

D.N.R.COLLEGE(AUTONOMOUS):BHIMAVARAM

MCA DEPARTMENT

BRIDGE COURSE

FUNDAMENTALS OF COMPUTERS



IMCA Presented by

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UNIT I

Introduction to Computers: History of Computers, Central processing unit, Characteristics and limitations of computer, Types of Computers, Types of memories. Block diagram of Computer, Peripheral Devices: Input, Output and storage, Input devices, Output devices, Secondary devices, Communication between the CPU and Input/Output devices. Software: Types of software. Number Systems (Binary, Octal, Hexadecimal).

UNIT-II

Operating System: Introduction to OS, Types of OS, Functions of OS, Evolution of Operating Systems - Simple Batch, Multi programmed, time-shared, Parallel, Distributed Systems, Real- Time Systems. MSDOS Internal Commands: chdir, cls, path, prompt, label, ver, vol, echo, set. External Commands: scandisk, discopy, diskcomp, format, backup, restore, Operating System installation steps.

MS-Office Tools (Word, Excel & PowerPoint): Introduction of Word Processing, MSWord: Creating, Editing, printing, page formatting, inserting tables, pictures, Mail Merge. MS Excel: Introduction to spreadsheet, creating, formatting, printing, usage of formulae, Graphs of worksheets. MS PowerPoint: Creating a presentation with designs and animations.

UNIT III

Computer Networks: Introduction to computer Networks, Network topologies -Bus topology, star topology, Ring topology, Mesh topology, Hybrid topology. Types of Networks:Local area Network, Wide Area Networks, Metropolitan Networks, Campus/Corporate Area Network, Personal Area Network. Network Devices: Hub, Repeater, Switch, Bridge, Router, Gateway, Network interface Card.

Introduction to Internet: Web Browsers, Searching and Surfing, Creating an E-Mail account, sending and receiving E-Mails. Web Browsers, Searching and Surfing, Creating an E-Mail account, sending and receiving E-Mails.

UNIT IV

Problem Solving and Programming: Algorithm development, Flowcharts, Looping, some programming features, Pseudo code, Structured Programming concepts.

Programming Languages: Machine Language and assembly language, high-level and lowlevel languages, Assemblers, Compilers and Interpreters.

TEXT BOOKS:

1. An Introduction to Computer studies –Noel Kalicharan-Cambridge.
2. Fundamentals of Computers –ReemaThareja-Oxford higher education.
3. Silberschatz, Galvin and Gagne, “Operating Systems Concepts”, Wiley.
4. Computer Networks: Tannenbaum.

REFERENCE BOOKS:

1. Peter Norton_s, Introduction to Computers, Tata McGraw Hill.
2. Computer Fundamentals, Anita Goel, Pearson Education, 2017.

FUNDAMENTALS OF COMPUTERS

UNIT-1

Introduction to Computers:

(1) History of Computers

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

Abacus

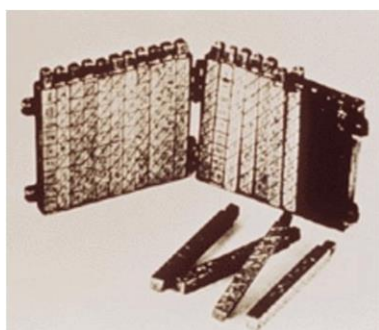
The history of computer begins with the birth of abacus which is believed to be the first computer. It is said that Chinese invented Abacus around 4,000 years ago.

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



Napier's Bones

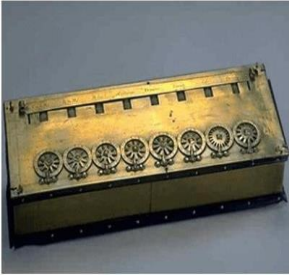
It was a manually-operated calculating device which was invented by John Napier (1550-1617) of Merchiston. In this calculating tool, he used 9 different ivory strips or bones marked with numbers to multiply and divide. So, the tool became known as "Napier's Bones. It was also the first machine to use the decimal point.



Pascaline

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

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



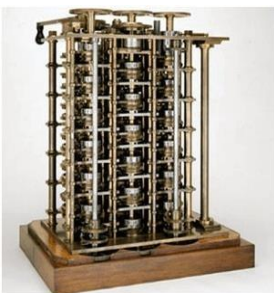
Stepped Reckoner or Leibnitz wheel

It was developed by a German mathematician-philosopher Gottfried Wilhelm Leibnitz in 1673. He improved Pascal's invention to develop this machine. It was a digital mechanical calculator which was called the stepped reckoner as instead of gears it was made of fluted drums. See the following image;



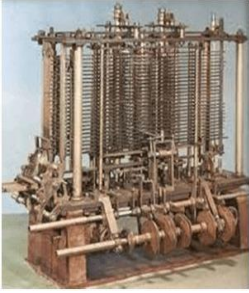
Difference Engine

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



Analytical Engine

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



Tabulating Machine

It was invented in 1890, by Herman Hollerith, an American statistician. It was a mechanical tabulator based on punch cards. It could tabulate statistics and record or sort data or information. This machine was used in the 1890 U.S. Census. Hollerith also started the Hollerith's Tabulating Machine Company which later became International Business Machine (IBM) in 1924.



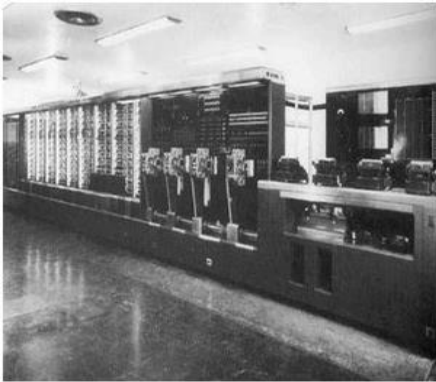
Differential Analyzer

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



Mark I

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



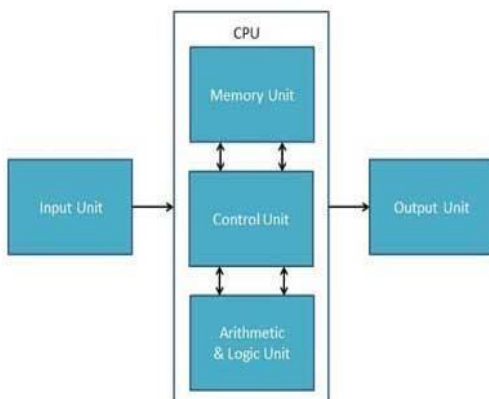
(2) Central Processing Unit (CPU)

- CPU is considered as the brain of the computer.
- CPU performs all types of data processing operations.
- It stores data, intermediate results, and instructions (program).
- It controls the operation of all parts of the computer.



CPU itself has following three components.

- Memory or Storage Unit
- Control Unit
- ALU(Arithmetic Logic Unit)



Memory or Storage Unit

This unit can store instructions, data, and intermediate results. This unit supplies information to other units of the computer when needed. It is also known as internal storage unit or the main memory or the primary storage or Random Access Memory (RAM).

Its size affects speed, power, and capability. Primary memory and secondary memory are two types of memories in the computer. Functions of the memory unit are –

- It stores all the data and the instructions required for processing.
- It stores intermediate results of processing.
- It stores the final results of processing before these results are released to an output device.
- All inputs and outputs are transmitted through the main memory.

Control Unit

This unit controls the operations of all parts of the computer but does not carry out any actual data processing operations.

Functions of this unit are :

- It is responsible for controlling the transfer of data and instructions among other units of a computer.
- It manages and coordinates all the units of the computer.
- It obtains the instructions from the memory, interprets them, and directs the operation of the computer.
- It communicates with Input/Output devices for transfer of data or results from storage.
- It does not process or store data.

ALU (Arithmetic Logic Unit)

This unit consists of two subsections namely,

- Arithmetic Section
- Logic Section

Arithmetic Section

Function of arithmetic section is to perform arithmetic operations like addition, subtraction, multiplication, and division. All complex operations are done by making repetitive use of the above operations.

Logic Section

Function of logic section is to perform logic operations such as comparing, selecting, matching, and merging of data.

(3) 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 that operates upon information or data . Now a day’s more than 80 % of the work done by computers today is a non mathematical or non- numerical nature.

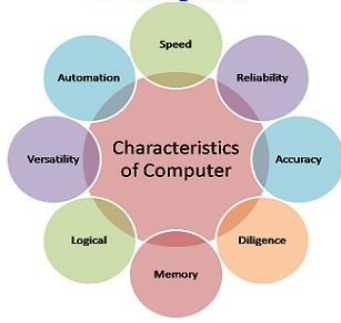
Modern Definition of computers : A computer is an electronic device which is used to perform operation on raw data as per instruction given by user. All the Plugged with computer system(e.g. keyboard, mouse, printer,CPU etc) is called hardware, the language , instruction, data are the called software.



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^{-3}), 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, luck 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 seed 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 takes 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.

Characteristics / Features of Computer



Limitation or Drawback of Computer

1. **No I.Q. :** Computer is not a magical device. It performs only those works which man can do but the main difference is that computer can work those operations with very high speed and reliable accuracy. It has no 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 do. Man has succeeded 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 requires power to operate.
5. Problem may occur due to system breakdown.

(4) 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.

(5) Types of Memories:

A memory is just like a human brain. It is used to store data and instructions. Computer memory is the storage space in the computer, where data is to be processed and instructions required for processing are stored. The memory is divided into large number of small parts called cells. Each location or cell has a unique address, which varies from zero to memory size minus one. For example, if the computer has 64k words, then this memory unit has $64 * 1024 = 65536$ memory locations. The address of these locations varies from 0 to 65535.

Memory is primarily of three types –

- Cache Memory

- Primary Memory/Main Memory
- Secondary Memory

Cache Memory

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



Advantages

The advantages of cache memory are as follows –

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

Disadvantages

The disadvantages of cache memory are as follows –

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

Primary Memory (Main Memory)

Primary memory holds only those data and instructions on which the computer is currently working. It has a limited capacity and data is lost when power is switched off. It is generally made up of semiconductor device. These memories are not as fast as registers. The data and instruction required to be processed resides in the main memory. It is divided into two subcategories RAM and ROM.



Characteristics of Main Memory

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

Secondary Memory

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



Characteristics of Secondary Memory

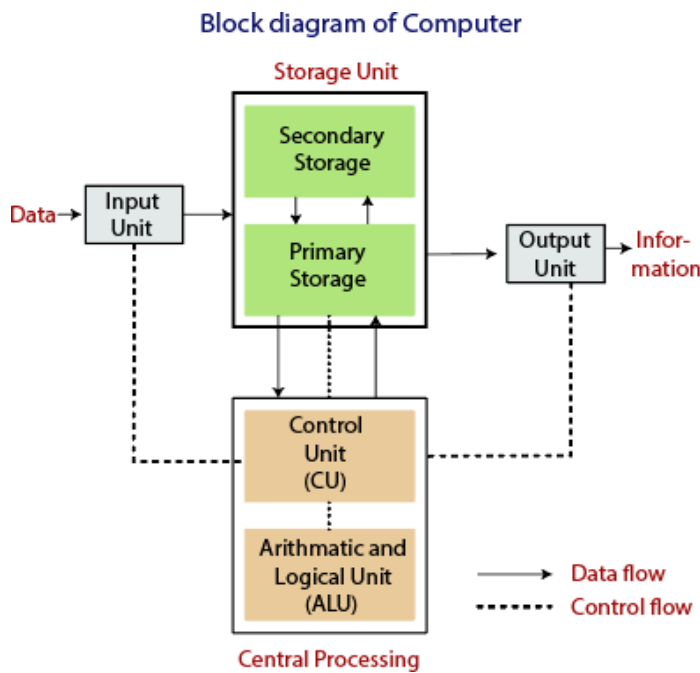
- These are magnetic and optical memories.
- It is known as the backup memory.
- It is a non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.

(6) Block Diagram of Computer

Computer Block Diagram System: Mainly computer system consists of three parts, that are central processing unit (CPU), Input Devices, and Output Devices. The Central Processing Unit (CPU) is divided into two parts again: arithmetic logic unit (ALU) and the control unit (CU). The set of instruction is in the form of raw data.

A large amount of data is stored in the computer memory with the help of primary and secondary storage devices. The CPU is like the heart/brain of the computer. The user does not get the desired output,

without the necessary option taken by the CPU. The Central processing unit (CPU) is responsible for the processing of all the instructions which are given by the user to the computer system.



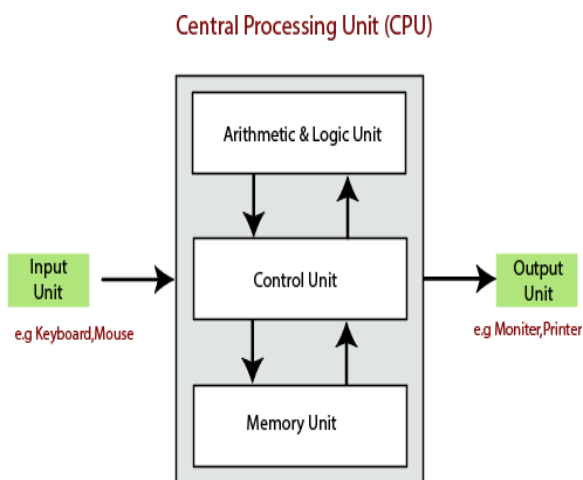
Block Diagram of the computer.

The data is entered through input devices such as the keyboard, mouse, etc. This set of instruction is processed by the CPU after getting the input by the user, and then the computer system produces the output. The computer can show the output with the help of output devices to the user, such as monitor, printer, etc.

- CPU (Central Processing Unit)
- Storage Unit
- ALU(Arithmetic Logic Unit)
- Control Unit

Central Processing Unit (CPU)

The computer system is nothing without the Central processing Unit so, it is also known as the brain or heart of computer. The CPU is an electronic hardware device which can perform different types of operations such as arithmetic and logical operation.



The CPU contains two parts: the arithmetic logic unit and control unit. We have discussed briefly the arithmetic unit, logical unit, and control unit which are given below:

Control Unit

The control unit (CU) controls all the activities or operations which are performed inside the computer system. It receives instructions or information directly from the main memory of the computer.

When the control unit receives an instruction set or information, it converts the instruction set to control signals then; these signals are sent to the central processor for further processing. The control unit understands which operation to execute, accurately, and in which order.

Arithmetic and Logical Unit

The arithmetic and logical unit is the combinational digital electronic circuit that can perform arithmetic operations on integer binary numbers. It presents the arithmetic and logical operation. The outputs of ALU will change asynchronously in response to the input. The basic arithmetic and bitwise logic functions are supported by ALU.

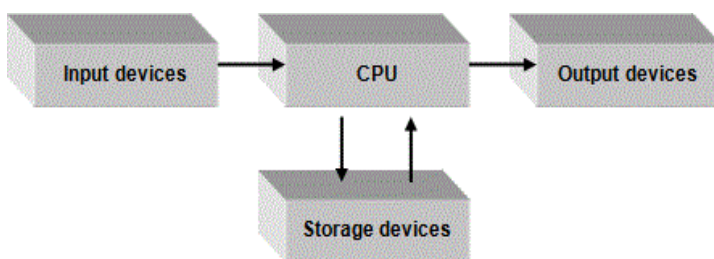
Storage Unit

The information or set of guidelines are stored in the storage unit of the computer system. The storage unit provides the space to store the data or instruction of processed data. The information or data is saved or hold in computer memory or storage device. The data storage is the core function and fundamental of the computer components.

Peripheral Devices:

(7) Input, Output and Storage devices

All computers have the same four basic building blocks. These are the input devices, output devices, storage devices and the brain of the computer, the Central Processing Unit (CPU).



A diagrammatic representation of the four parts of a computer.

Input devices

Input devices take data from the 'outside world' (i.e. outside of the computer) and send it to the Central Processing Unit for processing. Data can be collected and entered into a computer in a range of ways. These include, for example, a keyboard, a mouse, a graphics tablet, a touch screen, a bar code reader, a magnetic stripe reader and so on. So data from the world outside of the computer is entered into the computer system using 'input devices'.

Output devices

Every computer system will need to have a way of displaying information or printing information out so that it is useful to humans. There needs to be, therefore, some 'output devices'. A very useful output device is a VDU (or Visual Display Unit). Another handy one that allows you to produce 'hardcopy' (i.e. a printout on paper) is a printer. It is possible that you also need an audio output. Speakers or headphones would be useful in these circumstances!

Storage devices

Of course, the computer might not want to display or print out the results of some processing immediately. It might simply want to store the results for another time. It therefore needs some storage devices. Storage devices will store data, even when the power to the computer is switched off. When the power is switched on again, the data can be retrieved. For this reason, storage devices are known as 'non-volatile' devices. Examples include USB pen drives, hard disks, CDs, CD R/Ws, DVDs, SD and micro SD cards, Blu-ray disks and magnetic tape. The hard drive is a very important storage device in your computer that deserves a special mention at this point in time. Not only does it hold all of your files, even when the power is switched off, it also holds your operating system and all of the programs you want to use, too.

Another increasingly important 'storage device' is cloud storage. This is where you store data on someone else's computer system by uploading files to it across the Internet. This means that you don't have to use your own storage space and your files in theory should be backed up by the cloud company and safe from viruses, although some people are concerned about file security; they have lost control over what happens to their data once it has been uploaded. As long as you have an Internet connection, you can get your files back at any time from any computer. There are many free services available you can set up and use, including Dropbox, Apple iCloud, SkyDrive and Google Drive.

(or)

Storage Devices – It is an important unit of computer and is of types primary and secondary memory. **Primary Storage Devices** – They consists of cache, processor register ROM & RAM.

Secondary Storage Devices – They consists of magnetic tape, disk drives (like hard disk drive, etc.), flash memory

The CPU

Once data has been read into the computer via the input devices, it is processed by the CPU. The CPU then outputs the data using output devices, perhaps to a monitor or speakers, or saves it for later using a storage device.

(8) Input Devices

Input device enables the user to send data, information, or control signals to a computer. The Central Processing Unit (CPU) of a computer receives the input and processes it to produce the output.

Some of the popular input devices are:

1. Keyboard
2. Mouse
3. Scanner
4. Joystick
5. Light Pen
6. Digitizer
7. Microphone

8. Magnetic Ink Character Recognition (MICR)
9. Optical Character Reader (OCR)
10. Digital Camera
11. Paddle
12. Steering Wheel
13. Gesture recognition devices
14. Light Gun
15. Touch Pad
16. Remote
17. Touch screen
18. VR
19. Webcam
20. Biometric Devices

1) Keyboard

The keyboard is a basic input device that is used to enter data into a computer or any other electronic device by pressing keys. It has different sets of keys for letters, numbers, characters, and functions. Keyboards are connected to a computer through USB or a Bluetooth device for wireless communication.

Types of keyboards: There can be different types of keyboards based on the region and language used. Some of the common types of keyboards are as follows:

i) QWERTY Keyboard:



It is the most commonly used keyboard with computers in modern times. It is named after the first six letters of the top row of buttons and is even popular in countries that do not use Latin-based alphabet. It is so popular that some people think that it is the only type of keyboard to use with computers as an input device.

ii) AZERTY Keyboard:



It is considered the standard French keyboard. It is developed in France as an alternative layout to the QWERTY layout and is mainly used in France and other European countries. Some countries have manufactured their own versions of AZERTY.

Its name is derived from the first six letters that appear on the top left row of the keyboard. The Q and W keys in AZERTY keyboard are interchanged with A and Z keys in QWERTY keyboard. Furthermore, in AZERTY keyboard M key is located to the left of the L key.

AZERTY keyboard differs from QWERTY keyboard not only in the placement of letters but also in many other ways, e.g., it gives emphasis on accents, which is required for writing European languages like French.

iii) DVORAK Keyboard:



This type of keyboard layout was developed to increase the typing speed by reducing the finger movement while typing. The most frequently used letters are kept in a home row to improve typing.

2) Mouse

The mouse is a hand-held input device which is used to move cursor or pointer across the screen. It is designed to be used on a flat surface and generally has left and right button and a scroll wheel between them. Laptop computers come with a touchpad that works as a mouse. It lets you control the movement of cursor or pointer by moving your finger over the touchpad. Some mouse comes with integrated features such as extra buttons to perform different buttons.

The mouse was invented by Douglas C. Engelbart in 1963. Early mouse had a roller ball integrated as a movement sensor underneath the device. Modern mouse devices come with optical technology that controls cursor movements by a visible or invisible light beam. A mouse is connected to a computer through different ports depending on the type of computer and type of a mouse.

Common types of the mouse:

i) Trackball Mouse:



It is a stationary input device that has ball mechanism to move the pointer or cursor on the screen. The ball is half inserted in the device and can be easily rolled with finger, thumb or the palm to move the pointer on the screen. The device has sensor to detect the rotation of ball. It remains stationary; you don't need to move it on the operating surface. So, it is an ideal device if you have limited desk space as you don't need to move it like a mouse.

ii) Mechanical Mouse:



It has a system of a ball and several rollers to track its movement. It is a corded type of mouse. A mechanical mouse can be used for high performance. The drawback is that they tend to get dust into the mechanics and thus require regular cleaning.

iii) Optical Mouse:



An optical mouse uses optical electronics to track its movement. It is more reliable than a mechanical mouse and also requires less maintenance. However, its performance is affected by the surface on which it is operated. Plain non-glossy mouse mat should be used for best results. The rough surface may cause problems for the optical recognition system, and the glossy surface may reflect the light wrongly and thus may cause tracking issues.

iv) Cordless or Wireless Mouse:



As the name suggests, this type of mouse lacks cable and uses wireless technology such as IrDA (infrared) or radio (Bluetooth or Wi-Fi) to control the movement of the cursor. It is used to improve the experience of using a mouse. It uses batteries for its power supply.

3) Scanner

The scanner uses the pictures and pages of text as input. It scans the picture or a document. The scanned picture or document then converted into a digital format or file and is displayed on the screen as an output. It uses optical character recognition techniques to convert images into digital ones. Some of the common types of scanners are as follows:

Types of Scanner:

i) Flatbed Scanner:



It has a glass pane and a moving optical CIS or CCD array. The light illuminates the pane, and then the image is placed on the glass pane. The light moves across the glass pane and scans the document and thus produces its digital copy. You will need a transparency adapter while scanning transparent slides.

ii) Handheld Scanner:



It is a small manual scanning device which is held by hand and is rolled over a flat image that is to be scanned. The drawback in using this device is that the hand should be steady while scanning; otherwise, it may distort the image. One of the commonly used handheld scanners is the barcode scanner which you would have seen in shopping stores.

iii) Sheetfed Scanner:



In this scanner, the document is inserted into the slot provided in the scanner. The main components of this scanner include the sheet-feeder, scanning module, and calibration sheet. The light does not move in this scanner. Instead, the document moves through the scanner. It is suitable for scanning single page documents, not for thick objects like books, magazines, etc.

iv) Drum Scanner:



Drum scanner has a photomultiplier tube (PMT) to scan images. It does not have a charge-coupled device like a flatbed scanner. The photomultiplier tube is extremely sensitive to light. The image is placed on a glass tube, and the light moves across the image, which produces a reflection of the image which is captured by the PMT and processed. These scanners have high resolution and are suitable for detailed scans.

v) Photo Scanner:



It is designed to scan photographs. It has high resolution and color depth, which are required for scanning photographs. Some photo scanners come with in-built software for cleaning and restoring old photographs.

4) Joystick



A joystick is also a pointing input device like a mouse. It is made up of a stick with a spherical base. The base is fitted in a socket that allows free movement of the stick. The movement of stick controls the cursor or pointer on the screen.

The first joystick was invented by C. B. Mirick at the U.S. Naval Research Laboratory. A joystick can be of different types such as displacement joysticks, finger-operated joysticks, hand operated, isometric joystick, and more. In joystick, the cursor keeps moving in the direction of the joystick unless it is upright, whereas, in mouse, the cursor moves only when the mouse moves.

5) Light Pen



A light pen is a computer input device that looks like a pen. The tip of the light pen contains a light-sensitive detector that enables the user to point to or select objects on the display screen. Its light sensitive tip detects the object location and sends the corresponding signals to the CPU. It is not compatible with LCD screens, so it is not in use today. It also helps you draw on the screen if needed. The first light pen was invented around 1955 as a part of the Whirlwind project at the Massachusetts Institute of Technology (MIT).

6) Digitizer



Digitizer is a computer input device that has a flat surface and usually comes with a stylus. It enables the user to draw images and graphics using the stylus as we draw on paper with a pencil. The images or graphics drawn on the digitizer appear on the computer monitor or display screen. The software converts the touch inputs into lines and can also convert handwritten text to typewritten words.

