bit information. The cell is made up of two parts: a **capacitor** and a **transistor**. The size of the capacitor and the transistor is so small, requiring millions of them to store on a single chip. Hence, a DRAM chip can hold more data than an SRAM chip of the same size. However, the capacitor needs to be continuously refreshed to retain information because DRAM is volatile. If the power is switched off, the data stored in memory is lost.

#### **Characteristics of DRAM**

1. It requires continuously refreshed to retain the data.
2. It is slower than SRAM
3. It holds a large amount of data
4. It is the combination of capacitor and transistor
5. It is less expensive as compared to SRAM
6. Less power consumption

**SRAM:** SRAM (**S**tatic **R**andom-**A**ccess **M**emory) is a type of RAM used to store static data in the memory. It means to store data in SRAM remains active as long as the computer system has a power supply. However, data is lost in SRAM when power failures have occurred.

#### **Characteristics of Static Ram**

1. It does not require to refresh.
2. It is faster than DRAM
3. It is expensive.
4. High power consumption
5. Longer life
6. Large size
7. Uses as a cache memory

### **SRAM Vs. DRAM**

<b>SRAM</b>	<b>DRAM</b>
It is a Static Random-Access Memory.	It is a Dynamic Random Access Memory.
The access time of SRAM is slow.	The access time of DRAM is high.
It uses flip-flops to store each bit of information.	It uses a capacitor to store each bit of information.
It does not require periodic refreshing to preserve the information.	It requires periodically refreshing to preserve the information.
It uses in cache memory.	It is used in the main memory.
The cost of SRAM is expensive.	The cost of DRAM is less expensive.
It has a complex structure.	Its structure is simple.
It requires low power consumption.	It requires more power consumption.

### **Advantages of RAM**

- It is a faster type of memory in a computer.
- It requires less power to operate.
- Program loads much faster
- More RAM increases the performance of a system and can multitask.

- Perform read and write operations.
- The processor can read information faster than a hard disc, floppy, USB, etc.

### **Disadvantages of RAM**

- Less RAM reduces the speed and performance of a computer.
- Due to volatile, it requires electricity to preserve the data.
- It is expensive than ROM
- It is unreliable as compared to ROM
- The Size of RAM is limited.



### **Read-Only Memory (ROM)**

ROM is a memory device or storage medium that is used to **permanently** store information inside a chip. It is a read-only memory that can only read stored information, data or programs, but we cannot write or modify anything. A ROM contains some important instructions or program data that are required to start or boot a computer. It is a **non-volatile** memory; it means that the stored information cannot be lost even when the power is turned off or the system is shut down.

### **Types of ROM**

There are five types of Read Only Memory:

#### **1. MROM (Masked Read Only Memory):**

MROM is the oldest type of read-only memory whose program or data is pre-configured by the integrated circuit manufacturer at the time of manufacturing. Therefore, a program or instruction stored within the MROM chip cannot be changed by the user.

#### **2. PROM (Programmable Read Only Memory):**

It is a type of digital read-only memory, in which the user can write any type of information or program only once. It means it is the empty PROM chip in which the user can write the desired content or program only once using the special PROM programmer or PROM burner device; after that, the data or instruction cannot be changed or erased.

#### **3. EPROM (Erasable and Programmable Read Only Memory):**

It is the type of read only memory in which stored data can be erased and re-programmed only once in the EPROM memory. It is a non-volatile memory chip that holds data when there is no power supply and can also store data for a minimum of 10 to 20 years. In EPROM, if we want to erase any stored data and re-programmed it, first, we need to pass the ultraviolet light for 40 minutes to erase the data; after that, the data is re-created in EPROM.

#### **4. EEPROM (Electrically Erasable and Programmable Read Only Memory):**

The EEPROM is an electrically erasable and programmable read only memory used to erase stored data using a high voltage electrical charge and re-programmed it. It is also a non-volatile memory whose data cannot be erased or lost; even the power is turned off. In EEPROM, the stored data can be erased and reprogrammed up to 10 thousand times, and the data erase one byte at a time.

#### **1. Flash ROM:**

Flash memory is a non-volatile storage memory chip that can be written or programmed in small units called Block or Sector. Flash Memory is an EEPROM form of computer memory, and the contents or data

cannot be lost when the power source is turned off. It is also used to transfer data between the computer and digital devices.

#### **Advantages of ROM**

2. It is a non-volatile memory in which stored information can be lost even power is turned off.
3. It is static, so it does not require refreshing the content every time.
4. Data can be stored permanently.
5. It is easy to test and store large data as compared to RAM.
6. These cannot be changed accidentally
7. It is cheaper than RAM.
8. It is simple and reliable as compared to RAM.
9. It helps to start the computer and loads the OS.

#### **Disadvantages of ROM**

1. Store data cannot be updated or modify except to read the existing data.
2. It is a slower memory than RAM to access the stored data.
3. It takes around 40 minutes to destroy the existing data using the high charge of ultraviolet light.

### **RAM Vs. ROM**

<b>RAM</b>	<b>ROM</b>
It is a Random-Access Memory.	It is a Read Only Memory.
Read and write operations can be performed.	Only Read operation can be performed.
Data can be lost in volatile memory when the power supply is turned off.	Data cannot be lost in non-volatile memory when the power supply is turned off.
It is a faster and expensive memory.	It is a slower and less expensive memory.
Storage data requires to be refreshed in RAM.	Storage data does not need to be refreshed in ROM.
The size of the chip is bigger than the ROM chip to store the data.	The size of the chip is smaller than the RAM chip to store the same amount of data.
Types of RAM: DRAM and SRAM	Types of ROM: MROM, PROM, EPROM, EEPROM

### **Secondary Memory**

Secondary memory is a **permanent storage** space to hold a large amount of data. Secondary memory is also known as external memory that representing the various storage media (hard drives, USB, CDs, flash drives and DVDs) on which the computer data and program can be saved on a long term basis. However, it is cheaper and slower than the main memory. Unlike primary memory, secondary memory cannot be accessed directly by the CPU. Instead of that, secondary memory data is first loaded into the RAM (Random Access Memory) and then sent to the processor to read and update the data. Secondary memory devices also include magnetic disks like hard disk and floppy disks, an optical disk such as CDs and CDROMs, and magnetic tapes.

#### **Features of Secondary Memory**

- Its speed is slower than the primary/ main memory.
- Store data cannot be lost due to non-volatile nature.
- It can store large collections of different types, such as audio, video, pictures, text, software, etc.
- All the stored data in a secondary memory cannot be lost because it is a permanent storage area; even the power is turned off.
- It has various optical and magnetic memories to store data.

## Types of Secondary Memory

The following are the types of secondary memory devices:



### Hard Disk

A hard disk is a computer's permanent storage device. It is a non-volatile disk that permanently stores data, programs, and files, and cannot lose store data when the computer's power source is switched off. Typically, it is located internally on computer's motherboard that stores and retrieves data using one or more rigid fast rotating disk platters inside an air-sealed casing. It is a large storage device, found on every computer or laptop for permanently storing installed software, music, text documentation, videos, operating system, and data until the user did not delete.



### Floppy Disk

A floppy disk is a secondary storage system that consisting of thin, flexible magnetic coating disks for holding electronic data such as computer files. It is also known as Floppy Diskette that comes in three sizes like 8 inches, 5.5 inches and 3.5 inches. The stored data of a floppy disk can be accessed through the floppy disk drive. Furthermore, it is the only way through a new program installed on a computer or backup of the information. However, it is the oldest type of portable storage device, which can store data up to 1.44 MB. Since most programs were larger, that required multiple floppy diskettes to store large amounts of data. Therefore, it is not used due to very low memory storage.

### CD (Compact Disc)

A CD is an optical disk storage device, stands for Compact Disc. It is a storage device used to store various data types like audio, videos, files, OS, Back-Up file, and any other information useful to a computer. The CD has a width of 1.2 mm and 12 cm in height, which can store approximately 783 MB of data.



ata size. It uses laser light to read and write data from the CDs.

### Types of CDs

1. **CD-ROM (Compact Disc Read Only Memory):** It is mainly used for bulk size mass like audio CDs, software and computer games at the time of manufacture. Users can only read data, text, music, videos from the disc, but they cannot modify or burn it.
2. **CD-R (Compact Disc Recordable):** The type of Compact Disc used to write once by the user; after that, it cannot be modified or erased.
3. **CD-RW (Compact Disc Rewritable):** It is a rewritable CD disc, often used to write or delete the stored data.

### DVD Drive/Disc

DVD is an optical disc storage device, stands for **Digital Video Display or Digital Versatile Disc**. It has the same size as a CD but can store a larger amount of data than a compact disc. It was developed in **1995** by Sony, Panasonic, Toshiba and Philips four electronics companies. DVD drives are divided into three types, such as DVD ROM (Read Only Memory), **DVD R** (Recordable) and **DVD RW** (Rewritable or Erasable). It can store multiple data formats like audio, videos, images, software, operating system, etc. The storing capacity of data in DVD is 4.7 GB to 17 GB.



### **Blu Ray Disc (BD)**

Blu Ray is an Optical disc storage device used to store a large amount of data or high definition of video recording and playing other media files. It uses laser technology to read the stored data of the Blu-ray Disk. It can store more data at a greater density as compared to CD/ DVD. For example, compact discs allow us to store 700 MB of data, and in DVDs, it provides up to 8 GB of storage capacity, while Blu-ray Discs provide 28 GB of space to store data.

### **Pen Drive**

A pen drive is a portable device used to permanently store data and is also known as a USB flash drive. It is commonly used to store and transfer the data connected to a computer using a USB port. It does not have any moveable part to store the data; it uses an integrated circuit chip that stores the data. It allows the users to store and transfer data like audio, videos, images, etc. from one computer to any USB pen drive. The storing capacity of pen drives from 64 MB to 128 GB or more.



### **Cache Memory**

It is a small-sized chip-based computer memory that lies between the CPU and the main memory. It is a faster, high performance and temporary memory to enhance the performance of the CPU. It stores all the data and instructions that are often used by computer CPUs. It also reduces the access time of data from the main memory. It is faster than the main memory, and sometimes, it is also called CPU memory because it is very close to the CPU chip. The following are the levels of cache memory.



- L1 Cache:** The L1 cache is also known as the onboard, internal, or primary cache. It is built with the help of the CPU. Its speed is very high, and the size of the L1 cache varies from 8 KB to 128 KB.
- L2 Cache:** It is also known as external or secondary cache, which requires fast access time to store temporary data. It is built into a separate chip in a motherboard, not built into the CPU like the L1 level. The size of the L2 cache may be 128 KB to 1 MB.
- L3 Cache:** L3 cache levels are generally used with high performance and capacity of the computer. It is built into a motherboard. Its speed is very slow, and the maximum size up to 8 MB.

### Advantages of Cache Memory

- Cache memory is the faster memory as compared to the main memory.
- It stores all data and instructions that are repeatedly used by the CPU for improving the performance of a computer.
- The access time of data is less than the main memory.

### Disadvantage of Cache Memory

- It is very costly as compared to the Main memory and the Secondary memory.
- It has limited storage capacity.

### Register Memory

The register memory is a temporary storage area for storing and transferring the data and the instructions to a computer. It is the smallest and fastest memory of a computer. It is a part of computer memory located in the CPU as the form of registers. The register memory is 16, 32 and 64 bits in size. It temporarily stores data instructions and the address of the memory that is repeatedly used to provide faster response to the CPU.

### Primary Vs. Secondary Memory

Primary Memory	Secondary Memory
It is also known as temporary memory.	It is also known as a permanent memory.
Data can be accessed directly by the processor or CPU.	Data cannot be accessed directly by the I/O processor or CPU.
Stored data can be a volatile or non-volatile memory.	The nature of secondary memory is always non-volatile.
It is more costly than secondary memory.	It is less costly than primary memory.
It is a faster memory.	It is a slower memory.
It has limited storage capacity.	It has a large storage capacity.
It required the power to retain the data in primary memory.	It does not require power to retain the data in secondary memory.
Examples of primary memory are RAM, ROM, Registers, EPROM, PROM and cache memory.	Examples of secondary memory are CD, DVD, HDD, magnetic tapes, flash disks, pen drive, etc.



## (b) What are software and its types with example?

### Software

Software, which is abbreviated as SW or S/W, is a set of programs that enables the hardware to perform a specific task. All the programs that run the computer are software. The software can be of three types: system software, application software, and programming software.