It can be used to capture handwritten signatures and data or images from taped papers. Furthermore, it is also used to receive information in the form of drawings and send output to a CAD (Computer-aided design) application and software like AutoCAD. Thus, it allows you to convert hand-drawn images into a format suitable for computer processing

7) Microphone



The microphone is a computer input device that is used to input the sound. It receives the sound vibrations and converts them into audio signals or sends to a recording medium. The audio signals are converted into digital data and stored in the computer. The microphone also enables the user to telecommunicate with others. It is also used to add sound to presentations and with webcams for video conferencing. A microphone can capture audio waves in different ways; accordingly the three most common types are described below:

i) **Dynamic:**



It is the most commonly used microphone with a simple design. It has a magnet which is wrapped by a metal coil and a thin sheet on the front end of the magnet. The sheet transfers vibrations from sound waves to the coil and from coil to electric wires which transmit the sound like an electrical signal.

ii) Condenser:



It is designed for audio recording and has a very sensitive and flat frequency response. It has a front plate called diaphragm and a back plate parallel to the front plate. When sound hits the diaphragm, it vibrates the diaphragm and alters the distance between the two plates. The changes in distance are transmitted as electric signals.

iii) Ribbon:



It is known for its reliability. It has a thin ribbon made of aluminum, duraluminum, or nanofilm suspended in a magnetic field. The sound waves cause vibrations in the ribbon, which generate a voltage proportional to the velocity of the vibration. The voltage is transmitted as an electrical signal. Early ribbon microphones had a transformer to increase the output voltage, but modern ribbon microphones come with advanced magnets to produce a strong signal.

8) Magnetic Ink Character Recognition (MICR)



MICR computer input device is designed to read the text printed with magnetic ink. MICR is a character recognition technology that makes use of special magnetized ink which is sensitive to magnetic fields. It is widely used in banks to process the cheques and other organizations where security is a major concern. It can process three hundred cheques in a minute with hundred-percent accuracy. The details on the bottom of the cheque (MICR No.) are written with magnetic ink. A laser printer with MICR toner can be used to print the magnetic ink.

The device reads the details and sends to a computer for processing. A document printed in magnetic ink is required to pass through a machine which magnetizes the ink, and the magnetic information is then translated into characters.

9) Optical Character Reader (OCR)



OCR computer input device is designed to convert the scanned images of handwritten, typed or printed text into digital text. It is widely used in offices and libraries to convert documents and books into electronic files.

It processes and copies the physical form of a document using a scanner. After copying the documents, the OCR software converts the documents into a two-color (black and white), version called bitmap. Then it is analyzed for light and dark areas, where the dark areas are selected as characters, and the light area is identified as background. It is widely used to convert hard copy legal or historic documents into PDFs. The converted documents can be edited if required like we edit documents created in ms word.

10) Digital camera:



It is a digital device as it captures images and records videos digitally and then stores them on a memory card. It is provided with an image sensor chip to capture images, as opposed to film used by traditional cameras. Besides this, a camera that is connected to your computer can also be called a digital camera.

It has photosensors to record light that enters the camera through the lens. When the light strikes the photosensors, each of the sensors returns the electrical current, which is used to create the images.

11) Paddle:



It is a simple input device that is widely used in games. It is a wheel that is held by hand and looks like a volume knob on a stereo that is used to increase or decrease the volume. Paddle moves or controls cursor or any other objects in the game in a back-and-forth motion. It is widely used as an alternative to the joystick. Besides this, the term paddle also refers to many handheld devices designed to control a function in an electronic device, computer, etc.,

12) Steering wheel:



It is used as an input device in racing video games such as car racing games or in driving programs as virtual simulators to steer a vehicle. It works like the real steering wheel by allowing you to take a right or left turn. A steering wheel may be provided with acceleration and brake pedal devices and a mechanism for shifting gears. Thus, it makes racing games more adventurous and entertaining.

13) Gesture recognition devices:



These devices take human gestures as input. There are many such devices that respond to gestures. For example, Kinect is one such device that observes the movement of a player's body and interprets these movements as inputs to video games. This feature is also available in certain tablets and smartphones

where you can perform certain tasks such as taking pictures using finger gestures such as swiping, pinching, etc.

14) Light Gun:



As the name suggests, it is a pointing input device that is designed to point at and shoot the targets on the screen in a video game, or arcade, etc. The light gun was used for the first time on the MIT Whirwind computer. When the gun is pointed at the target on the screen and the trigger is pulled, the screen goes blank for a fraction of a second. During this moment, the photodiode, which is present in the barrel, determines where the gun is pointed. For example, shooting ducks in a duck hunt game.

15) Touchpad:



It is usually found in laptops as a substitute for the mouse. It allows you to move or control the cursor on the screen using your finger. Just like a mouse, it also has two buttons for right and left click. Using the touchpad, you can perform all the tasks that you do with a mouse, such as selecting an object on the screen, copy, paste, delete, open a file or folder, and more.

16) Remote:



It is a hardware device designed to control the functioning of a device, e.g., a TV remote that can be used to change channels, increase or decrease the volume, from a distance without leaving the seat. The first cordless TV remote was invented by Dr. Robert Adler of Zenith in 1956. The remote sends the

electromagnetic waves to communicate with the device. These waves can be infrared rays, radio waves, etc.

17) Touch screen:



It is the display screen of a device such as a smartphone, tablet, etc., that allows users to interact or provide inputs to the device by using their finger. Today, most of the electronic devices come with touchscreen as an alternative to a mouse for navigating a graphical user interface. For example, by touching, you can unlock your phone, open emails, open files, play videos, etc. Besides this, it is used in lots of devices such as Camera, Car GPS, Fitness machine, etc.

The concept of the touch screen was first introduced and published by E.A. Johnson in 1965. The first touch screen was developed at the beginning of the 1970s by CERN engineers Frank Beck and Bent Stumpe.

18) VR:



VR stands for virtual reality. It is an artificial or virtual environment which is generated by computers. A person can interact with virtual objects of this artificial environment using some input devices such as headsets, gloves, headphones, etc. For example, he or she can find himself or herself walking on a beach, watching a football match, walking in the sky, etc., without actually doing all this.

19) Webcam:



Any camera which is connected to a computer is called a webcam. The in-built camera provided on a computer can also be considered a webcam. It is an input device as it can take pictures, and can be used to record videos if required. The pictures and videos are stored in the computer memory and can be displayed on the screen if required. Although it works almost the same as the digital camera, it is different from a digital camera, as it is designed to take compact digital photos that can be uploaded easily on the webpages and shared with others through the internet.

20) Biometric Devices:

Biometrics refers to a process in which a person is identified through his or her biological features such as fingerprints, eye cornea, face structure, etc. It is done by using biometric devices, which can be of different types based on their scanning features and abilities, such as:

i) Face Scanner:



It is designed to identify a person by scanning his or her face. It takes the face measurements of a person. For example, the distance between eyes, nose, and mouth, etc., accordingly, it confirms the identity of a person. Besides this, it is smart enough to differentiate between a person's picture and the real person.

ii) Hand Scanner:



The hand of a person can also be used to verify his or her identity as every person has a unique pattern of veins in the palm, just like fingerprints. This device takes advantage of this feature; it identifies a

person by scanning the palm of his hand. It uses infrared light to scan veins' patterns and blood flowing in them. Palm is even more unique than fingerprints.

iii) Fingerprint Scanner:



It scans the fingerprints to identify people or for biometric authentication. This device is developed, keeping in mind the fact that no two persons in the world can have the same fingerprints. It is widely used in companies as a fingerprint attendance system to mark the attendance of employees. This type of scanners captures the pattern of valleys and ridges found on a finger and store it in the memory or database. When you press your finger on the given space, it verifies the identity by using its pattern-matching software.

iv) Retina or Iris Scanner:



It scans the retina or iris of a person's eye to confirm the identity. This device is more secure than others as it is next to impossible to copy the retina or iris. It works by mapping the retina's blood vessel patterns of the eye. The blood vessels of retina absorb light more easily as well as can be identified with appropriate lighting.

In this scan, a beam of low-energy infrared light falls on the retina through the scanner's eyepiece. Then, the software captures the network of blood vessels in the retina and uses it to verify a person's identity.

v) Voice Scanner:



It records the voice of a person and digitizes it to create a distinctive voice print or template. The voiceprints are stored in the database, and are used to verify the voice of a person to confirm his or her identity. The person is required to speak in the normal or same voice that was used to create a voice template. It is not much reliable as it can be misused using a tape recording.

(9) Output Devices

Following are some of the important output devices used in a computer.

- Monitors
- Graphic Plotter
- Printer

Monitors

Monitors, commonly called as **Visual Display Unit (VDU)**, are the main output device of a computer. It forms images from tiny dots, called pixels that are arranged in a rectangular form. The sharpness of the image depends upon the number of pixels.

There are two kinds of viewing screen used for monitors.

- Cathode-Ray Tube (CRT)
- Flat-Panel Display

Cathode-Ray Tube (CRT) Monitor

The CRT display is made up of small picture elements called pixels. The smaller the pixels, the better the image clarity or resolution. It takes more than one illuminated pixel to form a whole character, such as the letter 'e' in the word help.



A finite number of characters can be displayed on a screen at once. The screen can be divided into a series of character boxes - fixed location on the screen where a standard character can be placed. Most screens are capable of displaying 80 characters of data horizontally and 25 lines vertically.

There are some disadvantages of CRT –

- Large in Size
- High power consumption

Flat-Panel Display Monitor

The flat-panel display refers to a class of video devices that have reduced volume, weight and power requirement in comparison to the CRT. You can hang them on walls or wear them on your wrists. Current uses of flat-panel displays include calculators, video games, monitors, laptop computer, and graphics display.



The flat-panel display is divided into two categories –

- **Emissive Displays** – Emissive displays are devices that convert electrical energy into light. For example, plasma panel and LED (Light-Emitting Diodes).
- **Non-Emissive Displays** – Non-emissive displays use optical effects to convert sunlight or light from some other source into graphics patterns. For example, LCD (Liquid-Crystal Device).

Printers

Printer is an output device, which is used to print information on paper.

There are two types of printers –

- Impact Printers
- Non-Impact Printers

Impact Printers

Impact printers print the characters by striking them on the ribbon, which is then pressed on the paper.

Characteristics of Impact Printers are the following –

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

These printers are of two types –

- Character printers
- Line printers

Character Printers

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

These are further divided into two types:

- Dot Matrix Printer(DMP)
- Daisy Wheel

Dot Matrix Printer

In the market, one of the most popular printers is Dot Matrix Printer. These printers are popular because of their ease of printing and economical price. Each character printed is in the form of pattern of dots and head consists of a Matrix of Pins of size (5*7, 7*9, 9*7 or 9*9) which come out to form a character which is why it is called Dot Matrix Printer.



Advantages

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

Disadvantages

- Slow Speed
- Poor Quality

Daisy Wheel

Head is lying on a wheel and pins corresponding to characters are like petals of Daisy (flower) which is why it is called Daisy Wheel Printer. These printers are generally used for word-processing in offices that require a few letters to be sent here and there with very nice quality.



Advantages

- More reliable than DMP
- Better quality
- Fonts of character can be easily changed

Disadvantages

- Slower than DMP
- Noisy
- More expensive than DMP

Line Printers

Line printers are the printers which print one line at a time.



These are of two types –

- Drum Printer
- Chain Printer

Drum Printer

This printer is like a drum in shape hence it is called drum printer. The surface of the drum is divided into a number of tracks. Total tracks are equal to the size of the paper, i.e. for a paper width of 132 characters, drum will have 132 tracks. A character set is embossed on the track. Different character sets available in the market are 48 character set, 64 and 96 characters set. One rotation of drum prints one line. Drum printers are fast in speed and can print 300 to 2000 lines per minute.

Advantages

- Very high speed

Disadvantages

- Very expensive
- Characters fonts cannot be changed

Chain Printer

In this printer, a chain of character sets is used, hence it is called Chain Printer. A standard character set may have 48, 64, or 96 characters.

Advantages

- Character fonts can easily be changed.
- Different languages can be used with the same printer.

Disadvantages

- Noisy

Non-impact Printers

Non-impact printers print the characters without using the ribbon. These printers print a complete page at a time, thus they are also called as Page Printers.

These printers are of two types –

- Laser Printers
- Inkjet Printers

Characteristics of Non-impact Printers

- Faster than impact printers
- They are not noisy

- High quality
- Supports many fonts and different character size

Laser Printers

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



Advantages

- Very high speed
- Very high quality output
- Good graphics quality
- Supports many fonts and different character size

Disadvantages

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

Inkjet Printers

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



They make less noise because no hammering is done and these have many styles of printing modes available. Color printing is also possible. Some models of Inkjet printers can produce multiple copies of printing also.

Advantages

- High quality printing
- More reliable

Disadvantages

- Expensive as the cost per page is high
- Slow as compared to laser printer

(10) Secondary Devices

You know that processor memory, also known as primary memory, is expensive as well as limited. The faster primary memory are also volatile. If we need to store large amount of data or programs permanently, we need a cheaper and permanent memory. Such memory is called **secondary memory**. Here we will discuss secondary memory devices that can be used to store large amount of data, audio, video and multimedia files.

Characteristics of Secondary Memory

These are some characteristics of secondary memory, which distinguish it from primary memory

- It is non-volatile, i.e. it retains data when power is switched off
- It is large capacities to the tune of terabytes
- It is cheaper as compared to primary memory

Depending on whether secondary memory device is part of CPU or not, there are two types of secondary memory – fixed and removable.

Let us look at some of the secondary memory devices available.

Hard Disk Drive

Hard disk drive is made up of a series of circular disks called **platters** arranged one over the other almost ½ inches apart around a **spindle**. Disks are made of non-magnetic material like aluminum alloy and coated with 10-20 nm of magnetic material.



Standard diameter of these disks is 14 inches and they rotate with speeds varying from 4200 rpm (rotations per minute) for personal computers to 15000 rpm for servers. Data is stored by magnetizing or demagnetizing the magnetic coating. A magnetic reader arm is used to read data from and write data to the disks. A typical modern HDD has capacity in terabytes (TB).

CD Drive

CD stands for **Compact Disk**. CDs are circular disks that use optical rays, usually lasers, to read and write data. They are very cheap as you can get 700 MB of storage space for less than a dollar. CDs are inserted in CD drives built into CPU cabinet. They are portable as you can eject the drive, remove the CD and carry it with you. There are three types of CDs –

- **CD-ROM (Compact Disk – Read Only Memory)** – The data on these CDs are recorded by the manufacturer. Proprietary Software, audio or video are released on CD-ROMs.
- **CD-R (Compact Disk – Recordable)** – Data can be written by the user once on the CD-R. It cannot be deleted or modified later.
- **CD-RW (Compact Disk – Rewritable)** – Data can be written and deleted on these optical disks again and again.

DVD Drive

DVD stands for **Digital Video Display**. DVD are optical devices that can store 15 times the data held by CDs. They are usually used to store rich multimedia files that need high storage capacity. DVDs also come in three varieties – read only, recordable and rewritable.



Pen Drive

Pen drive is a portable memory device that uses solid state memory rather than magnetic fields or lasers to record data. It uses a technology similar to RAM, except that it is nonvolatile. It is also called USB drive, key drive or flash memory.

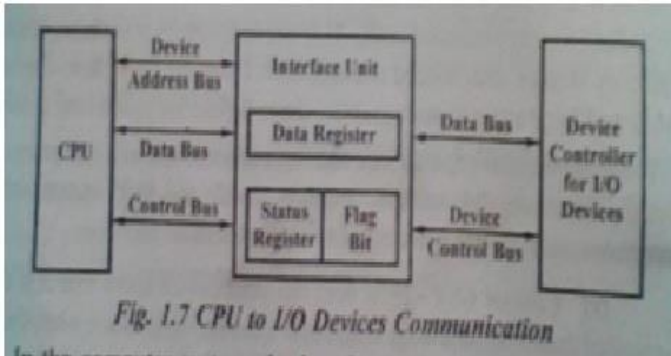


Blu Ray Disk

Blu Ray Disk (BD) is an optical storage media used to store high definition (HD) video and other multimedia files. BD uses shorter wavelength laser as compared to CD/DVD. This enables writing arm to focus more tightly on the disk and hence pack in more data. BDs can store up to 128 GB data.

(11) Communication between the CPU and Input/Output devices.

The communication between CPU and input/output devices is implemented using an interface unit. In a computer system, data is transferred from an input device to the processor and from the processor to an output device. Each input and output device is provided with a device controller, which is used to manage the working of various peripheral devices. Actually, the CPU communicates with the device controllers for performing the I/O operations.



In the computer system, the interface unit works as an intermediary between the processor and the device controllers of various peripheral devices. The interface unit accepts the control commands from the processor and interprets the commands so that they can be easily understood by the device controllers for performing the required operations. Hence, the interface unit is responsible for controlling the input and output operations. The processor to I/O devices communication involves two important operations-I/O read and I/O write.

The I/O operation helps the CPU to read the data from an input device. The sequence of steps done during transferring the data from and an input device to the CPU are as follows-

1. The input device kept the data that needs to be transferred on the data bus which transfers single byte of data at a time.
2. The input device then issues the data valid signal through the device control bus to the data register, showing that the data is present on the data bus.
3. After accepting the data by the data register of the interface unit, it issues a data accepted signal through the device control bus as an acknowledgement to the input device, showing that the data is received. Then, the input device disables the data valid signal.
4. The flag bit of the status register is set to 1 because the data register holds the data.
5. Now, the CPU issues an I/O read signal to the data register in the interface unit.
6. The data register then places the data on the data bus connected to the CPU. When the data is received, the CPU sends an acknowledgement signal to the input device, showing that the data has been received.

The I/O write operation helps the processor to write the data to an output device. The sequence of steps done during transferring the data from CPU to the output device are as follows-

1. The CPU kept the data that needs to be transferred on the data bus connected to the data register of the interface unit.
2. The CPU also kept the address of the output device on the device address bus.
3. The CPU then issues the I/O write signal which writes the data on the data register. The data register holds the data , showing that flag bit of the status register is set to 1 .
4. Now, the data register issues a data accepted signal through the control bus to the CPU, showing that the data has been received.
5. Then, the interface unit kept the data on the data bus connected to the device controller of the output device.
6. The output device receives the data and sends an acknowledgement signal to the CPU through the interface unit, showing that the desired data has been received.

(12) **Software**

Software is a set of programs, which is designed to perform a well-defined function. A program is a sequence of instructions written to solve a particular problem.

There are two types of software –

TYPES OF SOFTWARE

- System Software
- Application Software

i) System Software

The system software is a collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software is generally prepared by the computer manufacturers. These software products comprise of programs written in low-level languages, which interact with the hardware at a very basic level. System software serves as the interface between the hardware and the end users.

Some examples of system software are Operating System, Compilers, Interpreter, Assemblers, etc.



Here is a list of some of the most prominent features of a system software –

- Close to the system
- Fast in speed
- Difficult to design
- Difficult to understand
- Less interactive
- Smaller in size
- Difficult to manipulate Generally written in low-level language

ii) Application Software

Application software products are designed to satisfy a particular need of a particular environment. All software applications prepared in the computer lab can come under the category of Application software.

Application software may consist of a single program, such as Microsoft's notepad for writing and editing a simple text. It may also consist of a collection of programs, often called a software package, which work together to accomplish a task, such as a spreadsheet package.

Examples of Application software are the following –

- Payroll Software
- Student Record Software
- Inventory Management Software
- Income Tax Software
- Railways Reservation Software
- Microsoft Office Suite Software
- Microsoft Word
- Microsoft Excel
- Microsoft PowerPoint



Features of application software are as follows –

- Close to the user
- Easy to design
- More interactive
- Slow in speed
- Generally written in high-level language
- Easy to understand
- Easy to manipulate and use
- Bigger in size and requires large storage space

(13) Numeral Systems

When we type some letters or words, the computer translates them in numbers as computers can understand only numbers. A computer can understand the positional number system where there are only a few symbols called digits and these symbols represent different values depending on the position they occupy in the number.

The value of each digit in a number can be determined using –

- The digit
- The position of the digit in the number

- The base of the number system (where the base is defined as the total number of digits available in the number system)

Decimal Number System

The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands, and so on.

Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position. Its value can be written as

$$(1 \times 1000) + (2 \times 100) + (3 \times 10) + (4 \times 1)$$

$$(1 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + (4 \times 10^0)$$

$$1000 + 200 + 30 + 4$$

$$1234$$

As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

S.No.	Number System and Description
1	Binary Number System Base 2. Digits used : 0, 1
2	Octal Number System Base 8. Digits used : 0 to 7
3	Hexa Decimal Number System Base 16. Digits used: 0 to 9, Letters used : A- F

Binary Number System

Characteristics of the binary number system are as follows –

- Uses two digits, 0 and 1
- Also called as base 2 number system
- Each position in a binary number represents a **0** power of the base (2). Example 2^0
- Last position in a binary number represents a **x** power of the base (2). Example 2^x where **x** represents the last position - 1.

Example

Binary Number: 10101_2

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
------	---------------	----------------

Step 1	10101 ₂	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101 ₂	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101 ₂	21 ₁₀

Note – 10101₂ is normally written as 10101.

Octal Number System

Characteristics of the octal number system are as follows –

- Uses eight digits, 0,1,2,3,4,5,6,7
- Also called as base 8 number system
- Each position in an octal number represents a **0** power of the base (8). Example 8⁰
- Last position in an octal number represents a **x** power of the base (8). Example 8^x where **x** represents the last position - 1

Example

Octal Number: 12570₈

Calculating Decimal Equivalent –

Step	Octal Number	Decimal Number
Step 1	12570 ₈	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570 ₈	$(4096 + 1024 + 320 + 56 + 0)_{10}$
Step 3	12570 ₈	5496 ₁₀

Note – 12570₈ is normally written as 12570.

Hexadecimal Number System

Characteristics of hexadecimal number system are as follows –

- Uses 10 digits and 6 letters, 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F
- Letters represent the numbers starting from 10. A = 10, B = 11, C = 12, D = 13, E = 14, F = 15
- Also called as base 16 number system
- Each position in a hexadecimal number represents a **0** power of the base (16). Example, 16⁰
- Last position in a hexadecimal number represents a **x** power of the base (16). Example 16^x where **x** represents the last position - 1

Example

Hexadecimal Number: $19FDE_{16}$

Calculating Decimal Equivalent –

Step	Binary Number	Decimal Number
Step 1	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (F \times 16^2) + (D \times 16^1) + (E \times 16^0))_{10}$
Step 2	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (15 \times 16^2) + (13 \times 16^1) + (14 \times 16^0))_{10}$
Step 3	$19FDE_{16}$	$(65536 + 36864 + 3840 + 208 + 14)_{10}$
Step 4	$19FDE_{16}$	106462_{10}

Note – $19FDE_{16}$ is normally written as 19FDE.

UNIT-II

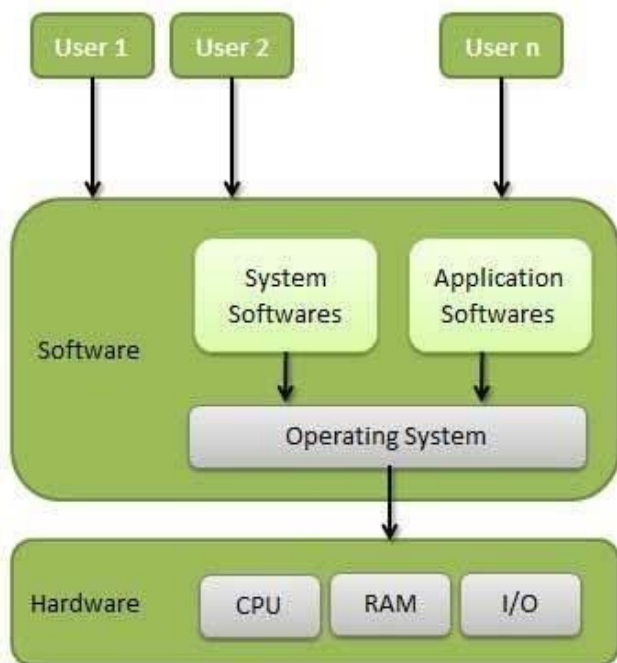
(1) Introduction to OS

An Operating System (OS) is an interface between a computer user and computer hardware. An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output, and controlling peripheral devices such as disk drives and printers.

Some popular Operating Systems include Linux Operating System, Windows Operating System, VMS, OS/400, AIX, z/OS, etc.

Definition

An operating system is a program that acts as an interface between the user and the computer hardware and controls the execution of all kinds of programs.



Following are some of important functions of an operating System.

- Memory Management
- Processor Management
- Device Management
- File Management
- Security
- Control over system performance
- Job accounting
- Error detecting aids
- Coordination between other software and users

Memory Management

Memory management refers to management of Primary Memory or Main Memory. Main memory is a large array of words or bytes where each word or byte has its own address.

Main memory provides a fast storage that can be accessed directly by the CPU. For a program to be executed, it must be in the main memory. An Operating System does the following activities for memory management –

- Keeps tracks of primary memory, i.e., what part of it are in use by whom, what part are not in use.
- In multiprogramming, the OS decides which process will get memory when and how much.
- Allocates the memory when a process requests it to do so.
- De-allocates the memory when a process no longer needs it or has been terminated.

Processor Management

In multiprogramming environment, the OS decides which process gets the processor when and for how much time. This function is called **process scheduling**. An Operating System does the following activities for processor management –

- Keeps tracks of processor and status of process. The program responsible for this task is known as **traffic controller**.
- Allocates the processor (CPU) to a process.
- De-allocates processor when a process is no longer required.

Device Management

An Operating System manages device communication via their respective drivers. It does the following activities for device management –

- Keeps tracks of all devices. Program responsible for this task is known as the **I/O controller**.
- Decides which process gets the device when and for how much time.
- Allocates the device in the efficient way.
- De-allocates devices.

File Management

A file system is normally organized into directories for easy navigation and usage. These directories may contain files and other directions.

An Operating System does the following activities for file management –

- Keeps track of information, location, uses, status etc. The collective facilities are often known as **file system**.
- Decides who gets the resources.
- Allocates the resources.

- De-allocates the resources.

Other Important Activities

Following are some of the important activities that an Operating System performs –

- **Security** – By means of password and similar other techniques, it prevents unauthorized access to programs and data.
- **Control over system performance** – Recording delays between request for a service and response from the system.
- **Job accounting** – Keeping track of time and resources used by various jobs and users.
- **Error detecting aids** – Production of dumps, traces, error messages, and other debugging and error detecting aids.
- **Coordination between other softwares and users** – Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

(2) Types of OS

There are many types of operating system exists in the current scenario:

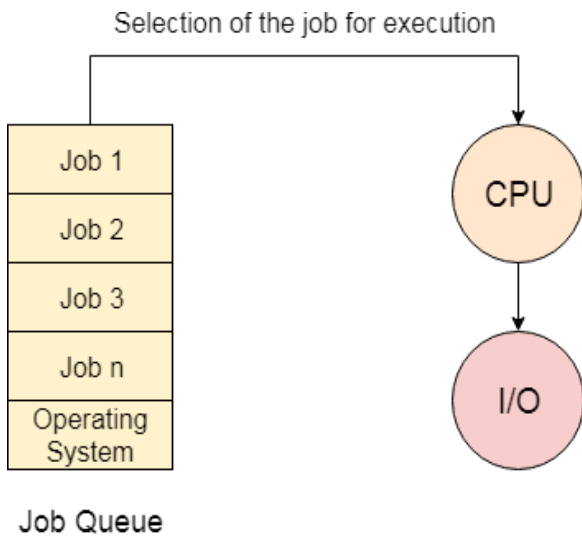
1. Batch Operating System
2. Multiprogramming Operating System
3. Multiprocessing Operating System
4. Real Time Operating System

1. Batch Operating System

In the era of 1970s, the Batch processing was very popular. The Jobs were executed in batches. People were used to have a single computer which was called mainframe.

In Batch operating system, access is given to more than one person; they submit their respective jobs to the system for the execution.

The system put all of the jobs in a queue on the basis of first come first serve and then executes the jobs one by one. The users collect their respective output when all the jobs get executed.



Disadvantages of Batch OS

1. Starvation

Batch processing suffers from starvation. If there are five jobs J1, J2, J3, J4, J4 and J5 present in the batch. If the execution time of J1 is very high then other four jobs will never be going to get executed or they will have to wait for a very high time. Hence the other processes get starved.

2. Not Interactive

Batch Processing is not suitable for the jobs which are dependent on the user's input. If a job requires the input of two numbers from the console then it will never be going to get it in the batch processing scenario since the user is not present at the time of execution.

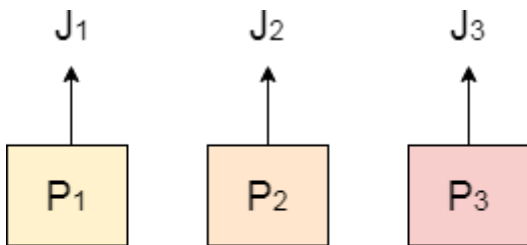
2. Multiprogramming Operating System

Multiprogramming is an extension to the batch processing where the CPU is kept always busy. Each process needs two types of system time: CPU time and IO time.

In multiprogramming environment, for the time a process does its I/O, The CPU can start the execution of other processes. Therefore, multiprogramming improves the efficiency of the system.

3. Multiprocessing Operating System

In Multiprocessing, Parallel computing is achieved. There are more than one processors present in the system which can execute more than one process at the same time. This will increase the throughput of the system.



Multi Processing

4. Real Time Operating System

In Real Time systems, each job carries a certain deadline within which the Job is supposed to be completed, otherwise the huge loss will be there or even if the result is produced then it will be completely useless.

The Application of a Real Time system exists in the case of military applications, if you want to drop a missile then the missile is supposed to be dropped with certain precision.

(3) Functions of Operation System

An operating system is a program that acts as a user-computer GUI (Graphical user interface). It controls the execution of all types of applications.

The operating system performs the following functions in a device.

1. Instruction
2. Input/output Management
3. Memory Management
4. File Management
5. Processor Management
6. Job Priority
7. Special Control Program
8. Scheduling of resources and jobs
9. Security
10. Monitoring activities
11. Job accounting

Instruction: The operating system establishes a mutual understanding between the various instructions given by the user.

Input/output Management: What output will come from the input given by the user, the operating system runs this program. This management involves coordinating various input and output devices. It assigns the functions of those devices where one or more applications are executed.

Memory Management: The operating system handles the responsibility of storing any data, system programs, and user programs in memory. This function of the operating system is called memory management.

File Management: The operating system is helpful in making changes in the stored files and in replacing them. It also plays an important role in transferring various files to a device.

Processor Management: The processor is the execution of a program that accomplishes the specified work in that program. It can be defined as an execution unit where a program runs.

Job Priority: The work of job priority is creation and promotion. It determines what action should be done first in a computer system.

Special Control Program: The operating systems make automatic changes to the task through specific control programs. These programs are called Special Control Program.

Scheduling of resources and jobs: The operating system prepares the list of tasks to be performed for the device of the computer system. The operating system decides which device to use for which task. This action becomes complicated when multiple tasks are to be performed simultaneously in a computer system. The scheduling programs of the operating system determine the order in which tasks are completed. It performs these tasks based on the priority of performing the tasks given by the user. It makes the tasks available based on the priority of the device.

Security: Computer security is a very important aspect of any operating system. The reliability of an operating system is determined by how much better security it provides us. Modern operating systems use a firewall for security. A firewall is a security system that monitors every activity happening in the computer and blocks that activity in case of any threat.

Monitoring activities: The operating system takes care of the activities of the computer system during various processes. This aborts the program if there are errors. The operating system sends instant messages to the user for any unexpected error in the input/output device. It also provides security to the system when the operating system is used in systems operated by multiple users. So that illegal users cannot get data from the system.

Job accounting: It keeps track of time & resources used by various jobs and users.

(4) Evolution of Operating Systems

1. Simple Batch
2. Multi Programmed
3. Time-Shared

4. Parallel

5. Distributed Systems

6. Real-Time Systems

1. Simple Batch:

- In this type of system, there is **no direct interaction between user and the computer**.
- The user has to submit a job (written on cards or tape) to a computer operator.
- Then computer operator places a batch of several jobs on an input device.
- Jobs are batched together by type of languages and requirement.
- Then a special program, the monitor, manages the execution of each program in the batch.
- The monitor is always in the main memory and available for execution.

Advantages of Simple Batch Systems

1. No interaction between user and computer.
2. No mechanism to prioritise the processes.



2. Multi Programmed

- In this the operating system picks up and begins to execute one of the jobs from memory.
- Once this job needs an I/O operation operating system switches to another job (CPU and OS always busy).
- Jobs in the memory are always less than the number of jobs on disk(Job Pool).

- If several jobs are ready to run at the same time, then the system chooses which one to run through the process of **CPU Scheduling**.
- In Non-multiprogrammed system, there are moments when CPU sits idle and does not do any work.
- In Multiprogramming system, CPU will never be idle and keeps on processing.

3. Time-Shared:

Time Sharing Systems are very similar to Multiprogramming batch systems. In fact time sharing systems are an extension of multiprogramming systems.

In Time sharing systems the prime focus is on minimizing the response time, while in multiprogramming the prime focus is to maximize the CPU usage.

4. Parallel System:

There is a trend multiprocessor system, such system have more than one processor in close communication, sharing the computer bus, the clock, and sometimes memory and peripheral devices.

These systems are referred to as "Tightly Coupled" system. Then the system is called **a parallel system**. In the parallel system, a number of processors are executing there job in parallel.

Advantages:

- It increases the throughput.
- By increasing the number of processors(CPU), to get more work done in a shorter period of time.



5. Distributed Systems :

The motivation behind developing distributed operating systems is the availability of powerful and inexpensive microprocessors and advances in communication technology.

These advancements in technology have made it possible to design and develop distributed systems comprising of many computers that are inter connected by communication networks. The main benefit of distributed systems is its low price/performance ratio.

Advantages Distributed Operating System

1. As there are multiple systems involved, user at one site can utilize the resources of systems at other sites for resource-intensive tasks.
2. Fast processing.
3. Less load on the Host Machine.

Types of Distributed Operating Systems

Following are the two types of distributed operating systems used:

1. Client-Server Systems
2. Peer-to-Peer Systems

i) Client-Server Systems

Centralized systems today act as **server systems** to satisfy requests generated by **client systems**.

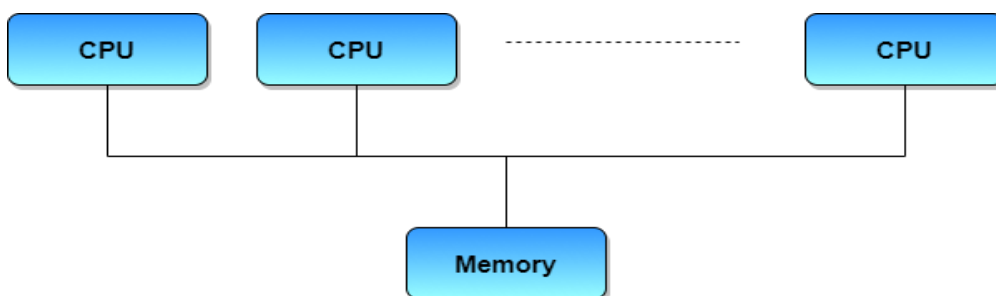
Server Systems can be broadly categorized as: **Compute Servers** and **File Servers**.

- **Compute Server systems**, provide an interface to which clients can send requests to perform an action, in response to which they execute the action and send back results to the client.
- **File Server systems**, provide a file-system interface where clients can create, update, read, and delete files.

ii) Peer-to-Peer Systems

The growth of computer networks - especially the Internet and World Wide Web (WWW) – has had a profound influence on the recent development of operating systems. When PCs were introduced in the 1970s, they were designed for **personal** use and were generally considered standalone computers. With the beginning of widespread public use of the Internet in the 1990s for electronic mail and FTP, many PCs became connected to computer networks.

In contrast to the **Tightly Coupled** systems, the computer networks used in these applications consist of a collection of processors that do not share memory or a clock. Instead, each processor has its own local memory. The processors communicate with one another through various communication lines, such as high-speed buses or telephone lines. These systems are usually referred to as loosely coupled systems (or distributed systems). The general structure of a client-server system is depicted in the figure below:



6. Real Time Operating System

It is defined as an operating system known to give maximum time for each of the critical operations that it performs, like OS calls and interrupt handling.

The Real-Time Operating system which guarantees the maximum time for critical operations and complete them on time are referred to as **Hard Real-Time Operating Systems**.

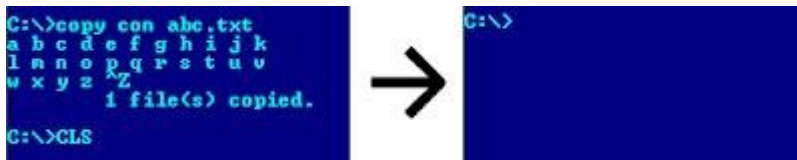
While the real-time operating systems that can only guarantee a maximum of the time, i.e. the critical task will get priority over other tasks, but no assurance of completing it in a defined time. These systems are referred to as **Soft Real-Time Operating Systems**.

5) MSDOS

MSDOS Internal Commands:

1. Cls

It is used to clear the screen. Syntax is **CLS**



```
C:\>copy con abc.txt
a b c d e f g h i j k
l m n o p q r s t u v
w x y z ^ _ `
1 file(s) copied.
C:\>CLS
```

2. Path

This command displays the path that how we have come to the present position or sets a search path for executable files.

Its Syntax is **PATH [[drive:]path[;...][;%PATH%]]**

Typing PATH without any parameters displays the current path under current directory. Typing PATH ; clears all search-path settings and direct cmd.exe to search only in the current directory. And including %PATH% in the new path setting causes the old path to be appended to the new setting.

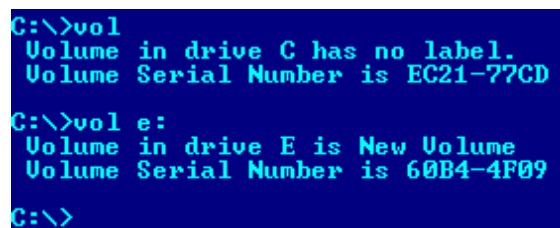
3. Ver

This command displays the version of the Microsoft Windows running on your computer.

4. Vol

It displays the disk volume label and serial number, if they exist for the drive specified. If no drive is specified it displays for the active drive.

Syntax is **VOL [drive:]**



```
C:\>vol
Volume in drive C has no label.
Volume Serial Number is EC21-77CD

C:\>vol e:
Volume in drive E is New Volume
Volume Serial Number is 60B4-4F09

C:\>
```


5. Promptt

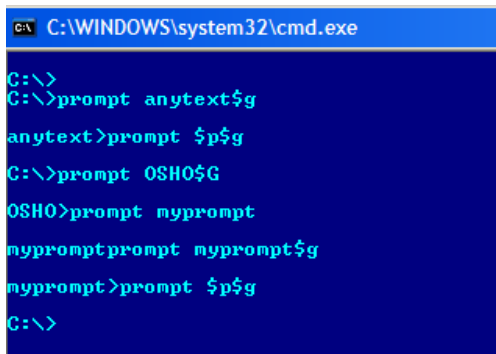
This changes the cmd.exe command prompt. By default the prompt is always set to the name of current drive followed by > sign.

Customize the Prompt

To customize the prompt to display any text of your choice, use the syntax **prompt anytext** and this will change the prompt to new command prompt anytext.

Prompt with Options (or Special Codes)

You can use prompt with options. To let the prompt display the current working directory use **prompt \$p\$g**. \$p in the above signifies the current drive and path. \$g signifies the greater than sign >



```
C:\WINDOWS\system32\cmd.exe
C:\>
C:\>prompt anytext$g
anytext>prompt $p$g
C:\>prompt OSH0$G
OSH0>prompt myprompt
mypromptprompt myprompt$g
myprompt>prompt $p$g
C:\>
```

6. chdir

Use the chdir command **to change to another directory**. The syntax is chdir followed by the name of the directory you want to go to. Example: chdir /home/user/www will change the directory you are in to /home/user/www. Wildcards are also permitted.

7. ECHO:

The ECHO command prints its own arguments back out to the DOS equivalent of the [standard output stream](#). (Hence the name, ECHO) Usually, this means directly to the screen, but the output of *echo* can be redirected, like any other command, to files or devices. Often used in [batch files](#) to print text out to the user.

Another important use of the echo command is to toggle echoing of commands on and off in batch files. Traditionally batch files begin with the `@echo off` statement. This says to the interpreter that echoing of commands should be off during the whole execution of the batch file, thus resulting in a "tidier" output (the `@` symbol declares that this particular command (echo off) should also be executed without echo.)

The command is available in MS-DOS versions 2 and later. [\[1\]](#)

8. LABEL:

Changes the label on a logical drive, such as a hard disk partition or a floppy disk.

The command is available in MS-DOS versions 3.1 and later and IBM PC DOS releases 3 and later. [\[1\]](#)

9. SET

Sets [environment variables](#).

The command is available in MS-DOS versions 2 and later.^[1]

[cmd.exe](#) in Windows NT 2000, 4DOS, 4OS2, 4NT, and a number of third-party solutions allow direct entry of environment variables from the command prompt. From at least Windows 2000, the set command allows for the evaluation of strings into variables, thus providing *inter alia* a means of performing integer arithmetic.^[23]

MSDOS External Commands:

1. DISKCOPY

This command copies the contents of one floppy from the source drive to a formatted or un-formatted floppy disk in the destination drive. This command copies the data from particular position on the source disk to exactly the same position on the destination disk. Syntax **Diskcopy A: B:** copies contents of A: to B: drive. This command can be used with /V switch which verifies that the disk is copied correctly.

2. FORMAT

This command creates a new root directory and a File Allocation Table (FAT) for the disk. In order for MS-DOS to be able to use a new disk you must use this command to format the disk.

FORMAT with /S switch

When the disk is formatted with /s option, the disk can be used as a booting disk. **C:>DOS>Format A: /s**

The above command copies the OS files MSDOS.SYS, IO.SYS and COMMAND.COM which are required for [booting the machine](#) from your system startup drive to the newly formatted disk. The disk can then be used for booting.

FORMAT with /U switch

Here's the command **C: > DOS > Format A: /U**

This command specifies an Unconditional Format which destroys all existing data and prevents you from later unformatting the disk.

FORMAT with /Q switch

This can be used only with the previously formatted disk. This deletes FAT, Root directory and data of disk but doesn't scan for the bad errors. This is generally used for Quick formatting.

Warning As Format command deletes all existing data, use this command with extreme caution. Any disk formatted (except with /U switch) may be later unformatted using the UNFORMAT command.

3. BACKUP

The Backup command backs up one or more files from one disk to another. You can backup files onto either a hard disk or on a floppy disk. Syntax is

BACKUP Source Destination

Here source specifies the location of files to be backed up and destination drive specifies the drive on which you want to store the backup files. The backed-up files are stored in backup.nnn and control.nnn files where nnn represents the backup disk number.

Backup with Switches

- The /S switch can be used to backup the contents of all files in the source including the contents of sub-directories.
- The /N switch can be used to backup only those files that have changed since the last backup.
- Backup command with /D:mm-dd-yyyy switch will backup files that have changed since the data specified.

4.RESTORE

The RESTORE command restores files that were backed up by using BACKUP command.

Syntax: **RESTORE drive1 drive2:path**

Here drive1 specifies the drive on which backup files are stored.

drive2:path specifies the path to which those backup files will be restored.

► Using backup command with /S switch is used to restore all backup files to their original directories and sub-directories.

(6) Operating System installation: Installing an Operating System such as Windows on Computer hardware.

The steps for installing an operating system, like [Linux](#) or [Microsoft Windows](#), depending on the operating system version you are installing. Each version has different steps and options that are unique to that operating system. Also, each operating system has different requirements for your computer to be able to run correctly.

On this page, you'll find general steps and guidelines for installing an operating system on the hard disk drive of your computer.

Install the operating system

To install the computer's operating system using a CD or DVD, you need to configure your computer to boot from the CD/DVD drive. You can change the [boot sequence](#) in your BIOS setup, and setting the CD/DVD drive to be the first boot device. Some computers may also allow you to access the boot sequence directly at computer start up, without entering the BIOS, by pressing a specific key on the keyboard. The key to press differs for each computer, but is often the Delete key or one of the [function keys](#).

If the operating system software came on a USB flash drive, you need to configure the computer to boot to a USB device as the first boot device.

Once the computer is configured to boot to the proper device, the computer should load the operating system installation program and guide you through the install process. You will be asked questions along the way for configuration of basic settings, like date and time, user account name, and if you want to enable automatic operating system updates. Go through the installation steps, answering questions and selecting the preferred options.

Second Topic

MS-Office Tools(Word,Excel & PowerPoint):

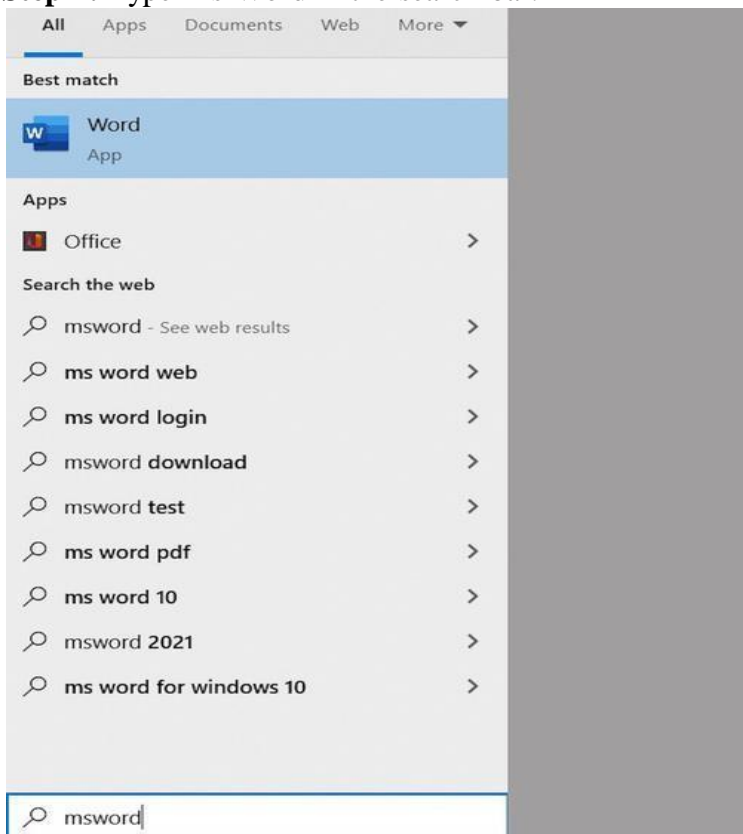
Introduction of Word Processing:

Microsoft word is a word processor software developed by Microsoft in 1983. It is the most commonly used word processor software. It is used to create professional quality documents, letters, reports, resumes, etc and also allows you to edit or modify your new or existing document. The file saved in Ms Word has .docx extension. It is a component of the Microsoft Office suite, but you can buy it separately and is available for both Windows and macOS. The latest version of Ms Word is 2019. In this article we will learn the features of Ms Word, but first we learn how to open Ms Word

How to open MS Word?

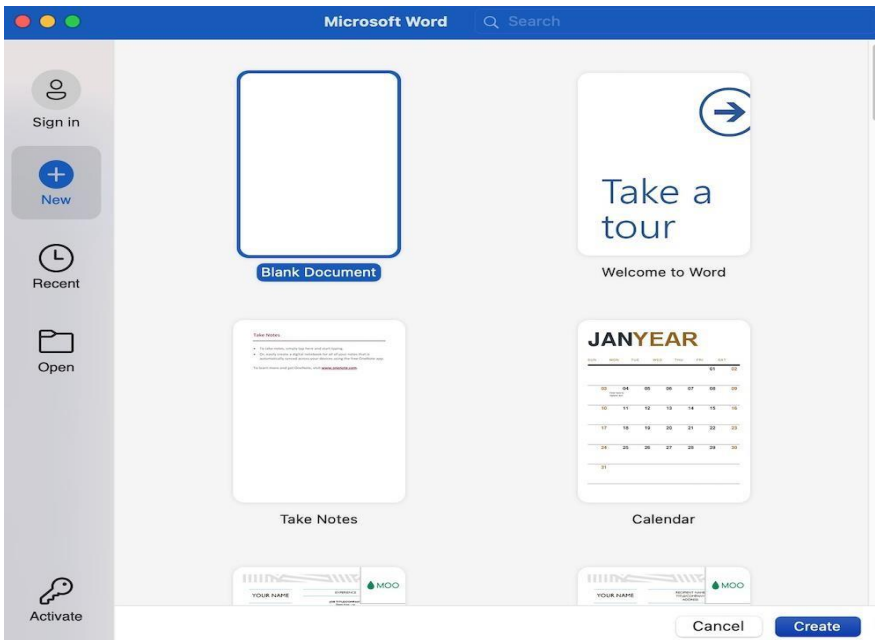
The following step shows how to open MS words:

Step 1: Type Ms Word in the search bar.