#### 1) System Software

The system software is the main software that runs the computer. When you turn on the computer, it activates the hardware and controls and coordinates their functioning. The application programs are also controlled by system software. An operating system is an example of system software.

##### i) Operating System:

An operating system is the system software that works as an interface to enable the user to communicate with the computer. It manages and coordinates the functioning of hardware and software of the computer. The commonly used operating systems are Microsoft Windows, [Linux](#) and Apple Mac OS X.

**Some other examples of system software include:**

- **BIOS:** It stands for basic input output system. It is a type of system software, which is stored in Read Only Memory (ROM) located on the motherboard. However, in advanced computer systems, it is stored in flash memory. BIOS is the first software that gets activated when you turn on your computer system. It loads the drivers of the hard disk into memory as well as assists the operating system to load itself into the memory.
- **Boot Program:** Boot refers to starting up a computer. When you switch on the computer, the commands in the ROM are executed automatically to load the boot program into memory and execute its instructions. The BIOS program has a basic set of commands that enables the computer to perform the basic input/output instructions to start the computer.
- **An assembler:** It plays the role of a converter as it receives basic computer instructions and converts them into a pattern of bits. The processor uses these bits to perform basic operations.
- **A device driver:** This system software controls hardware devices connected to a computer. It enables the computer to use the hardware by providing an appropriate interface. The kernel of a Computer's CPU communicates with different hardware through this software. Operating systems generally come with most of the device drivers. If the operating system does not have a device driver for hardware, you have to install the device driver before using that hardware device.

#### 2) Application Software:



Application software is a set of programs designed to perform a specific task. It does not control the working of a computer as it is designed for end-users. A computer can run without application software. Application software can be easily installed or uninstalled as required. It can be a single program or a collection of small programs. Microsoft Office Suite, Adobe Photoshop, and any other software like payroll software or income tax software are application software. As we know, they are designed to perform specific tasks. Accordingly, they can be of different types such as:

- **Word Processing Software:** This software allows users to create, edit, format, and manipulate the text and more. It offers lots of options for writing documents, creating images, and more. For example, MS Word, WordPad, Notepad, etc.
- **Spreadsheet Software:** It is designed to perform calculations, store data, create charts, etc. It has rows and columns, and the data is entered in the cell, which is an intersection of a row and column, e.g., Microsoft Excel.
- **Multimedia Software:** These software are developed to perform editing of video, audio, and text. It allows you to combine texts, videos, audio, and images. Thus, you can improve a text document by adding photos, animations, graphics, and charts through multimedia software. For example, VLC player, Window Media Player, etc.
- **Enterprise Software:** These software are developed for business operational functions. It is used in large organizations where the quantum of business is too large. It can be used for accounting, billing, order processing and more. For example, CRM (Customer Relationship Management), BI (Business Intelligence), ERP (Enterprise Resource Planning), SCM (Supply Chain Management), customer support system, and more.

### 3) Programming Software:

It is a set or collection of tools that help developers in writing other software or programs. It assists them in creating, debugging, and maintaining software or programs or applications. We can say that these are facilitator software that helps translate programming language such as [Java](#), [C++](#), [Python](#), etc., into machine language code. So, it is not used by end-users. For example, compilers, linkers, debuggers, interpreters, text editors, etc. This software is also called a programming tool or software development tool.

Some examples of programming software include:

- **Eclipse:** It is a java language editor.
- **Coda:** It is a programming language editor for Mac.
- **Notepad++:** It is an open-source editor for windows.
- **Sublime text:** It is a cross-platform code editor for Linux, Mac, and Windows.

### Q.3 (a) define operating system with functions and types



## Operating System

As the name suggests, an operating system is a type of software without which you cannot operate or run a computer. It acts as an intermediary or translation system between computer hardware and application programs installed on the computer. In other words, you cannot directly use computer programs with computer hardware without having a medium to establish a connection between them.

Besides this, it is also an intermediary between the computer user and the computer hardware as it provides a standard user interface that you see on your computer screen after you switch on your computer. For example, the Windows and the Mac OS are also operating systems that provide a graphical interface with icons and pictures to enable users to access multiple files and applications simultaneously.

So, although the operating system is itself a program or software, it allows users to run other programs or applications on the system. We can say that it works behind the scenes to run your computer.

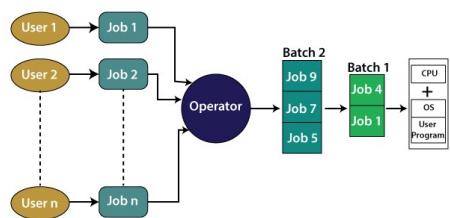
### Major Functions of Operating System:

- **Memory management:** It manages both the primary and secondary memory such as RAM, ROM, hard disk, pen drive, etc. It checks and decides the allocations and deallocation of memory space to different processes. When a user interacts with a system, the CPU is supposed to read or write operations, in this case, OS decides the amount of memory to be allocated for loading the program instructions and data into RAM. After this program is terminated, the memory area is again free and is ready to be allocated to other programs by the OS.
- **Processor Management:** It facilitates processor management, where it decides the order for the processes to access the processor as well as decides the processing time to be allocated for each process. Besides this, it monitors the status of processes, frees the processor when a process is executed then allocates it to a new process.
- **Device/ hardware management:** The operating system also contains drivers to manage devices. A driver is a type of translation software that allows the operating system to communicate with devices, and there are different drivers for different devices as each device speaks a different language.

- **Run software applications:** It offers the environment to run or use software applications developed to perform specific tasks, for example, Ms Word, Ms Excel, Photoshop, etc.
- **Data management:** It helps in data management by offering and displaying directories for data management. You can view and manipulate files, folders, e.g., you can move, copy, name, or rename, delete a file or a folder.
- **Evaluates the system's health:** It gives us an idea about the performance of the hardware of the system. For example, you can see how busy the CPU is, how fast the data is retrieved from the hard disk, etc.
- **Provides user interface:** It acts as an interface between the user and the hardware. It can be a GUI where you can see and click elements on the screen to perform various tasks. It enables you to communicate with the computer even without knowing the computer's language.
- **I/O management:** It manages the input output devices and makes the I/O process smooth and effective. For example, it receives the input provided by the user through an input device and stores it in the main memory. Then it directs the CPU to process this input and accordingly provides the output through an output device such as a monitor.
- **Security:** It has a security module to protect the data or information stored in the memories of the computer against malware and unauthorized access. Thus, it not only manages your data but also helps to protect it.
- **Time Management:** It helps CPU in time management. The Kernel OS keeps checking the frequency of processes that requests CPU time. When two or more processes that are equally important compete for the CPU time, then the CPU time is sliced into segments and allocated to these processes in a round-robin fashion to prevent a single process from monopolizing the CPU.
- **Deadlock Prevention:** Sometimes a resource that is supposed to be shared by two or more processes is held by one process due to which the resource cannot continue. This situation is known as deadlock. The OS does not let this situation arise by carefully distributing the resources among the different processes.
- **Interrupt Handling:** OS also responds to interrupts, which are signals generated by a program or a device to seek the attention of the CPU. The OS checks the priority of the interrupt, and if it is more important than the currently running process, it stops the execution of the current process and preserves this state of CPU then executes the requested process. Thereafter the CPU returns to the same state where it was stopped.

## Types of Operating System:

### 1) Batch Processing Operating System:



The interaction between a user and the computer does not occur in this system. The user is required to prepare jobs on punch cards in the form of batches and submit them to the computer operator. The computer operator sorts the jobs or programs and keeps similar programs or jobs in the same batch and run as a group to speed up processing.

It is designed to execute one job at a time. Jobs are processed on a first-come, first-serve basis, i.e., in the order of their submission without any human intervention.

For example, the credit card bill generated by banks is an example of batch processing. A separate bill is not generated for each credit card purchase, rather a single bill that includes all purchases in a month is generated through batch processing. The bill details are collected and held as a batch, and then it is processed to generate the bill at the end of the billing cycle. Similarly, in a payroll system, the salaries of employees of the company are calculated and generated through the batch processing system at the end of each month.

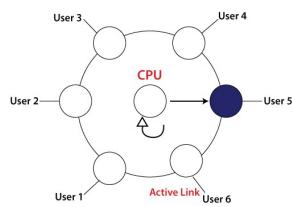
#### Advantages of Batch processing operating system:

- Repeated jobs can be completed easily without any human intervention
- Hardware or system support is not required to input data in batch systems
- It can work offline, so it causes less stress on the processor as it knows which task to process next and how long the task will last.
- It can be shared among multiple users.
- You can set the timing of batch jobs so that when the computer is not busy, it can start processing the batch jobs such as at night or any other free time.

#### Disadvantages of batch processing operating systems:

- You need to train the computer operators for using the batch system.
- It is not easy to debug this system.
- If any error occurs in one job, the other jobs may have to wait for an uncertain time.

### 2) Time Sharing Operating System:



As the name suggests, it enables multiple users located at different terminals to use a computer system and to share the processor's time simultaneously. In other words, each task gets time to get executed, and thus all tasks are executed smoothly.

Each user gets the processor's time as they get while using a single system. The duration of time allocated to a task is called quantum or time slice; when this duration is over, OS starts the next task.

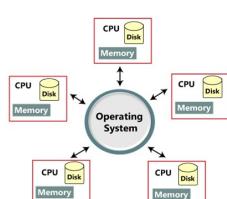
#### **Advantages of time sharing operating system:**

- It reduces CPU idle time and thus makes it more productive.
- Each process gets the chance to use the CPU.
- It allowed different applications run simultaneously.

#### **Disadvantages of time sharing operating system:**

- It requires a special operating system as it consumes more resources.
- Switching between tasks may hang up the system as it serves lots of users and runs lots of applications at the same time, so it requires hardware with high specifications.
- It is less reliable.

### **3) Distributed Operating System:**



It uses or runs on multiple independent processors (CPUs) to serve multiple users and multiple real-time applications. The communication between processors is established through many communication lines such as telephone lines and high-speed buses. The processors may differ from each other in terms of size and function.

The availability of powerful microprocessor and advanced communication technology have made it possible to design, develop, and use the distributed operating system. Besides this, it is an extension of a network operating system that supports a high level of communication and integration of machines on the network.

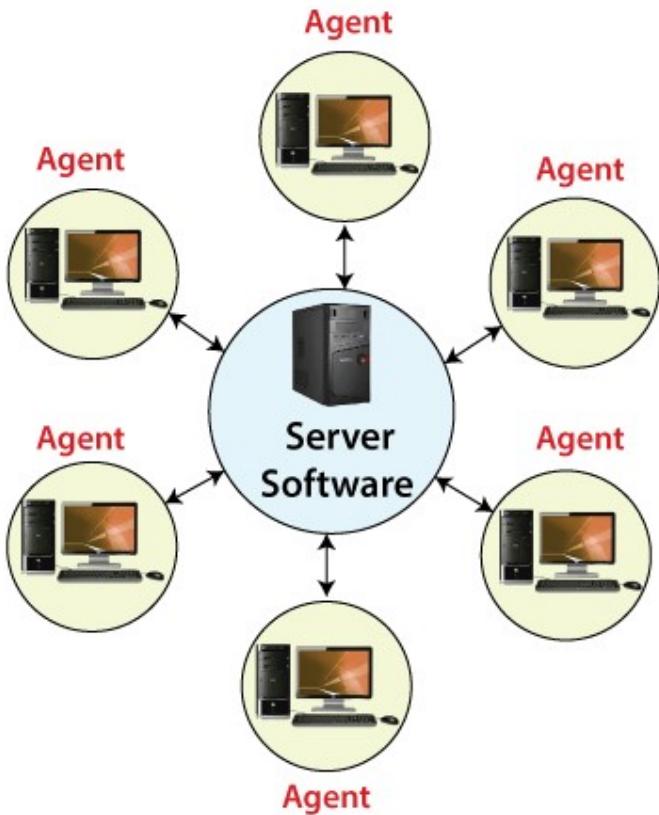
#### **Advantages of distributed operating system:**

- Its performance is higher than a single system as resources are being shared.
- If one system stops working, malfunctions, or breaks down, other nodes are not affected.
- Additional resources can be added easily.
- Shared access to resources like printer can be established.
- Delay in processing is reduced to a greater extent.
- Data sharing or exchange speed is high, owing to the use of electronic mail.