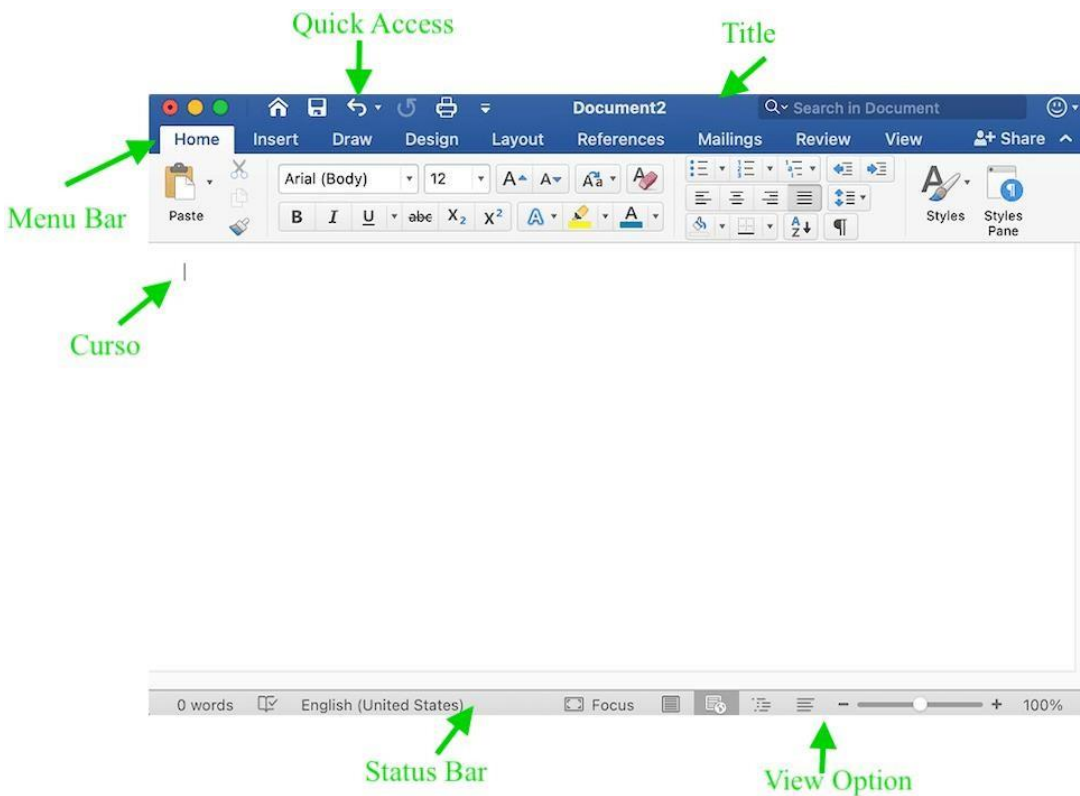


Step 2: Select Ms Word application.

Step 3: Select a blank document and press create button.



Then you will get a window like in the image below where you can write your content and perform different types of operations on that content, like font type, style, bold, italic, etc. You can also add images, tables, charts to your document.

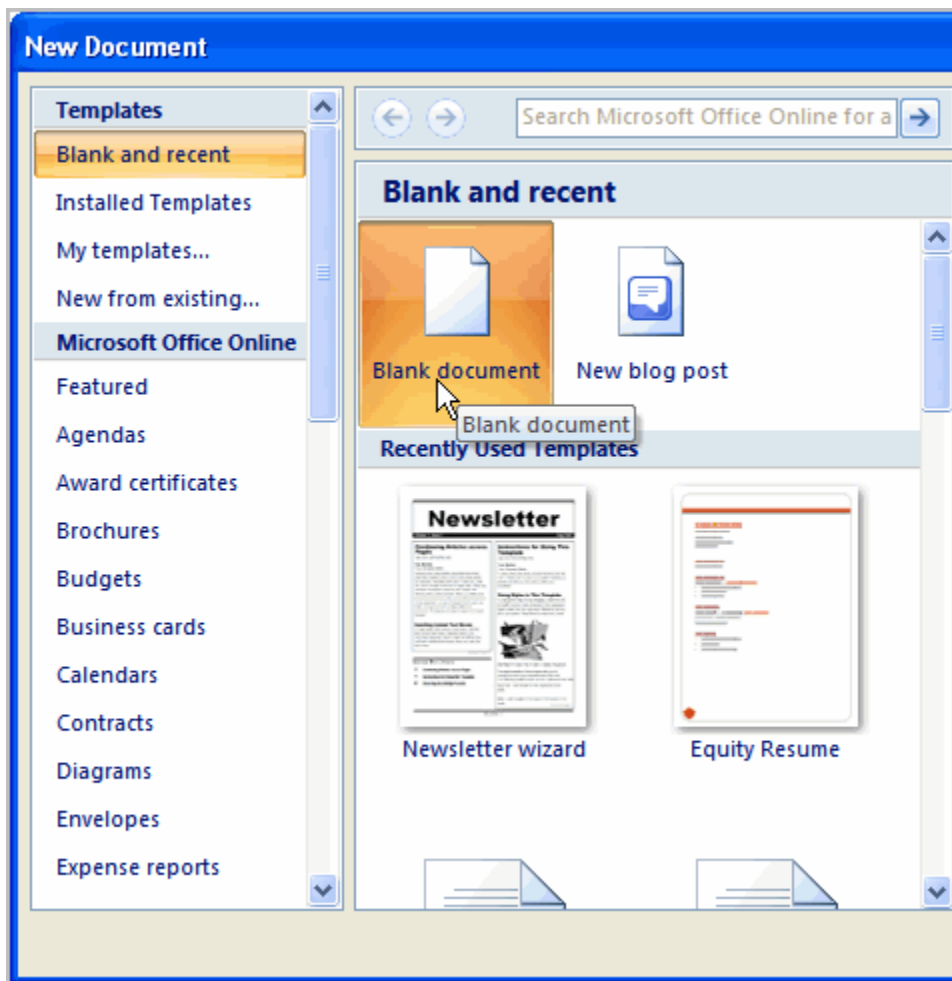


MS Word :

1) Creating:

To create a new blank document:

- Click the **Microsoft Office button**.
- Select **New**. The New Document dialog box appears.
- Select **Blank document** under the **Blank and recent** section. It will be highlighted by default.



- Click **Create**. A new blank document appears in the Word window.

You can access templates that are installed on your computer or on Office Online. Click the Microsoft Office button and select **New**. You can create blank documents and access templates from the dialog box that appears.

2) Editing:

1. Open the file that you want to edit.
2. Choose from the following tasks:

Task	Steps
Edit text	<ol style="list-style-type: none">a. Click the Edit tab.b. Select the text that you want to edit.c. Using the tools in the edit toolbar, change the required formatting including font style, paragraph alignment, list formatting, and indentation options.

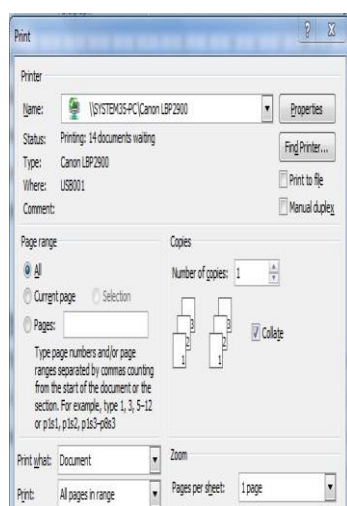
FORMATTING TEXT: To make a document look good ms-word offers a variety of formatting factors There are a number of font type in default font box in word document is “TIMES OFNEWROMAN”.

- 1) We can also change the style and font size and color of the text. Besides the regular style font can be either bold, italic (or) bold, italic.
- 2) We can give an underline to the text of necessary.
- 3) We can use the character spacing also
- 4) To format a text select the format menu and select the option font.
- 5) Before changing the format we have to select the text first.

PRINT THE DOCUMENT IN MS-WORDPRINT

THE DOCUMENT

- 1) Click on Microsoft Office Button and click in “print” option we can see a dialog box.



2) In this dialog box we can specify the following

3) Specifying the Page Range values and Number of copies.

4) Click ok

5) Then we carry out printing the document.

2Q) HOW TO INSERT/DRAW THE TABLES IN MS –WORD?

The basic steps for creating a standard table in Microsoft Word (2013) are:

1. Open a blank Word document
2. In the top ribbon, press *Insert*

3. Click on the *Table* button

4. Either use the diagram to select the number of columns and rows you need, or click *Insert Table* and a dialog box will appear where you can specify the number of columns and rows.

5. The blank table will look like **bold**, *italics*, and underlined, and you can call out certain items in the table.



6. Follow [these instructions](#) for ensuring your table meets APA formatting guidelines.

Need additional help? The tutoring service has self-paced table and chart lessons/tutorials within SkillSurfer. Follow these steps to access:

1. Log into the [tutoring service](#) (click on the blue hyperlink to the left to login!)
2. Click on *SkillSurfer*
3. Click on *Computers and Technology*
4. Click on *Intermediate* underneath *Microsoft Word*
5. Select *Creating Tables and Charts*

HOW TO INSERT A PICTURE IN MS-WORD?

Insert picture:

6. Choose Insert menu Ribbon.
7. Select the picture option.



1. Open the file that contains the picture to be inserted.
2. Select the picture in it.
3. Click on the Insert Button
4. Then the picture will appear in the document.

How to use Mail Merge in MS Word

Many day-to-day applications require similar documents containing similar text to be sent to a number of persons. These documents also have a typical common layout. Invitation letters sent to guests have a more-or-less common content and layout. Only the names of the recipients are different in these letters. One obvious way to generate such letters is to type all of them individually, putting the same amount of effort again and again. Another solution could be to copy the same block of text again and again onto the new letters. The names and addresses etc., which are different from each letter, can be entered separately in the documents. Though this method saves a lot of effort, it still requires proper caution. There should be a way where these kinds of documents can be prepared automatically. This task can be easily automated if we use the mail merge feature of a word processor. So, it is time we learnt the mail-merge feature of the word.

Components of mail merge:

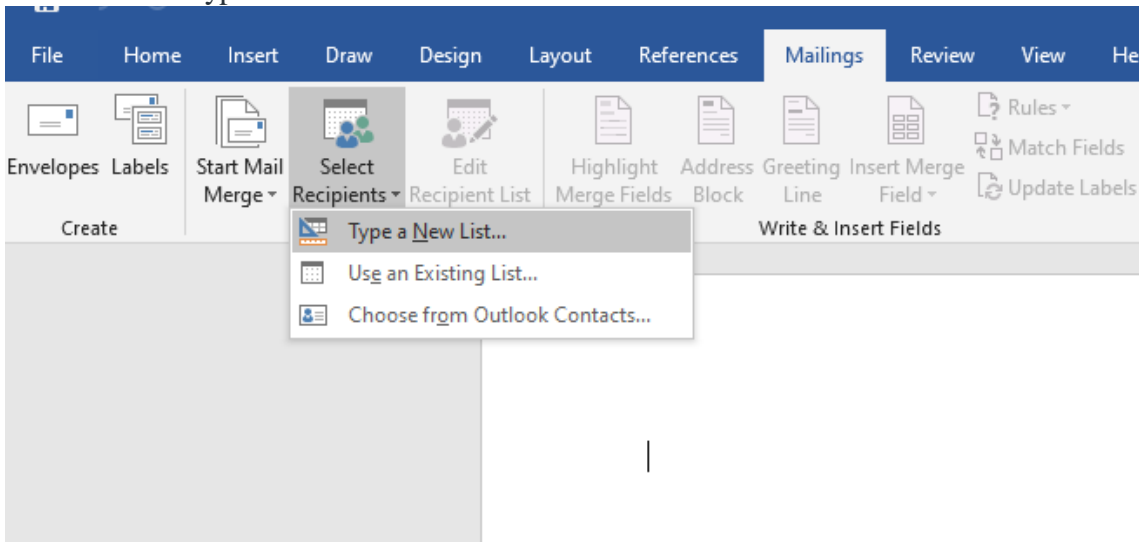
The three main components of the merging process are the main document, the data source, and the merged document.

1. The main document contains the main body of your letter, field names, and merges instructions. The basic information within the main document remains equivalent.
2. The data source (or Recipients' list) stores the knowledge that changes for every document. This information is inserted in the main document one by one. An example of the data source is a name and address list from which the program gets what you want to include in the main document.
3. The merged document contains the main text from the main document and data from a data source.

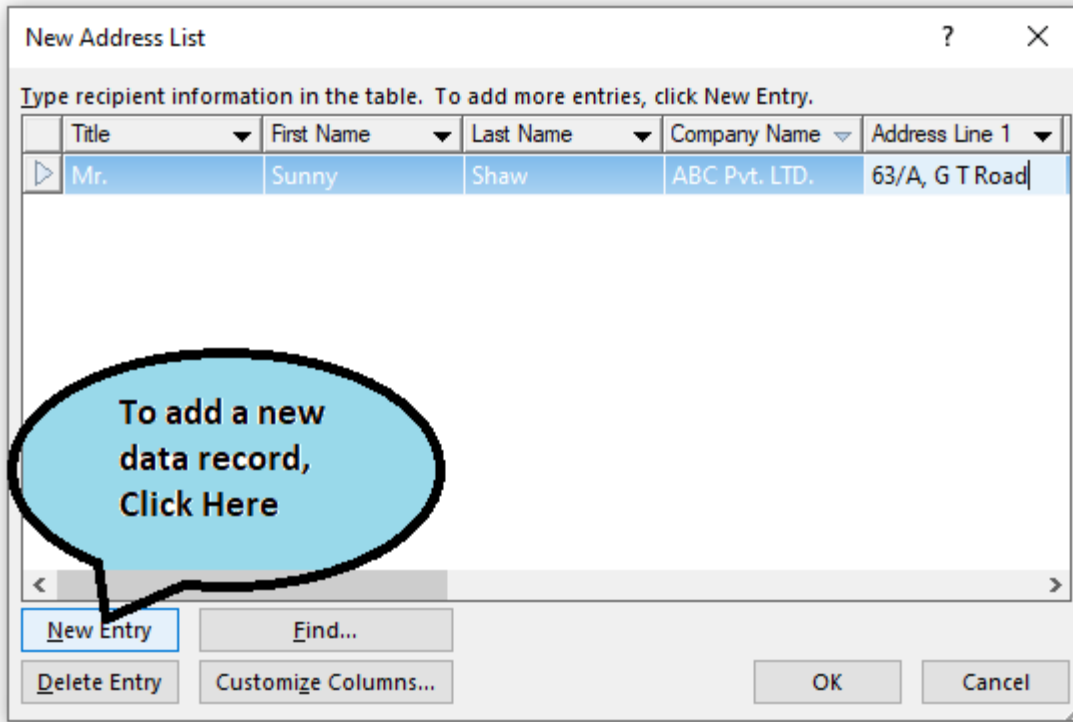
Steps for mail merger:

Step 1:

- Open MS Word and click on the command sequence: Mailings tab → Start mail merge group → Select recipients button → Type new List.



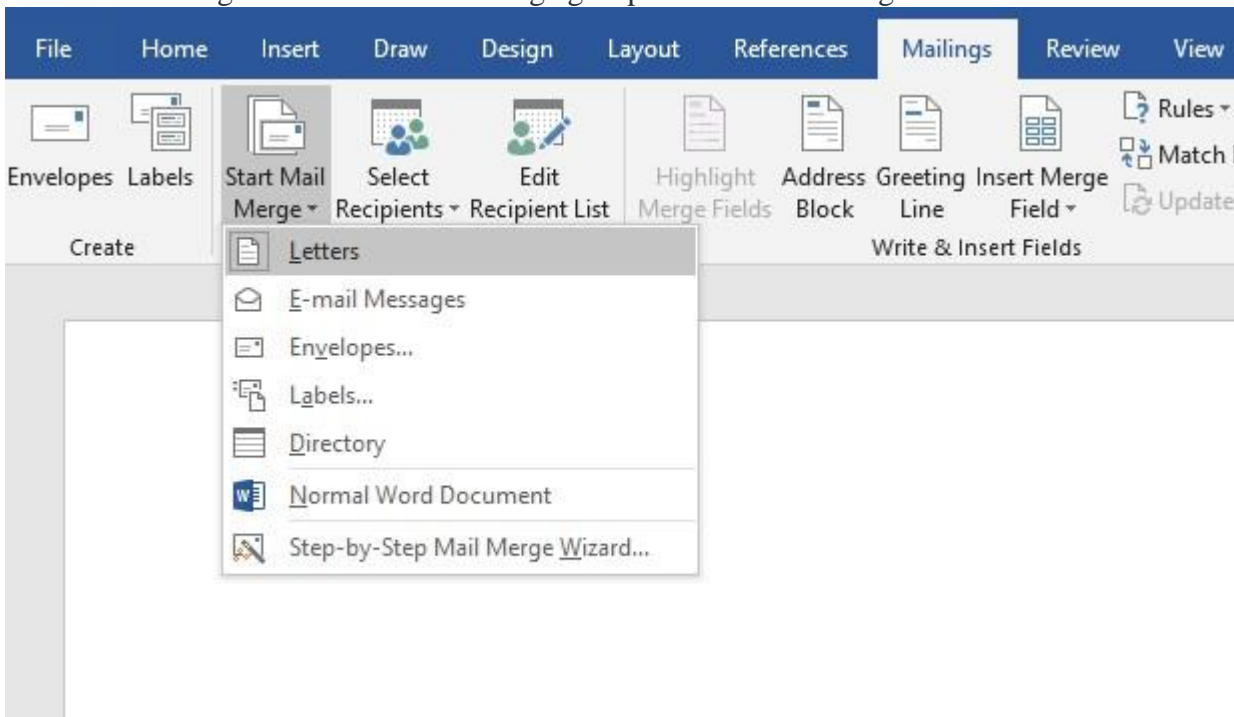
- A dialog namely “**New Address List**” will pop up(as shown in the below image). Type here the desired data under the given headings. To add a new record, click on the “New Entry” button at the bottom of the dialog and click OK when you are done.



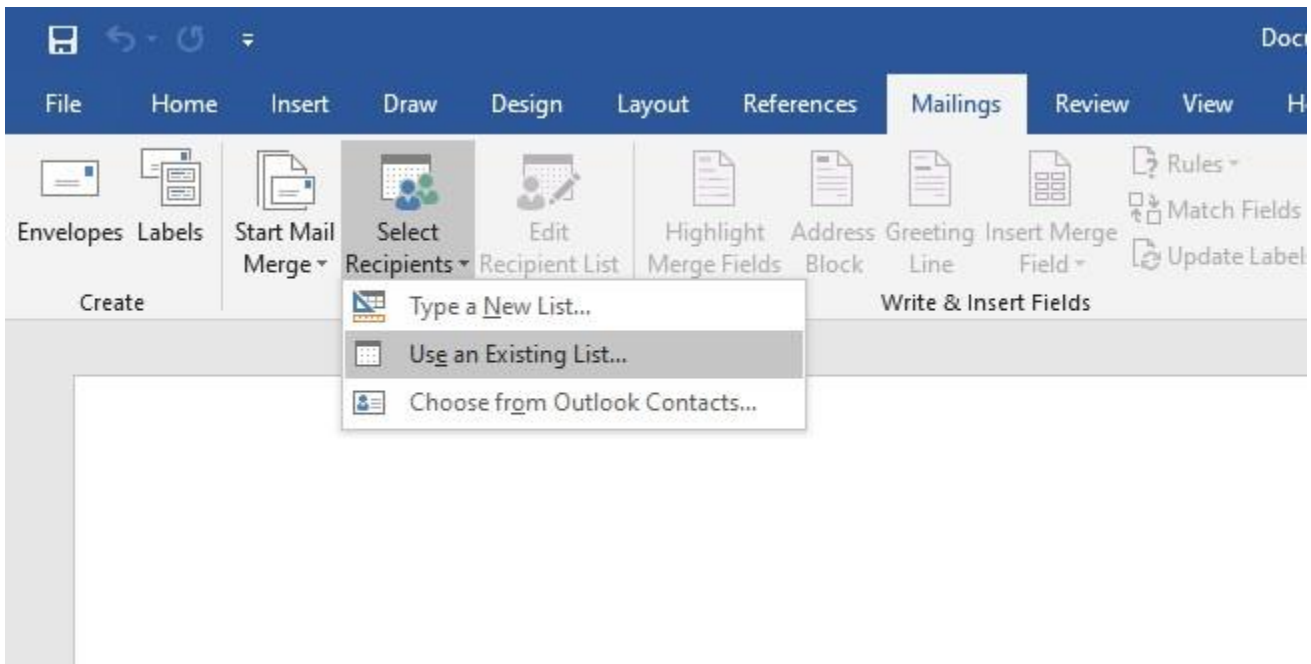
Step 2: Prepare Master Letter

The second step is to prepare our master letter for use in the mail merge. Before we enter all the letter text we'd like to link this Word file to our list of names.

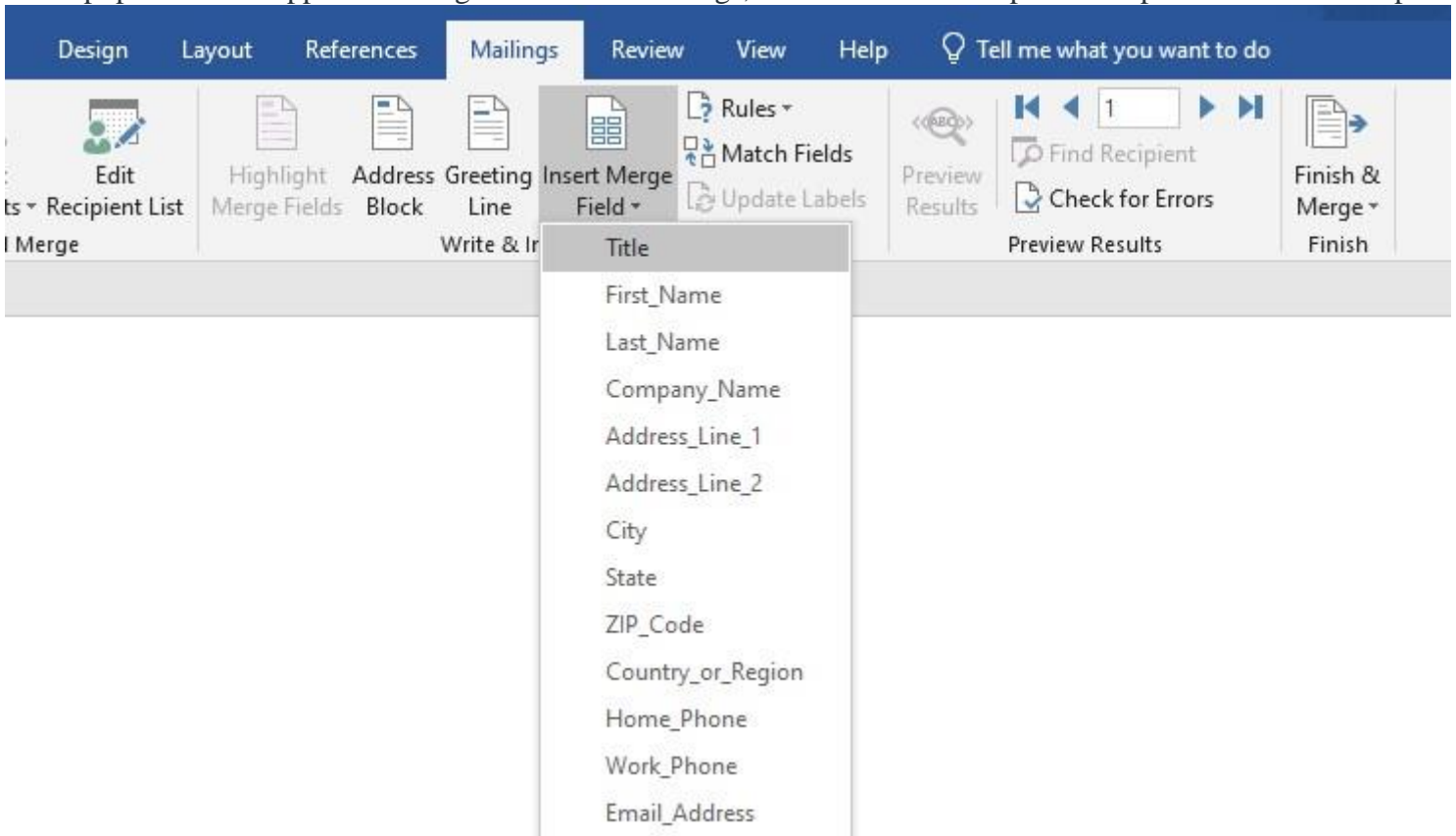
- Create a blank word document.
- Click Mailings tab → Start Mail Merge group → Start Mail Merge → Letters command.



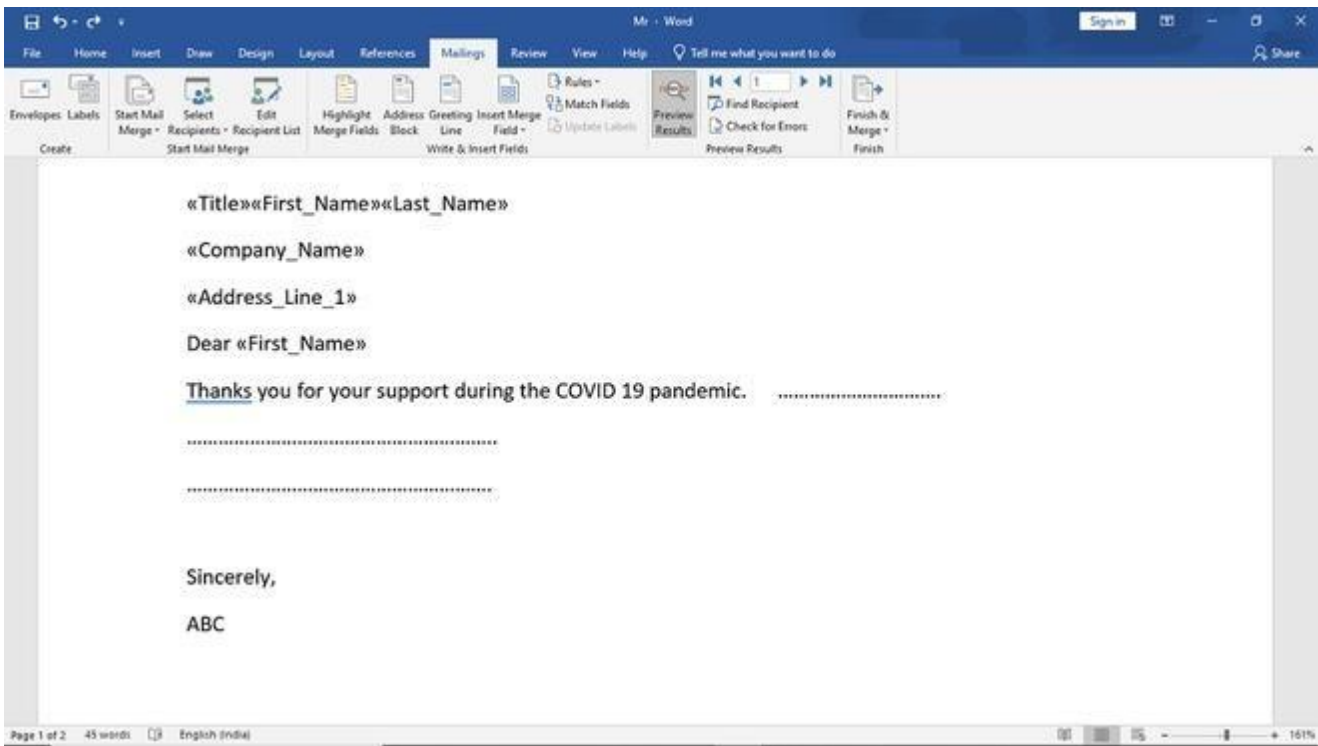
- Then click the Mailings tab → Start Mail Merge group → Select Recipients button → Use Existing List command.



- Now we can start typing the letter.
- Now we would like to add the name and address and other details for the people on the list.
- Mailings tab → Write & Insert Field group → Insert Merge Field button.
- A pop-down will appear showing all the table headings, so choose Title and press the spacebar to create a space.



Then do this again and choose FirstName, followed by a space (i.e., press only spacebar key and no other key); then choose LastName but this time press the Enter key to create a new line. Then repeat the steps to choose the Address field, and press enter key.



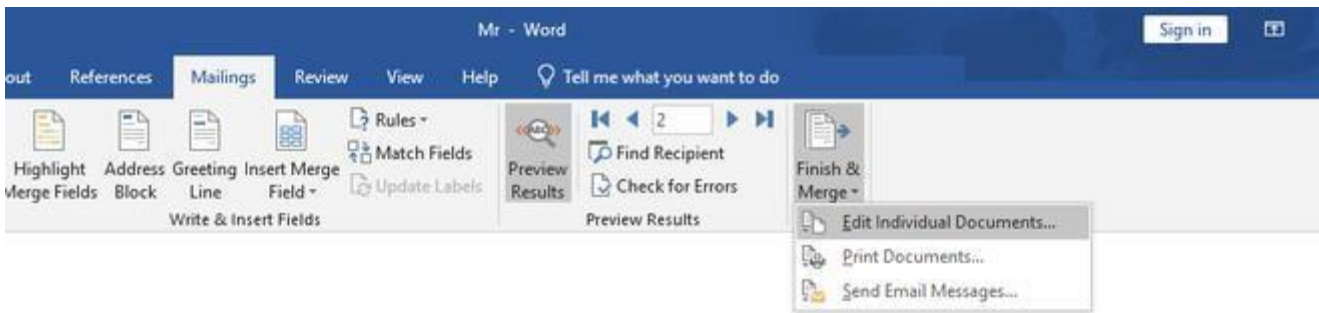
Step 3:

Before we actually carry out the merge, we must first preview what the merged letters will look like.

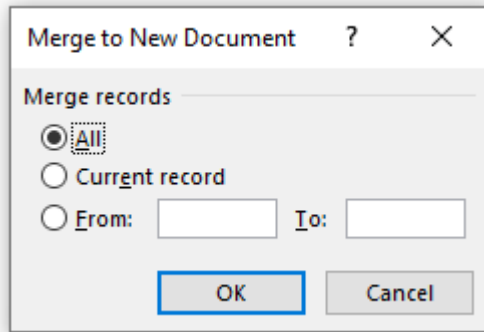
- Mailings tab → Preview Results group → Preview Results button



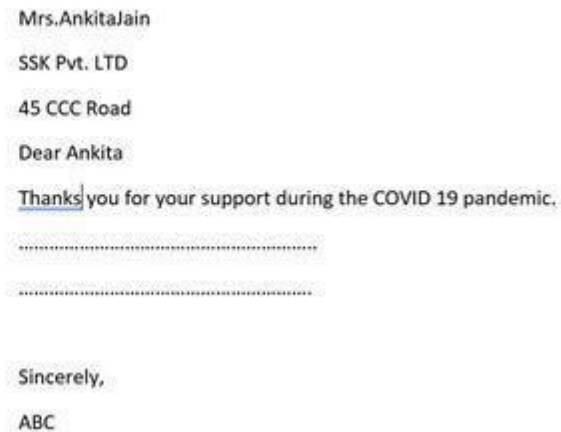
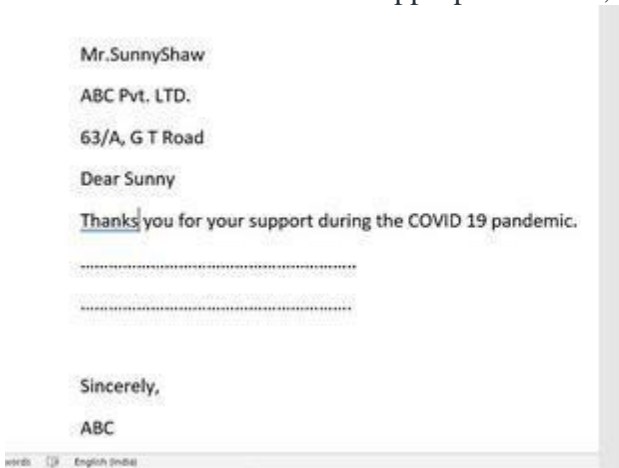
- Once we are happy with the preview, you can carry out the actual mail merge.
- To do this you click the Mailings tab → Finish group → Finish & Merge button and choose Edit Individual Documents.



- In the Merge to New Document panel, click All to create a separate letter for each person on the Names list. Word then creates a fresh document with as many pages as there are names on your list, and every page contains a wonderfully merged letter with all the correct individuals' details.



- We can save this with an appropriate name, such as ABC.docx

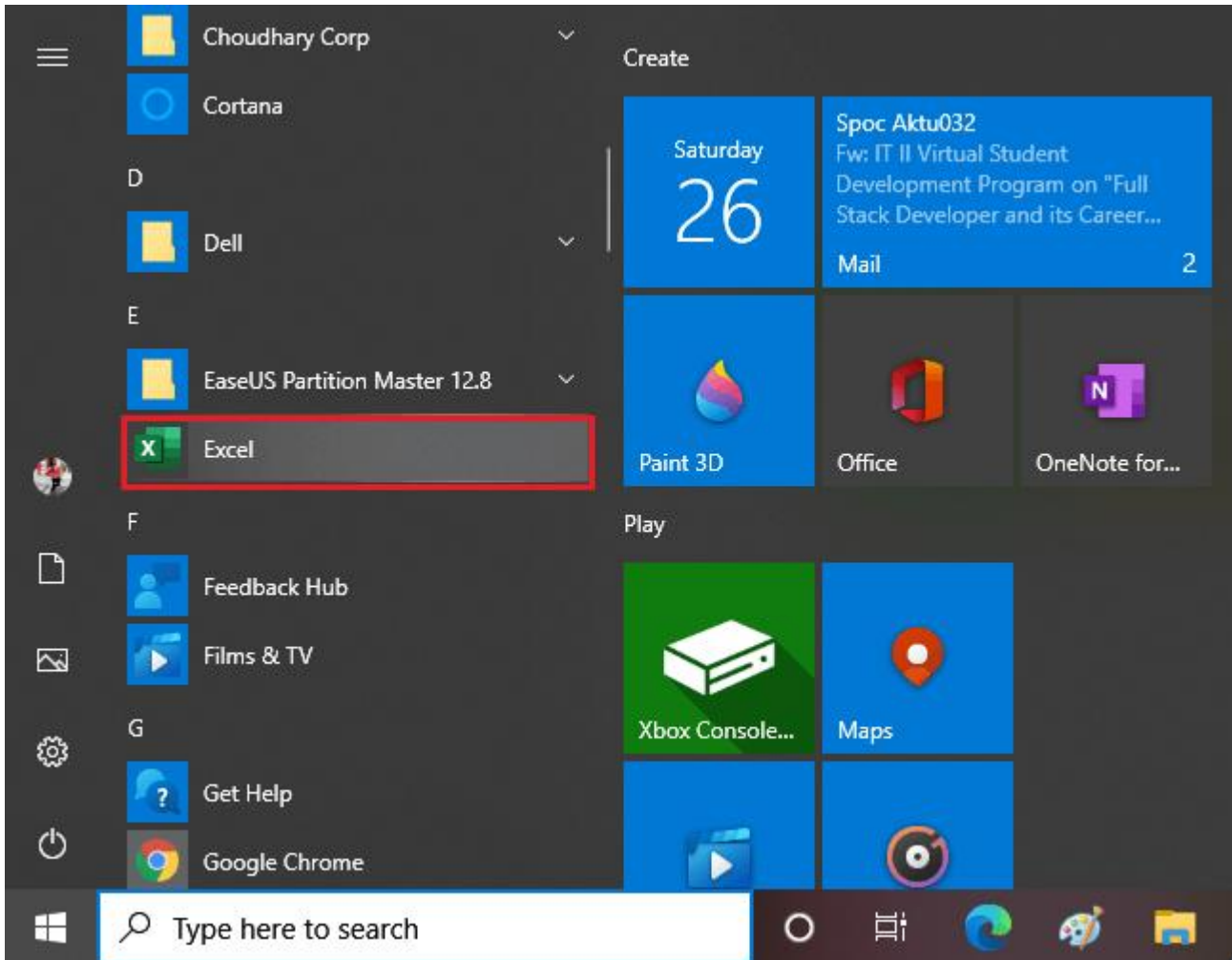


MS Excel:

Introduction

How to Open Microsoft Excel

In Windows 10 operating system, click on the Start button and search for the MS Excel application. If it is already installed in your system, it will appear here like this.



Double-tap on this icon to open the Excel.

When the Excel opens, an interface will appear like this. From here, you can create a new workbook, choose a template, and access your recently edited workbooks.

What is Workbook Window

In Excel, when we create a new document, we always select a blank workbook, as you already have done in the previous chapter. When this blank workbook opens up, an interface you see is called a workbook window.

This workbook window contains several essential components. Most importantly, rows and columns that together create cells.

In other words, an interface that you see when opening a new or existing document in Excel is called workbook window and that Excel file is called workbook.

What is Workbook

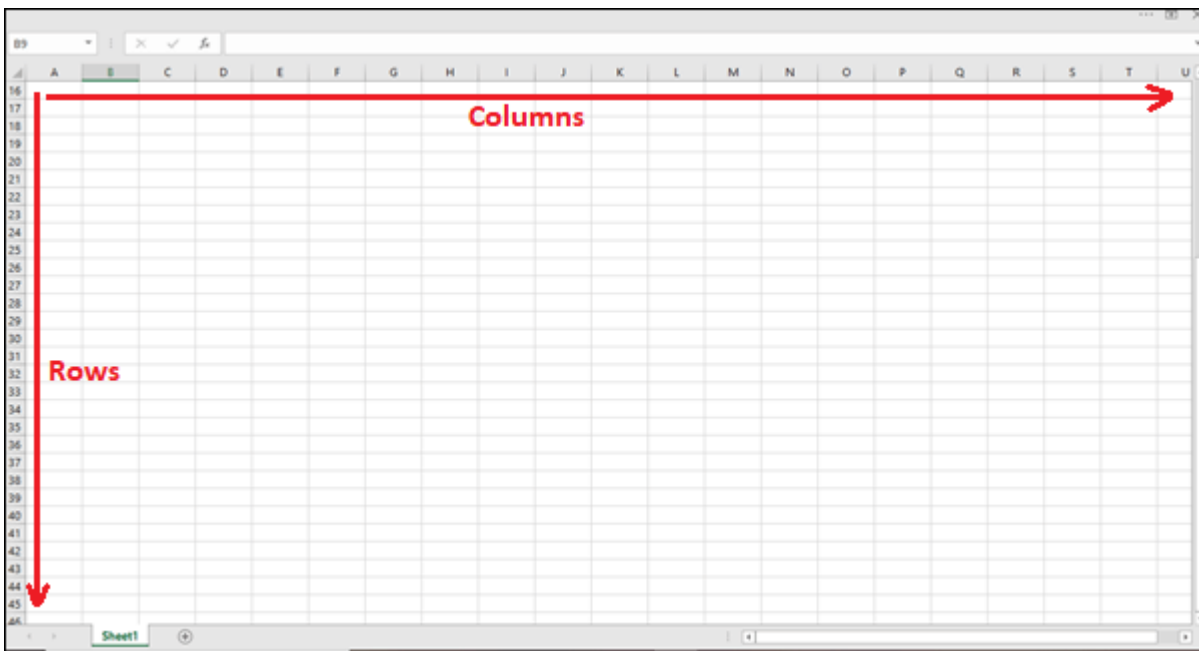
An Excel workbook is a collection of worksheets that stores the data inside rows and columns. A new Excel workbook is default named as **Book1** (see at the top of the Excel). You can provide and save the workbook according to the data saved in it. A single Excel worksheet consists of around 1,048,576 and 16,384 columns.

A workbook has several worksheets, named as **Sheet1, Sheet2, Sheet3, ... SheetN**. You can add these worksheets to your workbook by clicking on this + symbol near to sheets. One worksheet can be active at a time. It means - in an Excel workbook, only one worksheet can be active. However, you can more than one worksheet in a workbook.

Worksheet

Excel files are known as **workbooks**. Each workbook holds one or more worksheets (also called a "**spreadsheetsx**").

Whenever we create a new Excel workbook, it will include **one worksheet** named **Sheet1**. A worksheet is a framework of columns and rows where columns are identified by letters running across the top of worksheet, and rows are identified by numbers running down the left side of the worksheet.



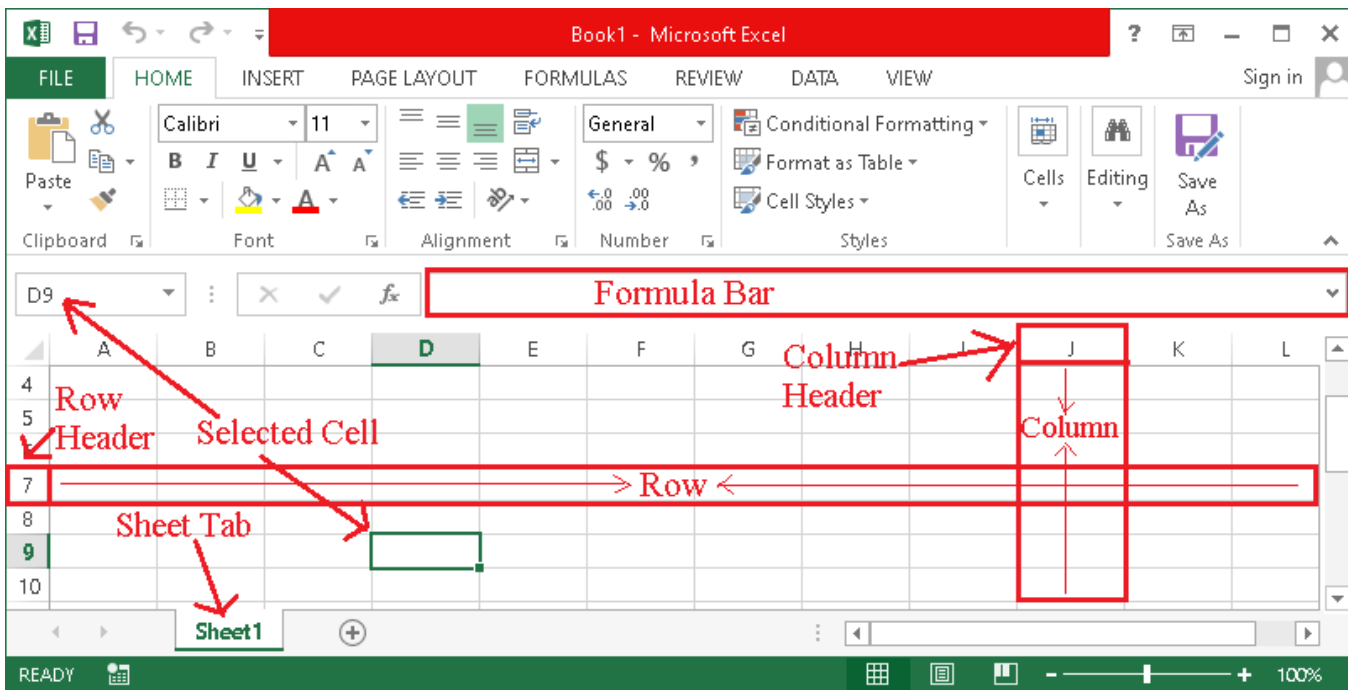
When working with a high amount of data, we can create multiple worksheets to help organize our workbook and make it easier to find content. We can also group worksheets to quickly add data to multiple worksheets at the same time.

What is MS Excel?

MS Excel or Microsoft Excel is a powerful spreadsheet program that is installed with the MS Office package. Excel mainly stores the data in tables, formed by several rows and columns. Additionally, users can also apply built-in formulae or functions on the stored data to get the desired output/ result. The applied formulae or functions are displayed on the formula bar.

MS Excel is a handy program for various data-related tasks and reports, such as making payslips or salary slips, calculating weekly expenses, accounting, and many more. Despite this, finding any information is easy with the interactive support of data sorting and filtering, allowing users to apply rules on data set by various criteria.

The following image represents the primary interface of an MS Excel worksheet, which is the typical screen we see for the first time when creating a new Excel sheet:



Advantages

- Advanced functionality
- Responsive/ Fast
- Extensive range of options for data visualization
- No need for internet (Excel 2016 and prior versions)
- Unlimited storage
- Extensive range of formulae and functions
- Highly customizable

Disadvantages

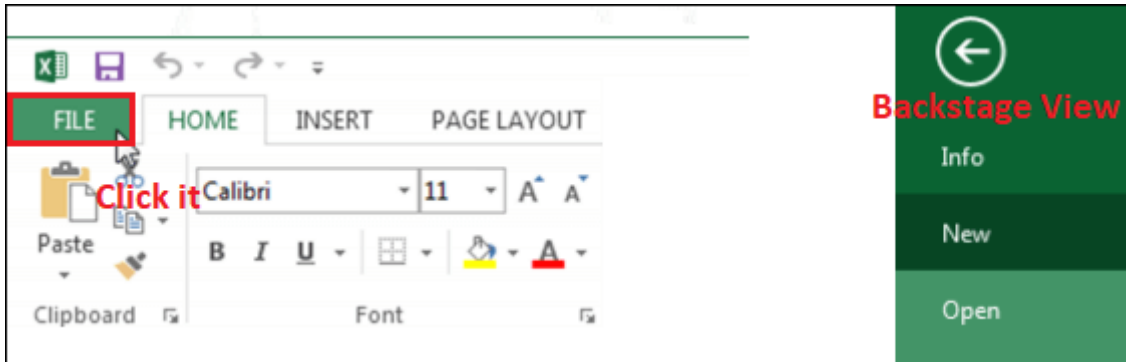
- Different versions have version compatibility difficulties

- Expensive Full version support
- No clean revision history

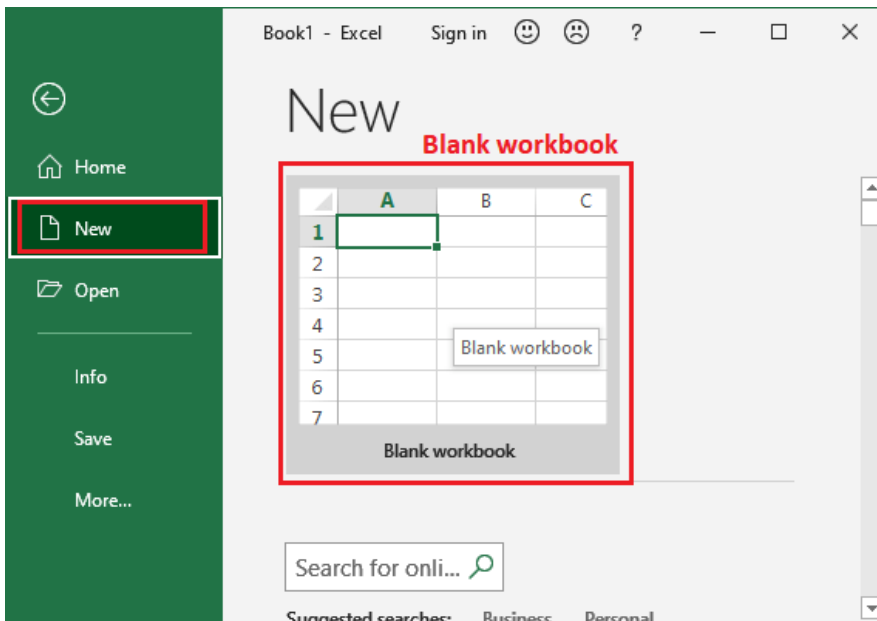
Create a new blank workbook

To create a new blank workbook in MS Excel, follow the given steps -

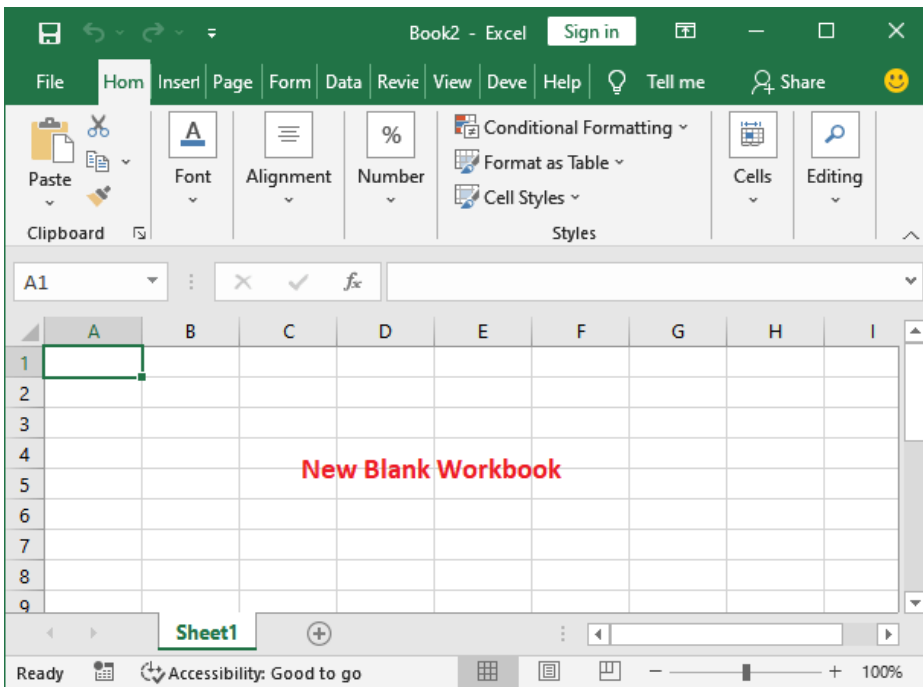
1. Select the File tab from where the Excel Backstage view will appear.