#### **Disadvantages of distributed operating system:**

- Security issue may arise due to sharing of resources
- Few messages may be lost in the system
- Higher bandwidth is required in case of handling a large amount of data
- Overloading issue may arise
- The performance may be low
- The languages which are used to set up a distributed system are not well defined yet
- They are very costly, so they are not easily available.

#### 4) Network Operating System:



As the name suggests, this OS connects computers and devices to a local area network and manages network resources. The software in a NOS enables the devices of the network to share resources and communicate with each other. It runs on a server and allows shared access to printers, files, applications, files, and other networking resources and functions over a LAN. Besides this, all users in the network are aware of each other's underlying configuration and individual connections. Examples: Ms Windows Server 2003 and 2008, Linux, UNIX, Novell NetWare, Mac OS X, etc.

#### **Advantages of network operating system:**

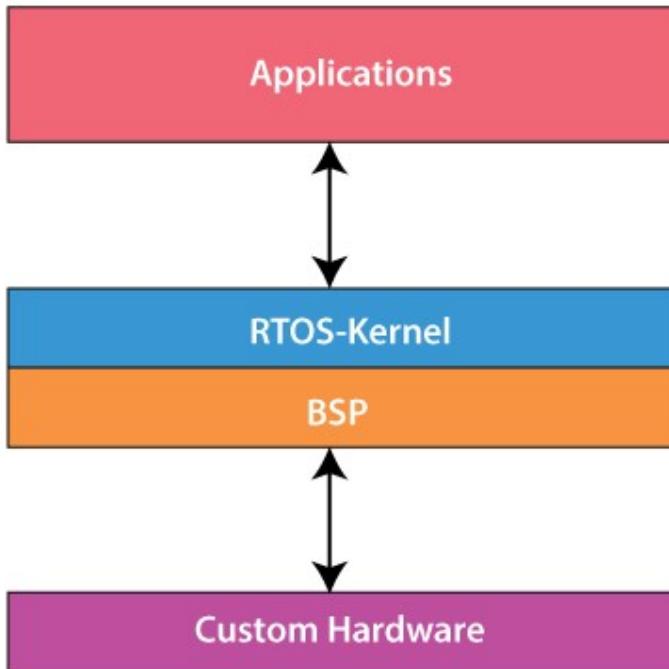
- The servers are centralized that can be accessed remotely from distant locations and different systems.
- It is easy to integrate advanced and recent technologies and hardware in this system.

#### **Disadvantages of network operating system:**

- The servers used in the system may be expensive.

- The system depends on the central location and requires regular monitoring and maintenance.

## 5) Real-Time Operating System:



It is developed for real-time applications where data should be processed in a fixed, small duration of time. It is used in an environment where multiple processes are supposed to be accepted and processed in a short time. RTOS requires quick input and immediate response, e.g., in a petroleum refinery, if the temperate gets too high and crosses the threshold value, there should be an immediate response to this situation to avoid the explosion. Similarly, this system is used to control scientific instruments, missile launch systems, traffic lights control systems, air traffic control systems, etc.

This system is further divided into two types based on the time constraints:

### **Hard Real-Time Systems:**

These are used for the applications where timing is critical or response time is a major factor; even a delay of a fraction of the second can result in a disaster. For example, airbags and automatic parachutes that open instantly in case of an accident. Besides this, these systems lack virtual memory.

### **Soft Real-Time Systems:**

These are used for application where timing or response time is less critical. Here, the failure to meet the deadline may result in a degraded performance instead of a disaster. For example, video surveillance (cctv), video player, virtual reality, etc. Here, the deadlines are not critical for every task every time.

### **Advantages of real-time operating system:**

- The output is more and quick owing to the maximum utilization of devices and system
- Task shifting is very quick, e.g., 3 microseconds, due to which it seems that several tasks are executed simultaneously
- Gives more importance to the currently running applications than the queued application
- It can be used in embedded systems like in transport and others.
- It is free of errors.
- Memory is allocated appropriately.

### **Disadvantages of real-time operating system:**

- A fewer number of tasks can run simultaneously to avoid errors.
- It is not easy for a designer to write complex and difficult algorithms or proficient programs required to get the desired output.
- Specific drivers and interrupt signals are required to respond to interrupts quickly.
- It may be very expensive due to the involvement of the resources required to work.

## **Generations of Operating System:**

### **The first generation (1945 to 1955):**

It was the time before the Second World War when the digital computer was not developed, and there were calculating engines with mechanical relays at this point in time. Later mechanical relays were replaced by vacuum tubes as they were very slow. But, the performance issue was not resolved even with vacuum tubes, besides these machines were too bulky and large as there were made of tens of thousands of vacuum tubes.

Furthermore, each of the machines was designed, programmed, and maintained by a single group of people. The programming languages and operating systems were not known, and absolute machine language was being used for programming.

These systems were designed for numerical calculations. The programmer was required to sign up for a block of time and then insert his plug board into the computer. In the 1950s, punch cards were introduced, which improved the computer performance. It allowed programmers to write programs on punch cards and read them into the system; the rest of the procedure was the same.

### **The second generation (1955 to 1965):**

This generation started with the introduction of transistors in the mid-1950s. The use of transistors made the computers more reliable, and they began to be sold to customers. These machines were called mainframes. Only the big organization and government corporations could afford it. In this machine, the programmer was required to write the program on a paper then punch it on cards. The card would be taken to the input room and handed over to an operator to get the output. The printer provides the output which was taken to the output room. These steps made it a time-consuming task. So, the batch system was adopted to address this issue.

In a batch system, the tasks were collected in a tray in the form of batches in the input room and read onto a magnetic tape, which was taken to the machine room, where it was mounted on a tape drive. Then using a special program, the operator was to read the first task or job from the tape and run it, and the output was generated onto a second tape. OS automatically read the next job from the tape, and Jobs were completed one by one. After the completion of the batch, the input and output tapes were taken off, and the next batch was started. The printouts were taken from the output tape. It was mainly used for engineering and scientific calculations. The first OS was used in this generation in computers was called FMS (Fortran Monitor System), and IBMSYS, and FORTRAN were used as a high-level language.

### **The third generation (1965 to 1979):**

This generation began with the introduction of 360 family of computers of [IBM](#) in 1964. In this generation, transistors were replaced by silicon chips, and the operating system was developed for multiprogramming, some of them even supported batch processing, time sharing, real-time processing, at the same time.

### **The fourth generation operating system (1979 to Present):**

This generation of OS started with the introduction of personal computers and workstations. Chips that contain thousands of transistors were introduced in this generation that made possible the development of personal computers that supported the growth of networks and thus the development of network operating systems and distributed operating systems. DOS, Linux, and window operation systems were few examples of OS of this generation.

**What is programming language? Define assemblers, compilers & interpreter**

[Next](#) [← Prev](#)

## Programming Language

As we know, to communicate with a person, we need a specific language, similarly to communicate with computers, programmers also need a language is called Programming language.

Before learning the programming language, let's understand what is language?

## What is Language?

Language is a mode of communication that is used to **share ideas, opinions with each other**. For example, if we want to teach someone, we need a language that is understandable by both communicators.

## What is a Programming Language?

A programming language is a **computer language** that is used by **programmers (developers) to communicate with computers**. It is a set of instructions written in any specific language ( C, C++, Java, Python) to perform a specific task.

A programming language is mainly used to **develop desktop applications, websites, and mobile applications**.

## Types of programming language

### 1. Low-level programming language

Low-level language is **machine-dependent (0s and 1s)** programming language. The processor runs low- level programs directly without the need of a compiler or interpreter, so the programs written in low-level language can be run very fast.

Low-level language is further divided into two parts -

#### i. Machine Language

Machine language is a type of low-level programming language. It is also called as **machine code or object code**. Machine language is easier to read because it is normally displayed in binary or hexadecimal form (base 16) form. It does not require a translator to convert the programs because computers directly understand the machine language programs.

The advantage of machine language is that it helps the programmer to execute the programs faster than the high-level programming language.

#### ii. Assembly Language

Assembly language (ASM) is also a type of low-level programming language that is designed for specific processors. It represents the set of instructions in a **symbolic and human-understandable form**. It uses an assembler to convert the assembly language to machine language.

The advantage of assembly language is that it requires less memory and less execution time to execute a program.

## 2. High-level programming language

High-level programming language (HLL) is designed for **developing user-friendly software programs and websites**. This programming language requires a compiler or interpreter to translate the program into machine language (execute the program).

The main advantage of a high-level language is that it is **easy to read, write, and maintain**.

High-level programming language includes **Python, Java, JavaScript, PHP, C#, C++, Objective C, Cobol, Perl, Pascal, LISP, FORTRAN, and Swift programming language**.

A high-level language is further divided into three parts -

### i. Procedural Oriented programming language

Procedural Oriented Programming (POP) language is derived from structured programming and based upon the procedure call concept. It divides a program into small procedures called **routines or functions**.

Procedural Oriented programming language is used by a software programmer to create a program that can be accomplished by using a programming editor like IDE, Adobe Dreamweaver, or Microsoft Visual Studio.

The advantage of POP language is that it helps programmers to easily track the program flow and code can be reused in different parts of the program.

*The advantage of POP language is that it helps programmers to easily track the program flow and code can be reused in different parts of the program.*

**Example:** C, FORTRAN, Basic, Pascal, etc.

### ii. Object-Oriented Programming language



Object-Oriented Programming (OOP) language is **based upon the objects**. In this **programming language, programs are divided into small parts called objects**. It is used to implement real-world entities like inheritance, polymorphism, abstraction, etc in the program to make the program reusable, efficient, and easy-to-use.

The main advantage of object-oriented programming is that OOP is faster and easier to execute, maintain, modify, as well as debug.

*Note: Object-Oriented Programming language follows a bottom-up approach.*

**Example:** C++, Java, Python, C#, etc.

### iii. Natural language

Natural language is a **part of human languages** such as English, Russian, German, and Japanese. It is used by machines to understand, manipulate, and interpret human's language. It is used by developers to **perform tasks such as translation, automatic summarization, Named Entity Recognition (NER), relationship extraction, and topic segmentation**.

The main advantage of natural language is that it helps users to ask questions in any subject and directly respond within seconds.

## 3. Middle-level programming language

Middle-level programming language **lies between the low-level programming language and high-level programming language**. It is also known as the intermediate programming language and pseudo-language.

A middle-level programming language's advantages are that it supports the features of high-level programming, it is a user-friendly language, and closely related to machine language and human language.

**Example:** C, C++, language

## Most commonly used Programming Language

As we all know, the programming language makes our life simpler. Currently, all sectors (like education, hospitals, banks, automobiles, and more) completely depend upon the programming language.

There are dozens of programming languages used by the industries. Some most widely used programming languages are given below -

## 1. Python



[Python](#) is one of the most widely used user-friendly programming languages. It is an open-source and easy to learn programming language developed in the 1990s. It is **mostly used in Machine learning, Artificial intelligence, Big Data, GUI based desktop applications, and Robotics.**

### Advantages

- Python is easy to read, easy to understand, and easy to write.
- It integrates with other programming languages like C, C++, and Java.
- Python executes code line-by-line, so it is easy for the programmer to find the error that occurred in the code.
- Python is platform-independent means you can write code once and run it anywhere.

### Disadvantages

- Python is not suitable for developing mobile applications and games.
- Python works with the interpreter. That's why it is slower than other programming languages like C and C++.

## 2. Java



[Java](#) is a simple, secure, platform-independent, reliable, architecture-neutral high-level programming language **developed by Sun Microsystems in 1995**. Now, Java is owned by Oracle. It is mainly used to develop bank, retail, information technology, android, big data, research community, web, and desktop applications.