2. Select New, and then click the Blank workbook.

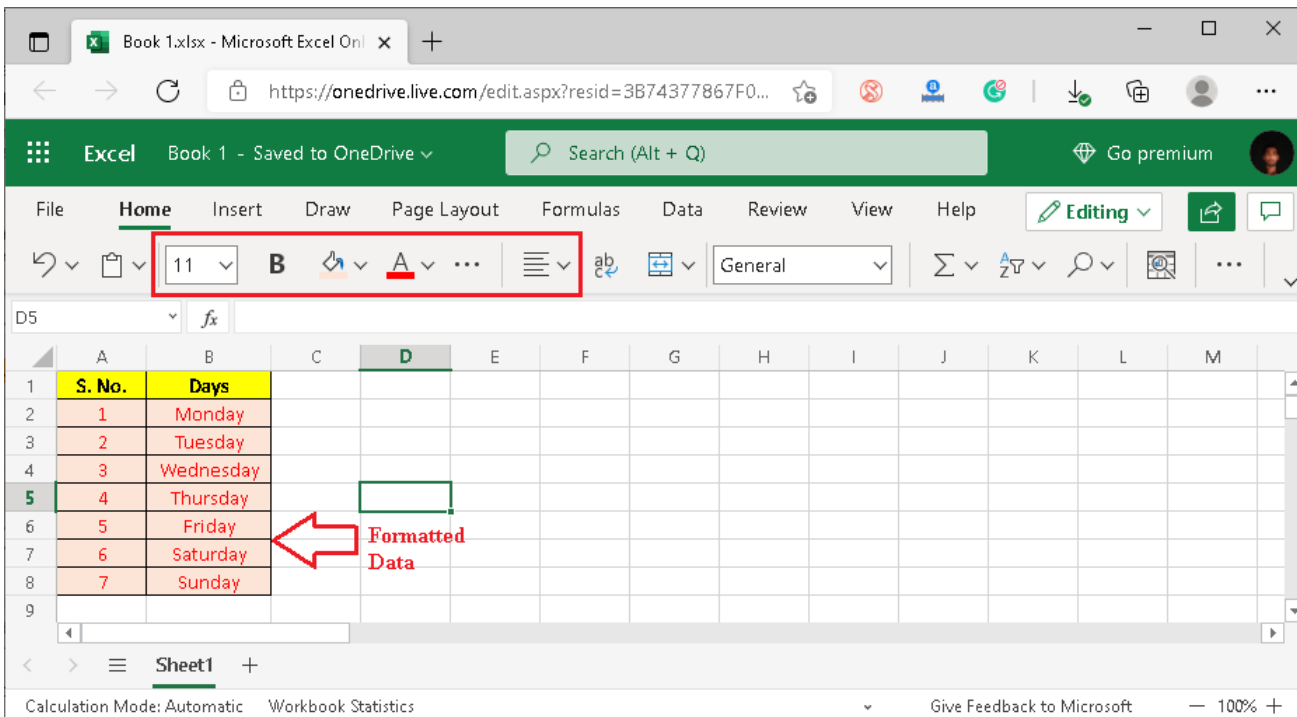


3. A new blank workbook will occur like this.



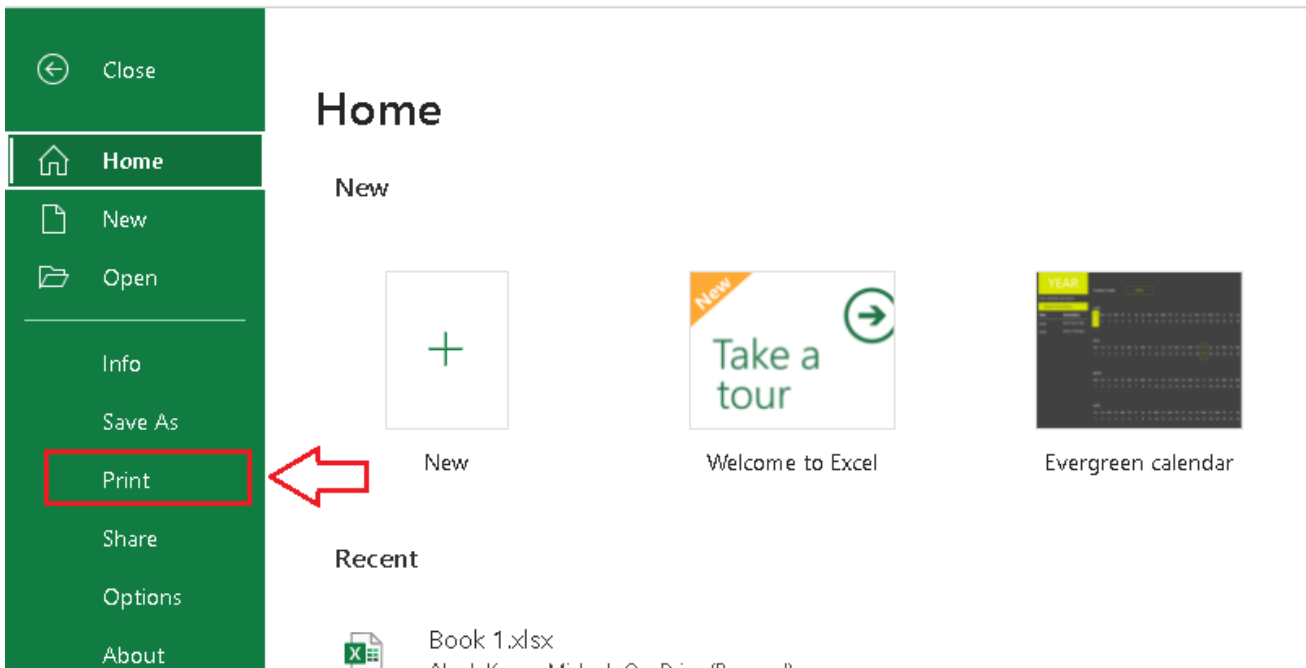
Formatting the Data in Worksheet

After inserting the contents into the worksheet, we might need to format the data to make it attractive or more informative. Most of the basic formatting options are located under the 'Home' tab.

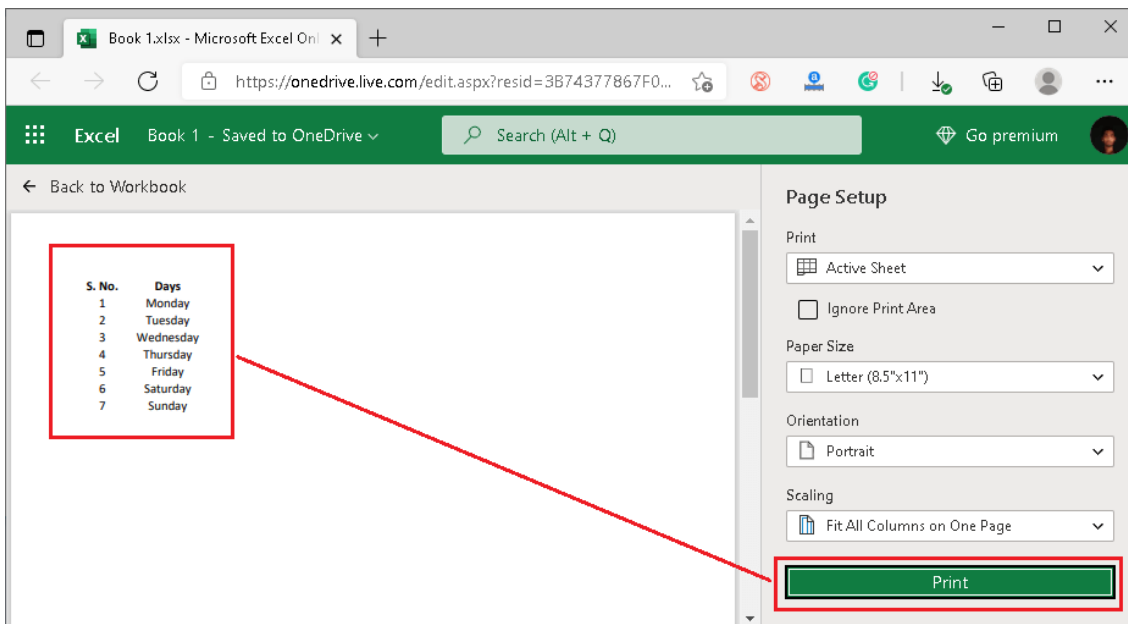


Printing a Worksheet

Excel online also enables users to print a sheet directly from the web browsers without saving it to the devices. For this, we need to give the print command to Excel online. More specifically, we must navigate to the **File > Print**.

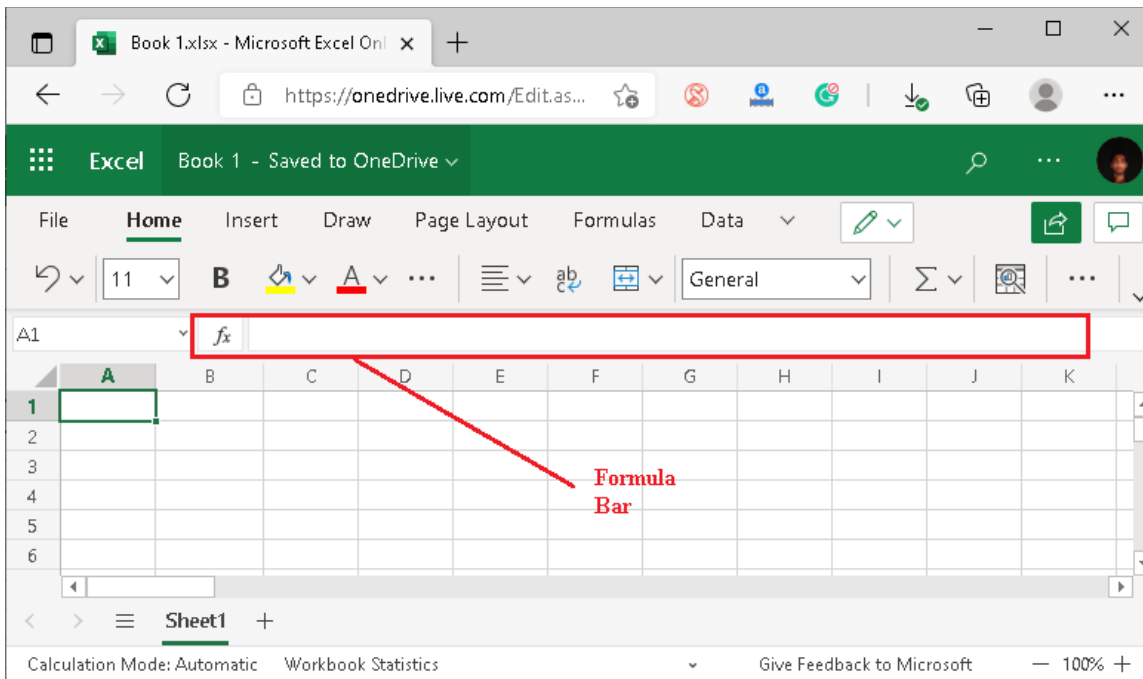


After selecting the print option, we need to configure the printing preferences as desired. This usually includes the page setup, orientation, layout, paper size, printer, etc. Once we have configured all the settings, we need to click on the 'Print' button to finalize the print process.



Formula Bar: The formula bar is where users can apply, enter, or alter the data, functions, and formulae of the selected cell in the worksheet. Users can also see the applied function on any particular cell in the formula bar by selecting the corresponding cell.

A formula bar is located below the shortcut toolbar and represented by the sign 'fx', as displayed below:



Formulas

A formula in Excel is used to do mathematical calculations. Formulas always start with the equal sign (=) typed in the cell, followed by your calculation.

Formulas can be used for calculations such as:

- =1+1
- =2*2
- =4/2=2

It can also be used to calculate values using cells as input.

Let's have a look at an example.

Type or copy the following values:

	A	B	C	D
1	2			
2	4			
3				
4				
5				
6				
7				
8				
9				
10				

Copy Values

Now we want to do a calculation with those values.

Step by step:

1. Select **C1** and type (=)
2. Right click **A1**
3. Type (+)
4. Right click **A2**
5. Press enter

	A	B	C	D
1	2		=A1+A2	
2	4			
3				
4				
5				
6				
7				
8				
9				
10				

	A	B	C	D
1	2		6	
2	4			
3				
4				
5				
6				
7				
8				
9				
10				

$A1(2) + A2(4) = C1(6)$.

Note: Using cells to make calculations is an important part of Excel and you will use this a lot as you learn.

Lets change from addition to multiplication, by replacing the (+) with a (*). It should now be $=A1*A2$, press enter to see what happens.

	A	B	C	D
1	2		=A1*A2	
2	4			
3				
4				
5				
6				
7				
8				
9				
10				

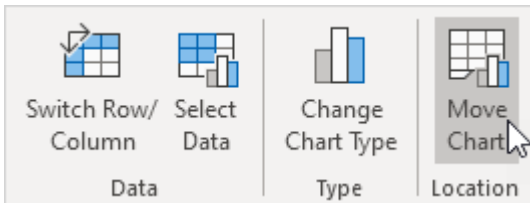
You got $C1(8)$, right?

Graphs of Worksheets: Chart Sheet

So far we have only seen charts on the same worksheet as the source data (embedded charts). However, you can also move a chart to a separate sheet that only contains a chart (chart sheet).

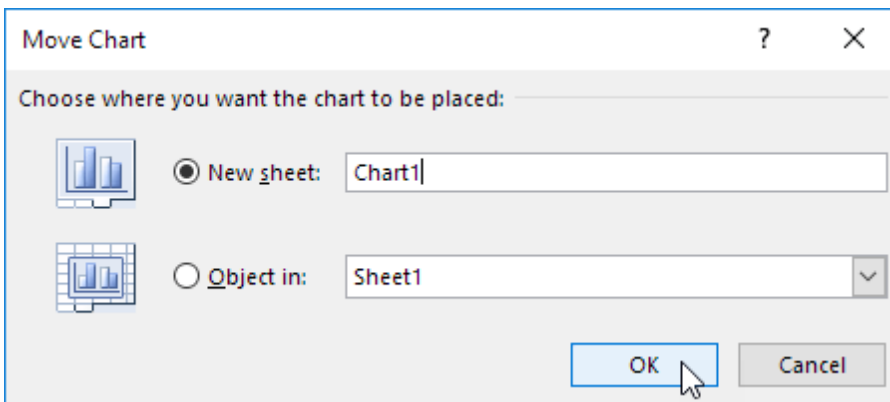
To move a chart to a chart sheet, execute the following steps.

1. Select the chart.
2. On the Design tab, in the Location group, click Move Chart.

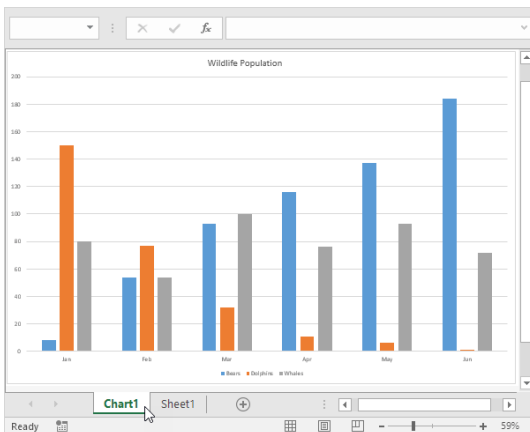


The Move Chart dialog box appears.

3. Click New sheet and enter a name.
4. Click OK.



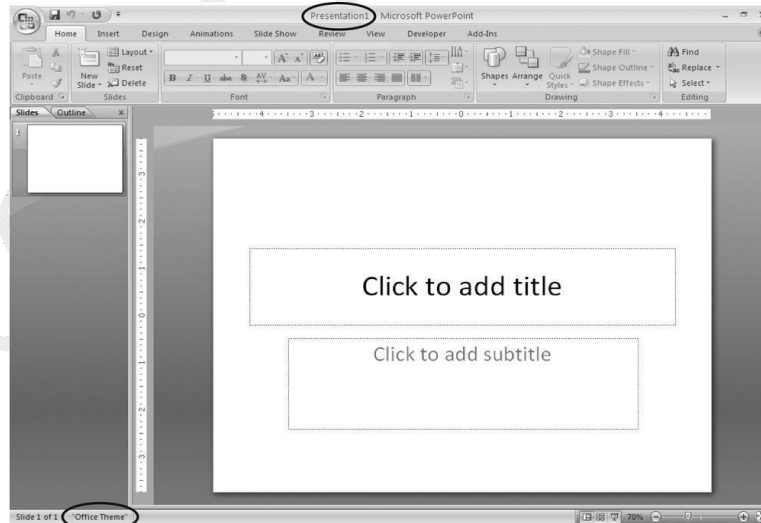
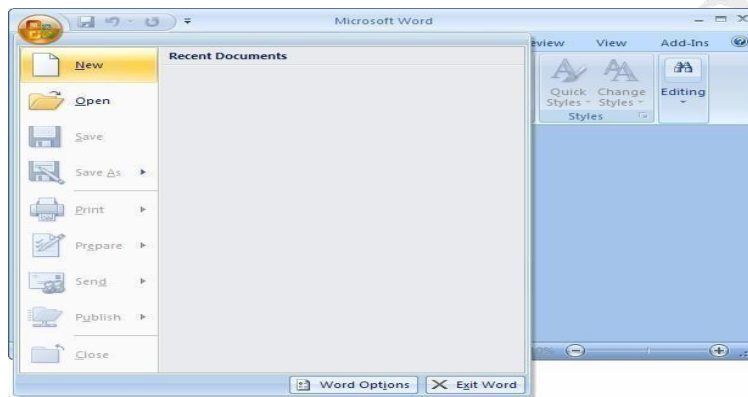
Result:



MS PowerPoint:

10) HOW TO CREATE A PRESENTATION IN MS POWER POINT?

PowerPoint divides these two basic choices into six specific options that are based on whether you want to piggyback your new presentation on an existing template, theme, or presentation. When you fire up PowerPoint and select Office button → New, you see the following six choices for creating a presentation, each of which is described in detail in the



- **Blank and recent.** Lets you create either a blank presentation or a presentation based on one of the themes or templates you recently applied to a PowerPoint presentation.
- **Installed Templates.** Lets you create a presentation based on one of the handful of generic templates that comes with PowerPoint, such as Classic Photo Album or Corporate Presentation.
- **Installed Themes.** Lets you create a presentation based on one of the canned look and feel options that comes with PowerPoint, such as Apex, Metro, or Opulent.
- **My templates.** Lets you create a presentation based on a template that you created, or that you downloaded from the Web.
- **New from existing.** Lets you load an old presentation into PowerPoint 2007, make changes, and save the newly changed presentation using a new filename.
- **Microsoft Office Online.** Lets you hunt for professionally designed templates and themes on Microsoft's Web site.

Here's how to create a new presentation using a template you recently applied to another presentation:

1. **Select Office button → New.**
2. The New Presentation window appears.
3. **In the left side of the New Presentation window, make sure the “Blank and recent” option is selected. (If it's not, click to select it.)**
4. In the middle of the New Presentation window, scroll through the template thumbnails.
5. **Click to select the template you want to base your new presentation on.**

In the right side of the New Presentation window, a preview appears (see [Figure 1-3](#)). Depending on whether the selected template is stored on your computer or on Microsoft's Web server, PowerPoint displays a Create or Download button, respectively, at the bottom of the New Presentation window.

5. **Click Create (or Download).**

The New Presentation window disappears. (If you clicked Download, then a Downloading Template message flashes briefly on the screen.) PowerPoint then loads the selected template into a new presentation it names Presentation1 (or Presentation2, or Presentation3, depending on how many presentations you've created since you launched PowerPoint).

EXPLAIN THE CUSTOM ANIMATION AND ITS EFFECTS IN MS-POWERPOINT?

There are plenty of animations in Microsoft PowerPoint that can be applied to text, shapes or pictures. Some of the most commonly used effects are: Appear, Fade in, Fly in, etc. Sometimes our imagination goes beyond standard PowerPoint animations, so we need to create a more complex, unique animation that no other presentation contains.

There are two ways in which a custom animation can be created: An

animation combo: multiple animations applied to one object

A custom motion path

Custom Animation Combo:

PowerPoint has a toolbar called Animation Pane that gives you total control over the animations on a slide. This makes creating sophisticated animations very easy with only a few clicks.

1. To show the Animation Pane, switch to the Animations tab in your PowerPoint and click the respective button.
2. Select an object on the slide.
3. Click the button **Add Animation** or select an animation from the sample gallery on the left hand side. It will apply the very first effect to the object.
4. To apply additional animations, click the same **Add Animation** button again. It's important to know that only this option will append an animation. Other methods will replace the prior animation.
5. Right-click on a subsequent animation and select **Start With previous** so both animations will coincide. If you select **After previous**, animations will be set in a sequence.

Custom Motion Path:

Applying a motion path will give you full control over object movements around the slide canvas to create precisely what you want.

You can make objects move along the path. To achieve that, do the following:

1. Select an object.
2. Click Add Animation.
3. At the very bottom of the list you will see motion paths. Pick the one that suits your idea.
4. Transform the path or Edit Points to make fine adjustments. If you choose Custom Path, you can draw freeform. When you are done, press the Esc button.

What is Animation?

An animation effect is a special visual or sound effect added to a text or an object on a slide or chart. Right click the object, select Custom Animation. Click on the Effects tab and choose the animation you want to use. Now click on Timings and select Animate and the On Mouseclick radio button.

To add an animation, you first select what you want to animate, choose an animation, and then modify it with effect options. Click the text. Then go to the ANIMATIONS tab, open the Animation gallery, and select one.

Types of Animations:

- Traditional Animation.
- 2D Animation.
- 3D Animation.
- Motion Graphics.

➤ Stop Motion.

Traditional Animation: Traditional animation can also be referred to as cell animation. This type of animation requires the animator to draw every single frame by hand to create an animated scene.

2D Animation: 2D animation refers to vector-based animations similar to the ones used in Flash. It gives more flexibility to beginners in animation because they don't have to rely so heavily on drawing skills.

3D Animation: 3D animation is also known as computer animation and it is currently the most commonly used form of animation. The process of 3D animation is very different from the traditional style 3D animation has less to do with drawing and more to do with moving a character in a program.

Motion Graphics: Unlike the previously mentioned types of animation, motion graphics are not driven by characters or storylines. This art form focuses on the ability to move graphic elements, shapes, and text. This process is commonly used for things like television promotions, explainer videos, and animated logos.

Stop Motion: Stop motion animation is very similar to traditional animation because it combines a series of still images that are slightly different to show movement. The largest difference is that stop motion uses photography and captures real objects.

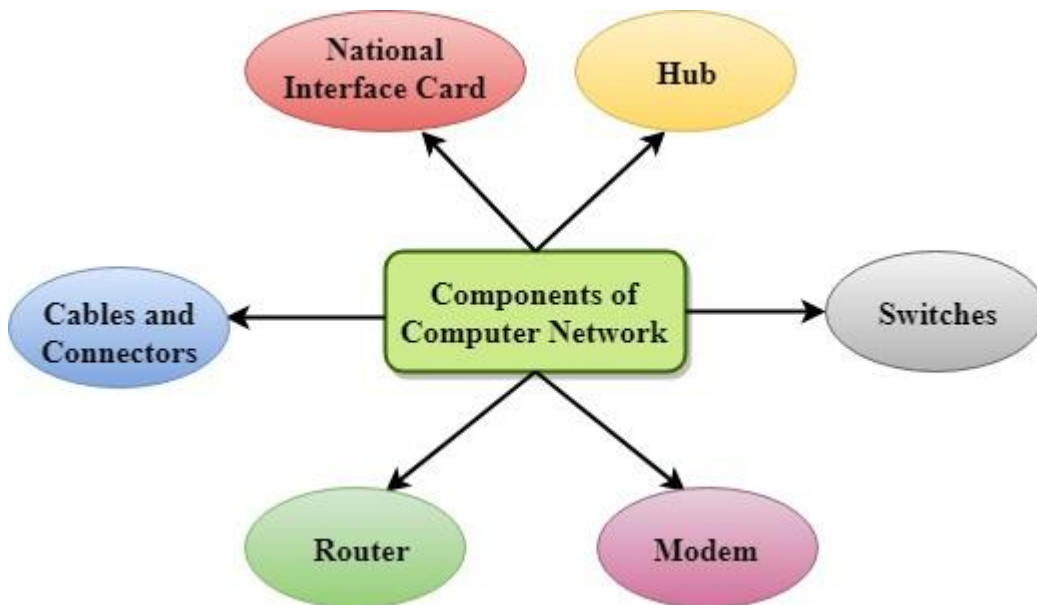
Unit-III

Computer Networks:

1) Introduction to Computer Networks:

- **Computer Network** is a group of computers connected with each other through wires, optical fibres or optical links so that various devices can interact with each other through a network.
- The aim of the computer network is the sharing of resources among various devices.
- In the case of computer network technology, there are several types of networks that vary from simple to complex level.

Components Of Computer Network:



Major components of a computer network are:

NIC(National interface card)

NIC is a device that helps the computer to communicate with another device. The network interface card contains the hardware addresses, the data-link layer protocol use this address to identify the system on the network so that it transfers the data to the correct destination.

There are two types of NIC: wireless NIC and wired NIC.

- **Wireless NIC:** All the modern laptops use the wireless NIC. In Wireless NIC, a connection is made using the antenna that employs the **radio wave technology**.
- **Wired NIC:** Cables use the **wired NIC** to transfer the data over the medium.

Hub

Hub is a central device that splits the network connection into multiple devices. When computer requests for information from a computer, it sends the request to the Hub. Hub distributes this request to all the interconnected computers.

Switches

Switch is a networking device that groups all the devices over the network to transfer the data to another device. A switch is better than Hub as it does not broadcast the message over the network, i.e., it sends the message to the device for which it belongs to. Therefore, we can say that switch sends the message directly from source to the destination.

Cables and connectors

Cable is a transmission media that transmits the communication signals. **There are three types of cables:**

- **Twisted pair cable:** It is a high-speed cable that transmits the data over **1Gbps** or more.
- **Coaxial cable:** Coaxial cable resembles like a TV installation cable. Coaxial cable is more expensive than twisted pair cable, but it provides the high data transmission speed.
- **Fibre optic cable:** Fibre optic cable is a high-speed cable that transmits the data using light beams. It provides high data transmission speed as compared to other cables. It is more expensive as compared to other cables, so it is installed at the government level.

Router

Router is a device that connects the LAN to the internet. The router is mainly used to connect the distinct networks or connect the internet to multiple computers.

Modem

Modem connects the computer to the internet over the existing telephone line. A modem is not integrated with the computer motherboard. A modem is a separate part on the PC slot found on the motherboard.

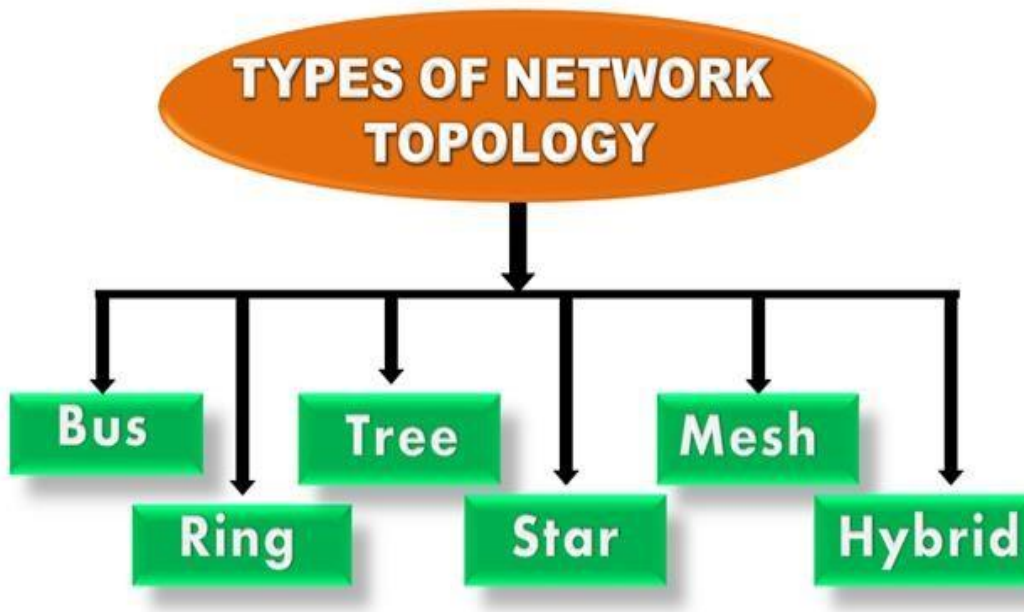
Uses Of Computer Network

- **Resource sharing:** Resource sharing is the sharing of resources such as programs, printers, and data among the users on the network without the requirement of the physical location of the resource and user.
- **Server-Client model:** Computer networking is used in the **server-client model**. A server is a central computer used to store the information and maintained by the system administrator. Clients are the machines used to access the information stored in the server remotely.
- **Communication medium:** Computer network behaves as a communication medium among the users. For example, a company contains more than one computer has an email system which the employees use for daily communication.
- **E-commerce:** Computer network is also important in businesses. We can do the business over the internet. For example, amazon.com is doing their business over the internet, i.e., they are doing their business over the internet.

2) Network topologies

Topology defines the structure of the network of how all the components are interconnected to each other. There are two types of topology: physical and logical topology.

Physical topology is the geometric representation of all the nodes in a network.



Bus Topology



- The bus topology is designed in such a way that all the stations are connected through a single cable known as a backbone cable.

- Each node is either connected to the backbone cable by drop cable or directly connected to the backbone cable.
- When a node wants to send a message over the network, it puts a message over the network. All the stations available in the network will receive the message whether it has been addressed or not.
- The bus topology is mainly used in 802.3 (ethernet) and 802.4 standard networks.
- The configuration of a bus topology is quite simpler as compared to other topologies.
- The backbone cable is considered as a "**single lane**" through which the message is broadcast to all the stations.
- The most common access method of the bus topologies is **CSMA** (Carrier Sense Multiple Access).

CSMA: It is a media access control used to control the data flow so that data integrity is maintained, i.e., the packets do not get lost. There are two alternative ways of handling the problems that occur when two nodes send the messages simultaneously.

- **CSMA CD: CSMA CD (Collision detection)** is an access method used to detect the collision. Once the collision is detected, the sender will stop transmitting the data. Therefore, it works on "**recovery after the collision**".
- **CSMA CA: CSMA CA (Collision Avoidance)** is an access method used to avoid the collision by checking whether the transmission media is busy or not. If busy, then the sender waits until the media becomes idle. This technique effectively reduces the possibility of the collision. It does not work on "recovery after the collision".

Advantages of Bus topology:

- **Low-cost cable:** In bus topology, nodes are directly connected to the cable without passing through a hub. Therefore, the initial cost of installation is low.
- **Moderate data speeds:** Coaxial or twisted pair cables are mainly used in bus-based networks that support upto 10 Mbps.
- **Familiar technology:** Bus topology is a familiar technology as the installation and troubleshooting techniques are well known, and hardware components are easily available.
- **Limited failure:** A failure in one node will not have any effect on other nodes.

Disadvantages of Bus topology:

- **Extensive cabling:** A bus topology is quite simpler, but still it requires a lot of cabling.
- **Difficult troubleshooting:** It requires specialized test equipment to determine the cable faults. If any fault occurs in the cable, then it would disrupt the communication for all the nodes.
- **Signal interference:** If two nodes send the messages simultaneously, then the signals of both the nodes collide with each other.
- **Reconfiguration difficult:** Adding new devices to the network would slow down the network.
- **Attenuation:** Attenuation is a loss of signal leads to communication issues. Repeaters are used to regenerate the signal.

Ring Topology



- Ring topology is like a bus topology, but with connected ends.
- The node that receives the message from the previous computer will retransmit to the next node.
- The data flows in one direction, i.e., it is unidirectional.
- The data flows in a single loop continuously known as an endless loop.
- It has no terminated ends, i.e., each node is connected to other node and having no termination point.
- The data in a ring topology flow in a clockwise direction.
- The most common access method of the ring topology is **token passing**.

- **Token passing:** It is a network access method in which token is passed from one node to another node.
- **Token:** It is a frame that circulates around the network.

Working of Token passing

- A token moves around the network, and it is passed from computer to computer until it reaches the destination.
- The sender modifies the token by putting the address along with the data.
- The data is passed from one device to another device until the destination address matches. Once the token received by the destination device, then it sends the acknowledgment to the sender.
- In a ring topology, a token is used as a carrier.

Advantages of Ring topology:

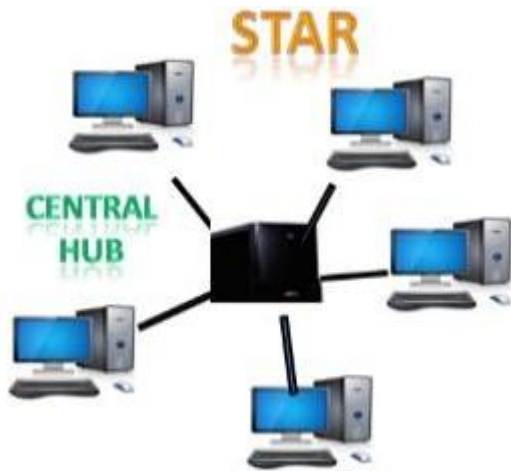
- **Network Management:** Faulty devices can be removed from the network without bringing the network down.
- **Product availability:** Many hardware and software tools for network operation and monitoring are available.
- **Cost:** Twisted pair cabling is inexpensive and easily available. Therefore, the installation cost is very low.
- **Reliable:** It is a more reliable network because the communication system is not dependent on the single host computer.

Disadvantages of Ring topology:

- **Difficult troubleshooting:** It requires specialized test equipment to determine the cable faults. If any fault occurs in the cable, then it would disrupt the communication for all the nodes.
- **Failure:** The breakdown in one station leads to the failure of the overall network.
- **Reconfiguration difficult:** Adding new devices to the network would slow down the network.

- **Delay:** Communication delay is directly proportional to the number of nodes. Adding new devices increases the communication delay.

Star Topology



- Star topology is an arrangement of the network in which every node is connected to the central hub, switch or a central computer.
- The central computer is known as a **server**, and the peripheral devices attached to the server are known as **clients**.
- Coaxial cable or RJ-45 cables are used to connect the computers.
- Hubs or Switches are mainly used as connection devices in a **physical star topology**.
- Star topology is the most popular topology in network implementation.

Advantages of Star topology

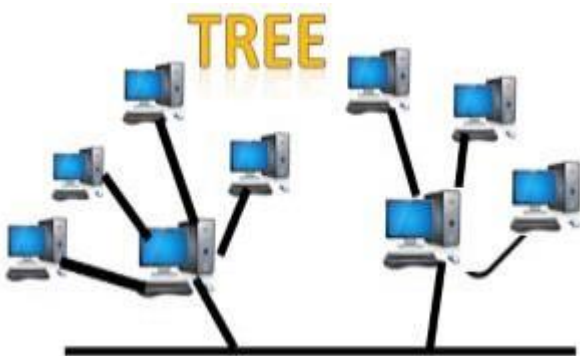
- **Efficient troubleshooting:** Troubleshooting is quite efficient in a star topology as compared to bus topology. In a bus topology, the manager has to inspect the kilometers of cable. In a star topology, all the stations are connected to the centralized network. Therefore, the network administrator has to go to the single station to troubleshoot the problem.
- **Network control:** Complex network control features can be easily implemented in the star topology. Any changes made in the star topology are automatically accommodated.

- **Limited failure:** As each station is connected to the central hub with its own cable, therefore failure in one cable will not affect the entire network.
- **Familiar technology:** Star topology is a familiar technology as its tools are cost-effective.
- **Easily expandable:** It is easily expandable as new stations can be added to the open ports on the hub.
- **Cost effective:** Star topology networks are cost-effective as it uses inexpensive coaxial cable.
- **High data speeds:** It supports a bandwidth of approx 100Mbps. Ethernet 100BaseT is one of the most popular Star topology networks.

Disadvantages of Star topology

- **A Central point of failure:** If the central hub or switch goes down, then all the connected nodes will not be able to communicate with each other.
- **Cable:** Sometimes cable routing becomes difficult when a significant amount of routing is required.

Tree topology



- Tree topology combines the characteristics of bus topology and star topology.
- A tree topology is a type of structure in which all the computers are connected with each other in hierarchical fashion.
- The top-most node in tree topology is known as a root node, and all other nodes are the descendants of the root node.

- There is only one path exists between two nodes for the data transmission. Thus, it forms a parent-child hierarchy.

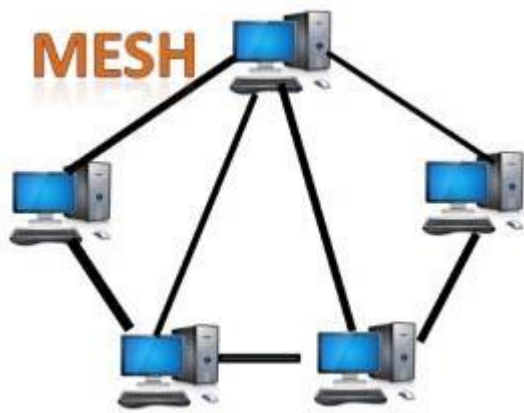
Advantages of Tree topology

- **Support for broadband transmission:** Tree topology is mainly used to provide broadband transmission, i.e., signals are sent over long distances without being attenuated.
- **Easily expandable:** We can add the new device to the existing network. Therefore, we can say that tree topology is easily expandable.
- **Easily manageable:** In tree topology, the whole network is divided into segments known as star networks which can be easily managed and maintained.
- **Error detection:** Error detection and error correction are very easy in a tree topology.
- **Limited failure:** The breakdown in one station does not affect the entire network.
- **Point-to-point wiring:** It has point-to-point wiring for individual segments.

Disadvantages of Tree topology

- **Difficult troubleshooting:** If any fault occurs in the node, then it becomes difficult to troubleshoot the problem.
- **High cost:** Devices required for broadband transmission are very costly.
- **Failure:** A tree topology mainly relies on main bus cable and failure in main bus cable will damage the overall network.
- **Reconfiguration difficult:** If new devices are added, then it becomes difficult to reconfigure.

Mesh topology

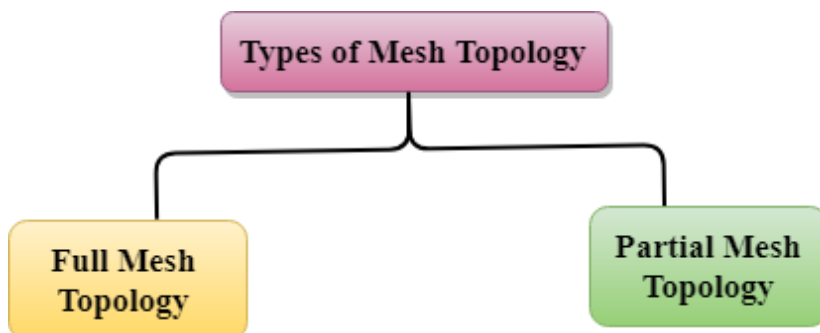


- Mesh technology is an arrangement of the network in which computers are interconnected with each other through various redundant connections.
- There are multiple paths from one computer to another computer.
- It does not contain the switch, hub or any central computer which acts as a central point of communication.
- The Internet is an example of the mesh topology.
- Mesh topology is mainly used for WAN implementations where communication failures are a critical concern.
- Mesh topology is mainly used for wireless networks.
- Mesh topology can be formed by using the formula:
Number of cables = $(n*(n-1))/2$;

Where n is the number of nodes that represents the network.

Mesh topology is divided into two categories:

- Fully connected mesh topology
- Partially connected mesh topology



- **Full Mesh Topology:** In a full mesh topology, each computer is connected to all the computers available in the network.
- **Partial Mesh Topology:** In a partial mesh topology, not all but certain computers are connected to those computers with which they communicate frequently.

Advantages of Mesh topology:

Reliable: The mesh topology networks are very reliable as if any link breakdown will not affect the communication between connected computers.

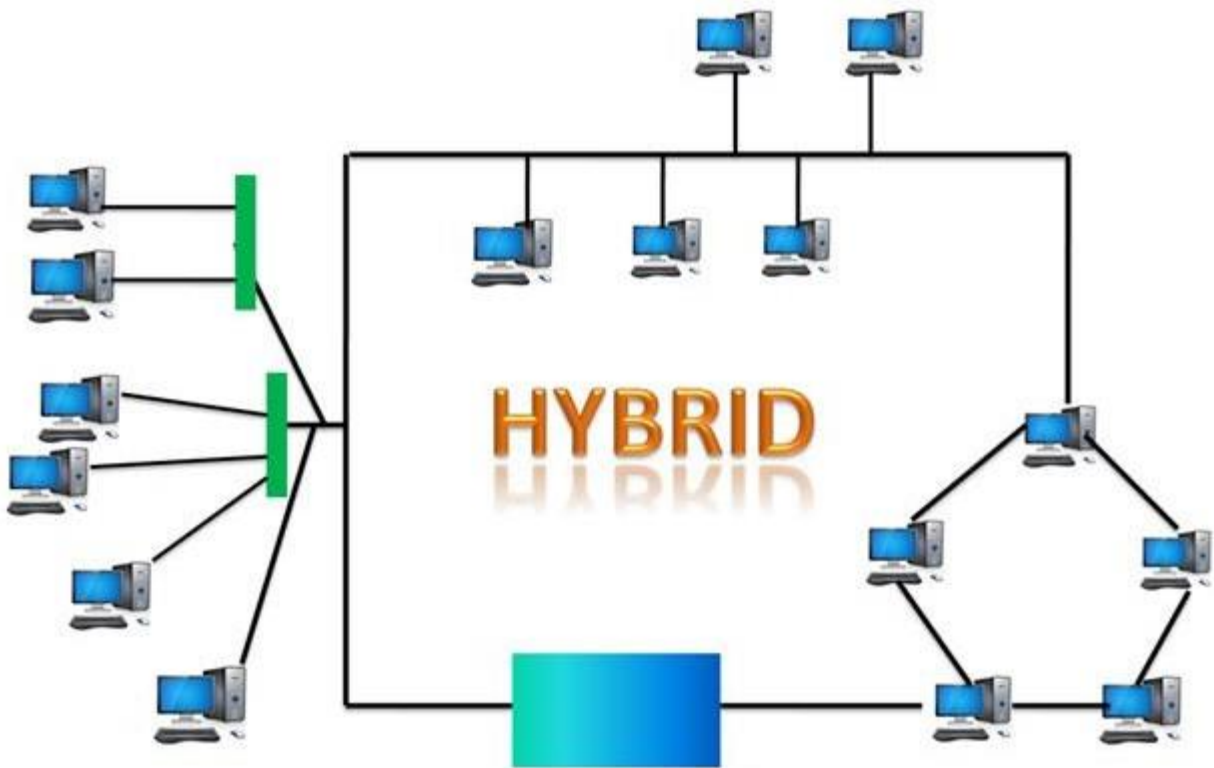
Fast Communication: Communication is very fast between the nodes.

Easier Reconfiguration: Adding new devices would not disrupt the communication between other devices.

Disadvantages of Mesh topology

- **Cost:** A mesh topology contains a large number of connected devices such as a router and more transmission media than other topologies.
- **Management:** Mesh topology networks are very large and very difficult to maintain and manage. If the network is not monitored carefully, then the communication link failure goes undetected.
- **Efficiency:** In this topology, redundant connections are high that reduces the efficiency of the network.

Hybrid Topology



- The combination of various different topologies is known as **Hybrid topology**.
- A Hybrid topology is a connection between different links and nodes to transfer the data.
- When two or more different topologies are combined together is termed as Hybrid topology and if similar topologies are connected with each other will not result in Hybrid topology. For example, if there exist a ring topology in one branch of ICICI bank and bus topology in another branch of ICICI bank, connecting these two topologies will result in Hybrid topology.

Advantages of Hybrid Topology

- **Reliable:** If a fault occurs in any part of the network will not affect the functioning of the rest of the network.
- **Scalable:** Size of the network can be easily expanded by adding new devices without affecting the functionality of the existing network.

- **Flexible:** This topology is very flexible as it can be designed according to the requirements of the organization.
- **Effective:** Hybrid topology is very effective as it can be designed in such a way that the strength of the network is maximized and weakness of the network is minimized.

Disadvantages of Hybrid topology

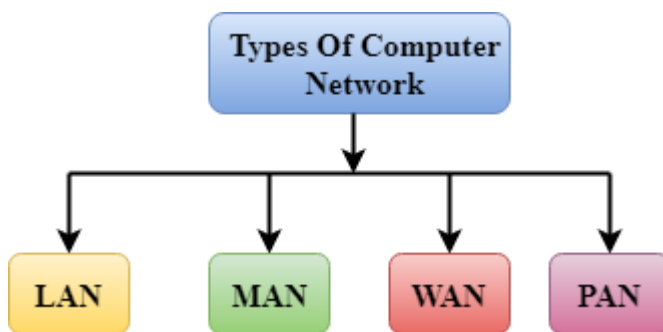
- **Complex design:** The major drawback of the Hybrid topology is the design of the Hybrid network. It is very difficult to design the architecture of the Hybrid network.
- **Costly Hub:** The Hubs used in the Hybrid topology are very expensive as these hubs are different from usual Hubs used in other topologies.
- **Costly infrastructure:** The infrastructure cost is very high as a hybrid network requires a lot of cabling, network devices, etc.

3) Types of Networks:

Computer Network Types

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.

A computer network can be categorized by their size. A **computer network** is mainly of **four types**:



- LAN(Local Area Network)
 - PAN(Personal Area Network)
 - MAN(Metropolitan Area Network)
 - WAN(Wide Area Network)
-

LAN(Local Area Network)

- Local Area Network is a group of computers connected to each other in a small area such as building, office.
- LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.
- It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and ethernet cables.
- The data is transferred at an extremely faster rate in Local Area Network.
- Local Area Network provides higher security.



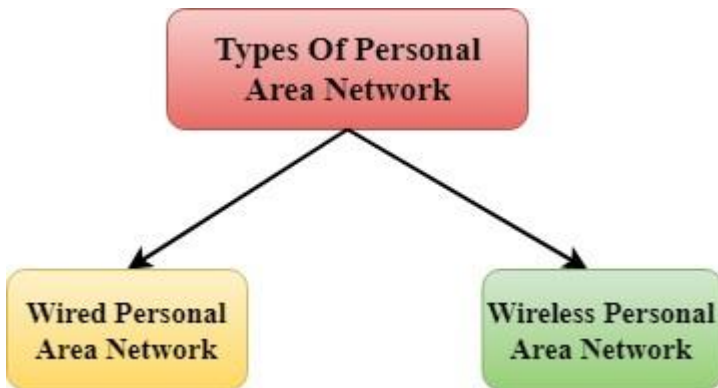
PAN(Personal Area Network)

- Personal Area Network is a network arranged within an individual person, typically within a range of 10 meters.
- Personal Area Network is used for connecting the computer devices of personal use is known as Personal Area Network.
- **Thomas Zimmerman** was the first research scientist to bring the idea of the Personal Area Network.
- Personal Area Network covers an area of **30 feet**.

- Personal computer devices that are used to develop the personal area network are the laptop, mobile phones, media player and play stations.



There are two types of Personal Area Network:



- Wired Personal Area Network
- Wireless Personal Area Network

Wireless Personal Area Network: Wireless Personal Area Network is developed by simply using wireless technologies such as WiFi, Bluetooth. It is a low range network.

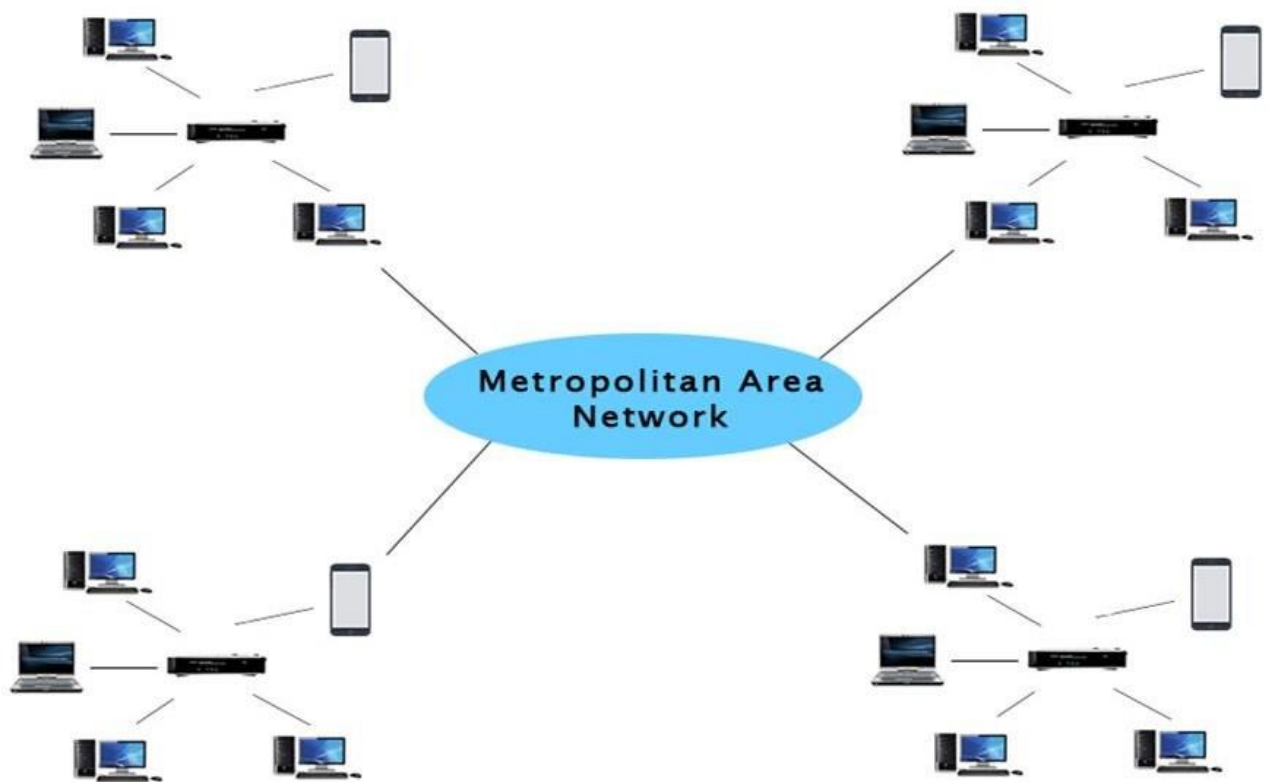
Wired Personal Area Network: Wired Personal Area Network is created by using the USB.

Examples Of Personal Area Network:

- **Body Area Network:** Body Area Network is a network that moves with a person. **For example**, a mobile network moves with a person. Suppose a person establishes a network connection and then creates a connection with another device to share the information.
 - **Offline Network:** An offline network can be created inside the home, so it is also known as a **home network**. A home network is designed to integrate the devices such as printers, computer, television but they are not connected to the internet.
 - **Small Home Office:** It is used to connect a variety of devices to the internet and to a corporate network using a VPN
-

MAN(Metropolitan Area Network)

- A metropolitan area network is a network that covers a larger geographic area by interconnecting a different LAN to form a larger network.
- Government agencies use MAN to connect to the citizens and private industries.
- In MAN, various LANs are connected to each other through a telephone exchange line.
- The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc.
- It has a higher range than Local Area Network(LAN).