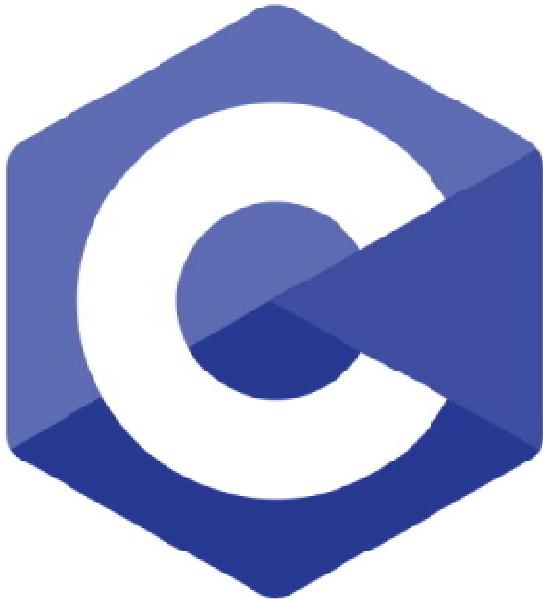
### **Advantages**

- Java is easy to write, compile, learn, and debug as compared to other programming languages.
- It provides an ability to run the same program on different platforms.
- It is a highly secured programming language because in java, there is no concept of explicit pointers.
- It is capable of performing multiple tasks at the same time.

### **Disadvantages**

- Java consumes more memory and slower than other programming languages like C or C++.
- It does not provide a backup facility.

### 3. C



**C** is a **popular, simple, and flexible general-purpose computer programming language**. Dennis M Ritchie develops it in 1972 at AT&T. It is a combination of both low-level programming language as well as a high-level programming language. It is used to design applications like **Text Editors, Compilers, Network devices, and many more**.

#### Advantages

- C language is easy to learn.
- It is fast, efficient, portable, easy to extend, powerful, and flexible programming language.
- It is used to perform complex calculations and operations such as MATLAB.
- It provides dynamic memory allocation to allocate memory at the run time.

#### Disadvantages

- In the C programming language, it is very difficult to find the errors.
- C does not support the concepts of constructors, destructors, abstraction, polymorphism, encapsulation, and namespace like OOPs.

## 4. C++



**C++** is one of the thousands of programming languages that we use to develop software. C++ programming language is developed by **Bjarne Stroustrup in 1980**. It is similar to the C programming language but also includes some additional features such as **exception handling, object-oriented programming, type checking, etc.**

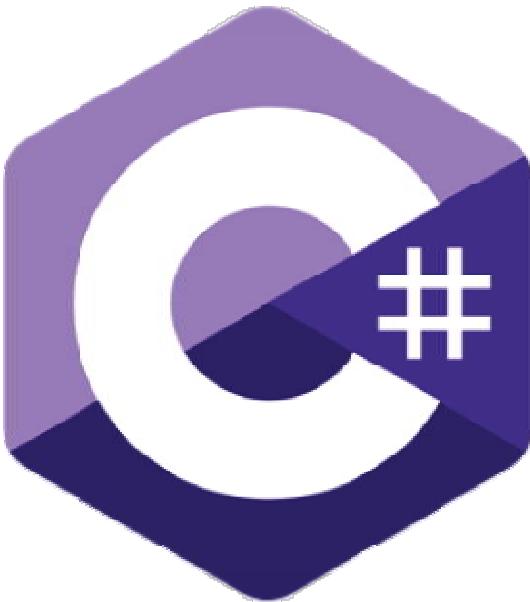
### Advantages

- C++ is a simple and portable structured programming language.
- It supports OOPs features such as Abstraction, Inheritance, Encapsulation.
- It provides high-level abstraction and useful for a low-level programming language, and more efficient for general-purpose.
- C++ is more compatible with the C language.

### Disadvantages

- C++ programming language is not secured as compared to other programming languages like Java or Python.
- C++ can not support garbage collection.
- It is difficult to debug large as well as complex web applications.

## 5. C#



**C# (pronounced as C sharp)** is a modern, general-purpose, and object-oriented programming language used with [XML](#) based Web services on the .NET platform. It is mainly designed to improve productivity in web applications. It is easier to learn for those users who have sufficient knowledge of common programming languages like C, C++, or Java.

### Advantages

- C# is a modern, type-safe, easy, fast, and open-source programming language that is easily integrated with Windows.
- The maintenance of C# (C sharp) is lower than the C++ programming language.
- C# is a pure object-oriented programming language.
- C# includes a strong memory backup facility. That's why it avoids the problem of memory leakage.

### Disadvantages

- C# is less flexible because it is completely based on Microsoft .Net framework.
- In C#, it is difficult to write, understand, debug, and maintain multithreaded applications.

## 6. JavaScript



[\*\*JavaScript\*\*](#) is a type of **scripting language** that is used on both client-side as well as a server-side. It is developed in the **1990s** for the Netscape Navigator web browser. It allows programmers to implement complex features to make web pages alive. It helps programmers to create dynamic websites, servers, mobile applications, animated graphics, games, and more.

### **Advantage**

- JavaScript helps us to add behavior and interactivity on the web page.
- It can be used to decrease the loading time from the server.
- It has the ability to create attractive, dynamic websites, and rich interfaces.
- JavaScript is a simple, versatile, and lightweight programming language.
- JavaScript and its syntax are easy to understand.

### **Disadvantage**

- JavaScript is completely based on the browser.
- It does not support multiple inheritance.
- It is less secure compared to other programming languages.

## 7. R



Currently, [R programming](#) is one of the popular programming languages that is used in **data analytics, scientific research, machine learning algorithms, and statistical computing**. It is developed in 1993 by Ross Ihaka and Robert Gentleman. It helps marketers and data scientists to easily analyze, present, and visualize data.

### **Advantages**

- R programming provides extensive support for Data Wrangling.
- It provides an easy-to-use interface.
- It runs on any platform like Windows, Linux, and Mac.
- It is an open-source and platform-independent programming language.

### **Disadvantages**

- R programming does not support 3D graphics.
- It is slower than other programming languages.

## 8. PHP



[\*\*PHP\*\*](#) stands for **Hypertext Preprocessor**. It is an open-source, powerful server-side scripting language mainly used to create static as well as dynamic websites. It is developed by **Rasmus Laird in 1994**. Inside the php, we can also write [HTML](#), [CSS](#), and [JavaScript](#) code. To save php file, file extension .php is used.

### Advantages

- PHP is a more secure and easy-to-use programming language.
- It supports powerful online libraries.
- It can be run on a variety of operating systems such as Windows, Linux, and Mac.
- It provides excellent compatibility with cloud services.

### Disadvantages

- PHP is not capable of handling a large number of applications and not suitable for large applications.
- It is quite difficult to maintain.

## 9. Go



[\*\*Go\*\*](#) or Golang is an **open-source programming language**. It is used to build simple, reliable, and efficient software. It is developed by **Robert Griesemer, Rob Pike, and Ken Thompson in 2007**.

### **Advantages**

- Go language is easy-to-learn and use.
- It comes with the in-built testing tools.
- Go is a fast programming language.

### **Disadvantages**

- Go language does not support generics.
- It does not support error handling.
- It supports a lack of frameworks.

## 10. Ruby



[Ruby](#) is an open-source, general-purpose, and pure object-oriented programming language released in **1993**. It is used in front-end and back-end web development. It is mainly **designed to write CGI (Common Gateway Interface) scripts**.

### **Advantages**

- Ruby supports various GUI (Graphical User Interface) tools like GTK and OpenGL.
- It is used to develop both internet as well as intranet applications.
- The code written in Ruby is small and contains less number of lines.

### **Disadvantages**

- Ruby is slower than other programming languages.
- It is very difficult for programmers to debug the code written in Ruby.

Define assemblers, compilers & interpreter

<https://www.bbc.co.uk/bitesize/guides/zmthsrd/revision/1>

# Compiler, Interpreter, Assembler

## Compiler

A compiler is defined as a computer program that is used to convert high level instructions or language into a form that can be understood by the computer. Since computer can understand only in binary numbers so a compiler is used to fill the gap otherwise it would have been difficult for a human to find info in the 0 and 1 form.

Earlier the compilers were simple programs which were used to convert symbols into bits. The programs were also very simple and they contained a series of steps translated by hand into the data. However, this was a very time consuming process. So, some parts were programmed or automated. This formed the first compiler.

More sophisticated compilers are created using the simpler ones. With every new version, more rules added to it and a more natural language environment is created for the human programmer. The compiler programs are evolving in this way which improves their ease of use.

There are specific compilers for certain specific languages or tasks. Compilers can be multiple or multistage pass. The first pass can convert the high level language into a language that is closer to computer language. Then the further passes can convert it into final stage for the purpose of execution.

Figure : Basic Compiler Concept

**Name of Compiled Languages:** c, c++, pascal, COBOL, BASIC, Ada, D, DASL, Corba, BCPL, ALGOL, Corn, Delphi, Smalltalk

## Interpreter

The programs created in high level languages can be executed by using two different ways. The first one is the use of compiler and the other method is to use an interpreter. High level instruction or language is converted into intermediate from by an interpreter. The advantage of using an interpreter is that the high

level instruction does not go through compilation stage which can be a time consuming method. So, by using an interpreter, the high level program is executed directly. That is the reason why some programmers use interpreters while making small sections as this saves time.

Almost all high level [programming](#) languages have compilers and interpreters. But some languages like LISP and BASIC are designed in such a way that the programs made using them are executed by an interpreter.

### **Difference between Compiler and Interpreter :-**

- A compiler converts the high level instruction into machine language while an interpreter converts the high level instruction into an intermediate form.
- Before execution, entire program is executed by the compiler whereas after translating the first line, an interpreter then executes it and so on.
- List of errors is created by the compiler after the compilation process while an interpreter stops translating after the first error.
- An independent executable file is created by the compiler whereas interpreter is required by an interpreted program each time.

**Name of compiled languages:** [Ada](#) , [ALGOL](#) ,[Algol 60](#), [Algol 68](#), [SMALL](#) , [BASIC](#) , [C](#), [C++](#), [Objective-C](#), [C Sharp \(programming language\)](#), [CLEO](#) , [COBOL](#) , [Cobra](#)

**Name of interpreted languages:** [LISP](#), Ant, APL, Eiffel, Forth, J, [JavaScript](#), Lisp, Mople, Perl, [PHP](#), VBScript.

## **Assembler**

An assembler is a [program](#) that takes basic computer [instructions](#) and converts them into a pattern of [bits](#) that the computer's [processor](#) can use to perform its basic operations. Some people call these instructions assembler language and others use the term *assembly language*.

### **Here's how it works :-**

- Most computers come with a specified set of very basic instructions that correspond to the basic machine operations that the computer can perform. For example, a "Load" instruction causes the processor to move a string of bits from a location in the processor's memory to a special holding place called a register. Assuming the processor has at least eight registers, each numbered, the following instruction would move the value (string of bits of a certain length) at memory location 3000 into the holding place called register
- The programmer can write a program using a sequence of these assembler instructions.
- This sequence of assembler instructions, known as the source code or source program, is then specified to the assembler program when that program is started.
- The assembler program takes each program statement in the source program and generates a corresponding bit stream or pattern (a series of 0's and 1's of a given length).
- The output of the assembler program is called the object code or object program relative to the input source program. The sequence of 0's and 1's that constitute the object program is sometimes called machine code.
- The object program can then be run (or executed) whenever desired.

**Name of Assembly languages:** ASCENT, BAL, COMPASS, FAP, GAS, HLA, HLASM, MACRO, MI, MIPS, PAL, LC, AKI, ASPER, AUTOCODER.

## Command Line Arguments

C provides a fairly simple mechanism for retrieving command line parameters entered by the user. It passes an **argv** parameter to the main function in the program. **argv** structures appear in a fair number of the more advanced library calls, so understanding them is useful to any C programmer.

Enter the following code and compile it:

```
#include <stdio.h>
int main(int argc, char *argv[])
{
    int x;

    printf("%d\n",argc);
    for (x=0; x<argc; x++)
        printf("%s\n",argv[x]);
}
```

In this code, the main program accepts two parameters, **argv** and **argc**. The **argv** parameter is an array of pointers to string that contains the parameters entered when the program was invoked at command line. The **argc** integer contains a count of the number of parameters.

This particular piece of code types out the command line parameters. To try this, compile the code to an executable file named **aaa** and

Type **aaa xxx yyy zzz** in the command line argument.

The code will print the command line parameters xxx, yyy and zzz, one per line.

The **char \*argv[]** line is an array of pointers to string. In other words, each element of the array is a pointer, and each pointer points to a string (technically, to the first character of the string). Thus, **argv[0]** points to a string that contains the first parameter on the command line (the program's name), **argv[1]** points to the next parameter, and so on. The argc variable tells you how many of the pointers in the array are valid. You will find that the preceding code does nothing more than print each of the valid strings pointed to by argv.