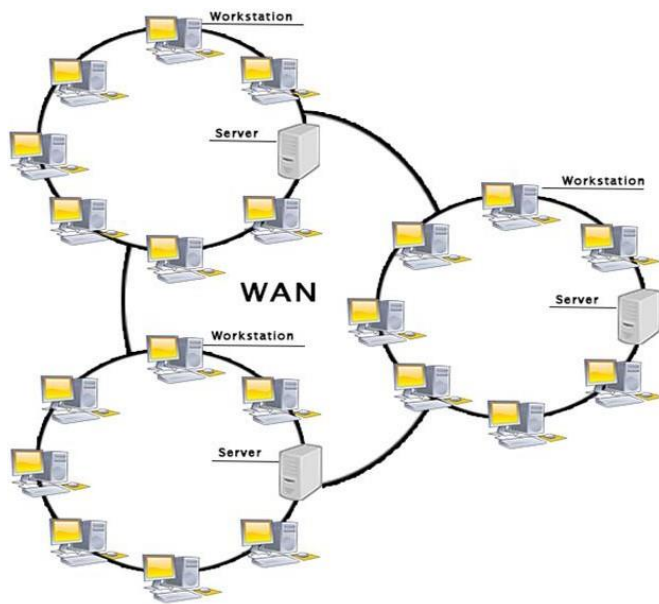


Uses Of Metropolitan Area Network:

- MAN is used in communication between the banks in a city.
- It can be used in an Airline Reservation.
- It can be used in a college within a city.
- It can also be used for communication in the military.

WAN(Wide Area Network)

- A Wide Area Network is a network that extends over a large geographical area such as states or countries.
- A Wide Area Network is quite bigger network than the LAN.
- A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fibre optic cable or satellite links.
- The internet is one of the biggest WAN in the world.
- A Wide Area Network is widely used in the field of Business, government, and education.



Examples Of Wide Area Network:

- **Mobile Broadband:** A 4G network is widely used across a region or country.
- **Last mile:** A telecom company is used to provide the internet services to the customers in hundreds of cities by connecting their home with fiber.
- **Private network:** A bank provides a private network that connects the 44 offices. This network is made by using the telephone leased line provided by the telecom company.

Advantages Of Wide Area Network:

Following are the advantages of the Wide Area Network:

- **Geographical area:** A Wide Area Network provides a large geographical area. Suppose if the branch of our office is in a different city then we can connect with them through WAN. The internet provides a leased line through which we can connect with another branch.
- **Centralized data:** In case of WAN network, data is centralized. Therefore, we do not need to buy the emails, files or back up servers.
- **Get updated files:** Software companies work on the live server. Therefore, the programmers get the updated files within seconds.
- **Exchange messages:** In a WAN network, messages are transmitted fast. The web application like Facebook, Whatsapp, Skype allows you to communicate with friends.

- **Sharing of software and resources:** In WAN network, we can share the software and other resources like a hard drive, RAM.
- **Global business:** We can do the business over the internet globally.
- **High bandwidth:** If we use the leased lines for our company then this gives the high bandwidth. The high bandwidth increases the data transfer rate which in turn increases the productivity of our company.

Disadvantages of Wide Area Network:

The following are the disadvantages of the Wide Area Network:

- **Security issue:** A WAN network has more security issues as compared to LAN and MAN network as all the technologies are combined together that creates the security problem.
- **Needs Firewall & antivirus software:** The data is transferred on the internet which can be changed or hacked by the hackers, so the firewall needs to be used. Some people can inject the virus in our system so antivirus is needed to protect from such a virus.
- **High Setup cost:** An installation cost of the WAN network is high as it involves the purchasing of routers, switches.
- **Troubleshooting problems:** It covers a large area so fixing the problem is difficult.

Network Devices

- Network devices are the devices that interconnect networks. Because these devices connect network entities, they are known as **connectivity devices**. These devices include:

❖ Network Interface Card (NIC)

❖ Hub

❖ Switch

❖ Bridge

❖ Router

❖ Gateway

1) **NIC** – NIC or network interface card is a network adapter that is used to connect the computer to the network. It is installed in the computer to establish a LAN. It has a unique id that is written on the chip, and it has a connector to connect the cable to it. The cable acts as an interface between the computer and router or modem. NIC card is a layer 2 device which means that it works on both physical and data link layer of the network model.

2. Hub – A hub is basically a multiport repeater. A hub connects multiple wires coming from different branches, for example, the connector in star topology which connects different stations. Hubs cannot filter data, so data packets are sent to all connected devices. In other words, the [collision domain](#) of all hosts connected through Hub remains one. Also, they do not have the intelligence to find out the best path for data packets which leads to inefficiencies and wastage.

Types of Hub

- **Active Hub:-** These are the hubs that have their own power supply and can clean, boost, and relay the signal along with the network. It serves both as a repeater as well as a wiring center. These are used to extend the maximum distance between nodes.
- **Passive Hub :-** These are the hubs that collect wiring from nodes and power supply from the active hub. These hubs relay signals onto the network without cleaning and boosting them and can't be used to extend the distance between nodes.
- **Intelligent Hub :-** It works like active hubs and includes remote management capabilities. They also provide flexible data rates to network devices. It also enables an administrator to monitor the traffic passing through the hub and to configure each port in the hub.

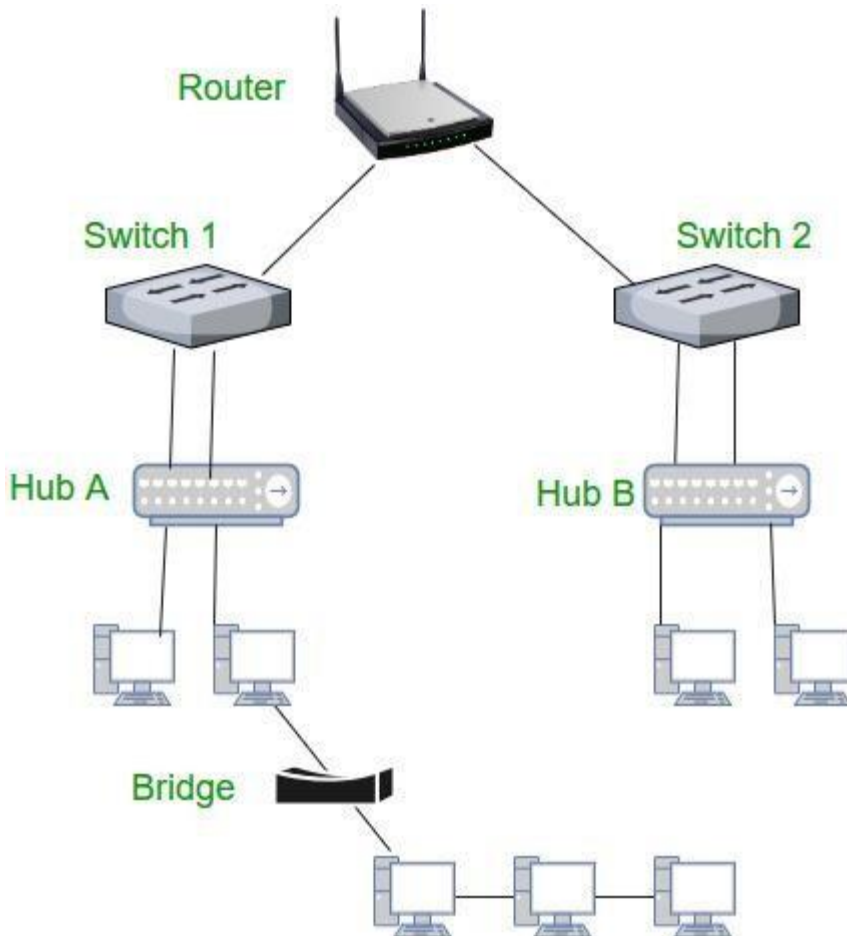
3. Switch – A switch is a multiport bridge with a buffer and a design that can boost its efficiency (a large number of ports imply less traffic) and performance. A switch is a data link layer device. The switch can perform error checking before forwarding data, which makes it very efficient as it does not forward packets that have errors and forward good packets selectively to the correct port only. In other words, the switch divides the collision domain of hosts, but [broadcast domain](#) remains the same.

4. . Bridge – A bridge operates at the data link layer. A bridge is a repeater, with added on the functionality of filtering content by reading the MAC addresses of source and destination. It is also used for interconnecting two LANs working on the same protocol. It has a single input and single output port, thus making it a 2 port device. **Types of Bridges**

- **Transparent Bridges:-** These are the bridge in which the stations are completely unaware of the bridge's existence i.e. whether or not a bridge is added or deleted from the network, reconfiguration of the stations is

unnecessary. These bridges make use of two processes i.e. bridge forwarding and bridge learning.

- **Source Routing Bridges:-** In these bridges, routing operation is performed by the source station and the frame specifies which route to follow. The host can discover the route by sending a special frame called the discovery frame, which spreads through the entire network using all possible paths to the destination.
- **5. Routers** – A router is a device like a switch that routes data packets based on their IP addresses. The router is mainly a Network Layer device. Routers normally connect LANs and WANs together and have a dynamically updating routing table based on which they make decisions on routing the data packets. Routers divide broadcast domains of hosts connected through it.



- **6. Gateway** – A gateway, as the name suggests, is a passage to connect two networks together that may work upon different networking models. They basically work as the messenger agents that take data from one system, interpret it, and transfer it to another system. Gateways are also called protocol converters and can operate at any network layer. Gateways are generally more complex than switches or routers. Gateway is also called a protocol converter.

Introduction to Internet:

1) Web Browser Definition: A software application used to access information on the World Wide Web is called a Web Browser. When a user requests some information, the web browser fetches the data from a web server and then displays the webpage on the user's screen.

It is also important to know in detail about what a web browser is for candidates preparing for Government exams. This is because [Computer Knowledge](#) is a common topic for many competitive exams and questions based on web browsers may be asked.

Types of Web Browser

The functions of all web browsers are the same. Thus, more than the different types there are different web browsers which have been used over the years.

Discussed below are different web browser examples and their specific features:

1. WorldWideWeb

- The first web browser ever
- Launched in 1990
- It was later named "Nexus" to avoid any confusion with the World Wide Web
- Had the very basic features and less interactive in terms of graphical interface
- Did not have the feature of bookmark

2. Mosaic

- It was launched in 1993
- The second web browser which was launched
- Had a better graphical interface. Images, text and graphics could all be integrated
- It was developed at the National Center for Supercomputing Applications
- The team which was responsible for creating Mosaic was lead by Marc Andreessen
- It was named "the world's first popular browser"

3. Netscape Navigator

- It was released in 1994
- In the 1990s, it was the dominant browser in terms of usage share
- More versions of this browser were launched by Netscape
- It had an advanced licensing scheme and allowed free usage for non-commercial purposes

4. Internet Explorer

- It was launched in 1995 by Microsoft
- By 2003, it has attained almost 95% of usage share and had become the most popular browsers of all

- Close to 10 versions of Internet Explorer were released by Microsoft and were updated gradually
- It was included in the Microsoft Windows operating system
- In 2015, it was replaced with “Microsoft Edge”, as it became the default browser on Windows 10

5. Firefox

- It was introduced in 2002 and was developed by Mozilla Foundation
- Firefox overtook the usage share from Internet Explorer and became the dominant browser during 2003-04
- Location-aware browsing was made available with Firefox
- This browser was also made available for mobile phones, tablets, etc.

6. Google Chrome

- It was launched in 2008 by Google
- It is a cross-platform web browser
- Multiple features from old browsers were amalgamated to form better and newer features
- To save computers from malware, Google developed the ad-blocking feature to keep the user data safe and secure
- Incognito mode is provided where private searching is available where no cookies or history is saved
- Till date, it has the best user interface

Apart from these, Opera Mini web browser was introduced in 2005 which was specially designed for mobile users. Before the mobile version, the computer version “Opera” was also released in 1995. It supported a decent user interface and was developed by Opera Software.

2) Searching and Surfing:

Browsing

Browsing means searching for something specific about which we know that it will be available at a particular place. When we elaborate this term in aspect of Internet than it means searching for some specific thing on a specific website. In browsing we already have some clear idea about our purpose. For example when we types on a search engine like Google or Yahoo, Who was the first president of USA? In this case we are specific about a thing and we will get the desired result without any further satisfaction.

Surfing

Before moving towards the introduction of surfing, imagine surfing is like a window shopping. Whenever you go into market to purchase something you almost goes into 6 to 10 shops to collect that thing, which you wants. Surfing is like that you search something on Internet and you are not clear about it. For example you types on the Google, list of most popular watch brands of the world. It will shows you the bulk amount of pages and now you have to search for the most popular watch brands of the world by searching the sites randomly. So in surfing user is not specific about his search and he has to randomly search out the material.

	Web Surfing	Web Browsing
Definition	It is defined as going through information aimlessly on different subjects on the different websites.	It is defined as going through searching for specific information on a specific website.
It is	These are random searches on the internet.	These are specific searches on the internet.
Purpose	One can surf aimlessly on the internet.	One can browse intently on the internet.

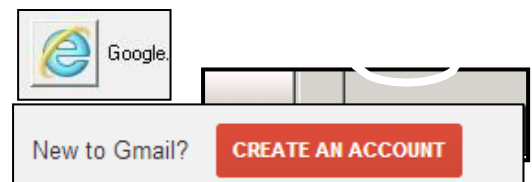
How to Create an Email Account

Creating an email account will enable you to register for Universal Jobmatch and many more job-seeking websites.

This guide shows you how to register for a **free email account using Gmail**. Registering with other email providers such as **Hotmail and Yahoo** is similar to the steps set out in this guide.

First Steps

If using library computers click on the **Google link** on the People's Network. Then click on the **Gmail link** near the topleft of the page. *If using a computer elsewhere* **perform an Internet search for Gmail.**

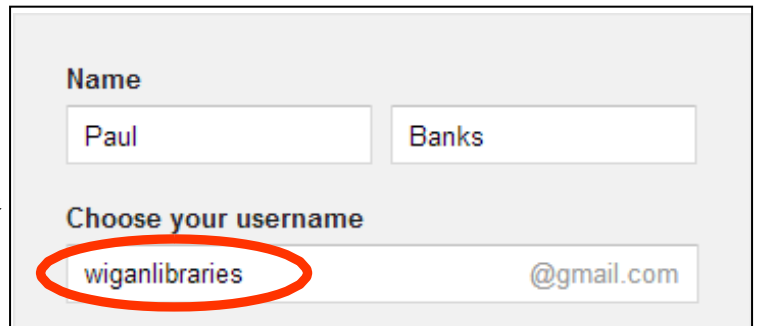


Click on **Create Account**.

Choosing your email address

To set up your new account, Google needs some information about you. Type your first and last names.

To create an email you need to **choose a username**. Your email address will be **yourusername followed by '@gmail.com'**.



The screenshot shows a form with two input fields for the name: 'Paul' and 'Banks'. Below them is a section titled 'Choose your username' with a single input field containing 'wiganlibraries' and '@gmail.com'. The 'wiganlibraries' part is circled in red.

Ideally, it should be some combination of your first and last name. However, if your name is very common (e.g. John Smith), it's very likely that email address has already in use. You may want to also include numbers in your email address such as your year of birth.

Choosing your password

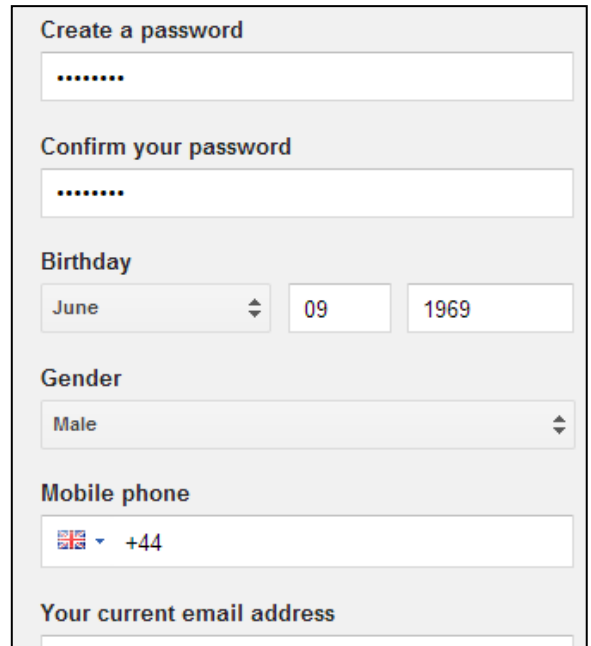
Choose a password that is **8 characters or more**. Make sure your password is secure and one that you can remember! Secure passwords include combinations of upper and lowercase letters and numbers.

Verifying your Gmail account

Type your **Birthdate** and **Gender**.

Enter your **mobile telephone number** or an **alternative email address if you have one**.

This is so you can verify you own the email account if you have difficulty accessing your account.



The screenshot shows a form with several fields: 'Create a password' (two rows of dots), 'Confirm your password' (one row of dots), 'Birthday' (dropdown for 'June', input for '09', input for '1969'), 'Gender' (dropdown for 'Male'), 'Mobile phone' (dropdown for '+44'), and 'Your current email address' (empty input field).

Prove you're not a Robot!

You may want to uncheck the box next to 'Set Google as my default homepage'.

Type in the letters or digits as they appear on the screen.

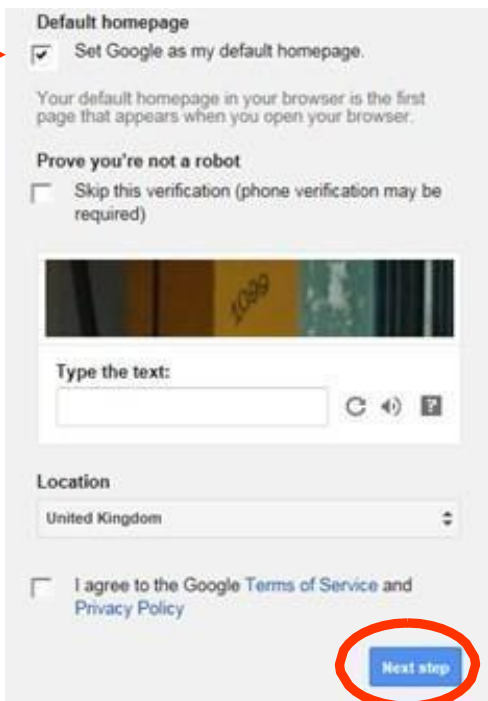
Agree to the terms of service

by checking the box.

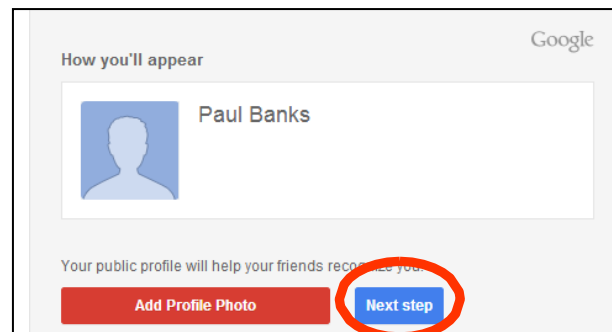
Click **Next step**.

(You can Add a profile picture at a later stage)

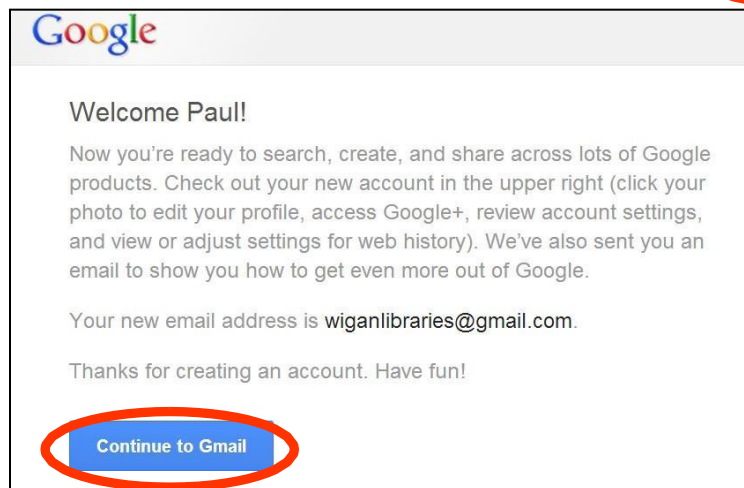
Click **Next step**.



This screenshot shows the 'Prove you're not a robot' verification step. It includes a 'Default homepage' section with a checked box for 'Set Google as my default homepage'. Below that is the 'Prove you're not a robot' section with an unchecked box for 'Skip this verification'. A CAPTCHA image is displayed with the text 'Type the text:' and an input field. The 'Location' dropdown is set to 'United Kingdom'. At the bottom, there is a checkbox for 'I agree to the Google Terms of Service and Privacy Policy' and a blue 'Next step' button circled in red.



This screenshot shows the 'How you'll appear' step. It displays a profile card for 'Paul Banks' with a placeholder profile picture. Below the card, there is a red 'Add Profile Photo' button and a blue 'Next step' button circled in red.



This screenshot shows the 'Welcome Paul!' step. It features the Google logo at the top, followed by a welcome message: 'Welcome Paul! Now you're ready to search, create, and share across lots of Google products. Check out your new account in the upper right (click your photo to edit your profile, access Google+, review account settings, and view or adjust settings for web history). We've also sent you an email to show you how to get even more out of Google.' Below this, it states 'Your new email address is wiganlibraries@gmail.com.' and 'Thanks for creating an account. Have fun!'. At the bottom, there is a blue 'Continue to Gmail' button circled in red.

Congratulations! You have created a email

account!To start using email click on

Continue to Gmail.

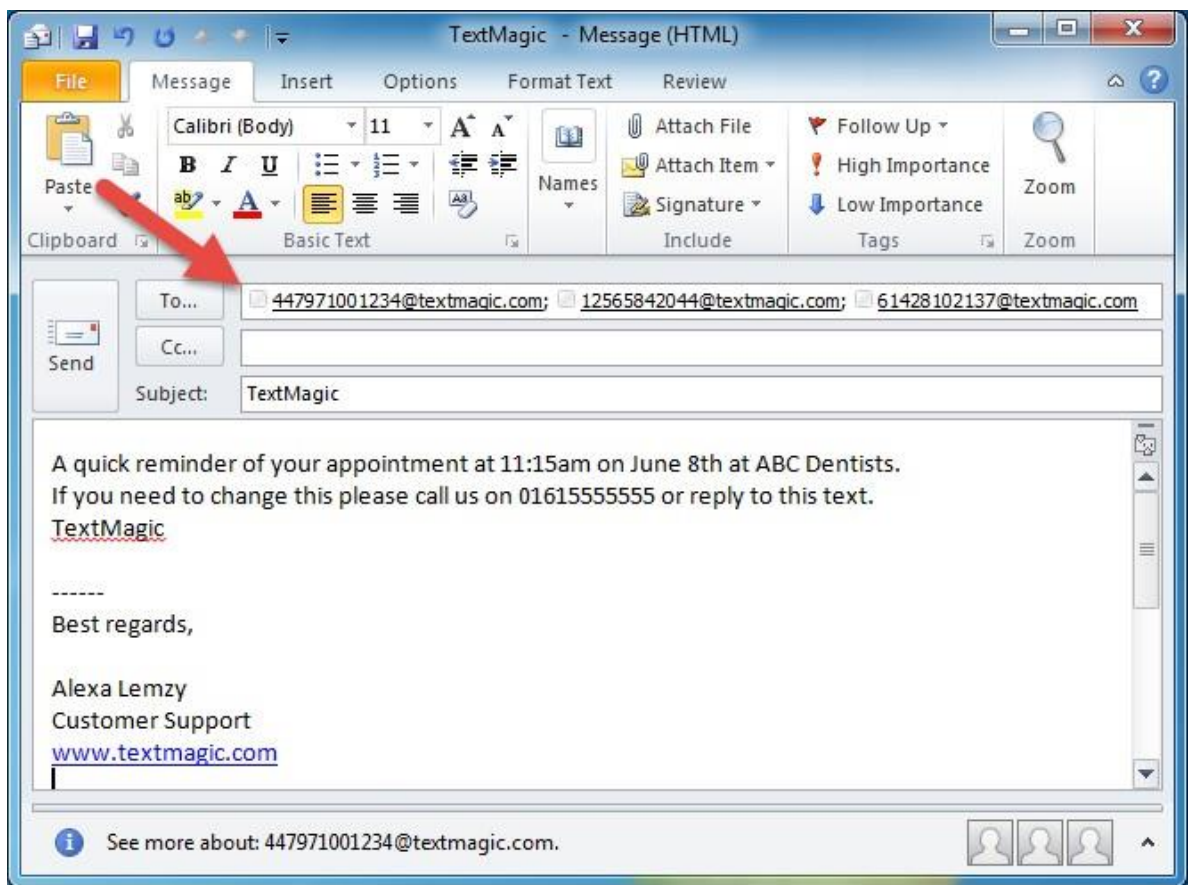
3)Sending and Receiving E-Mails:

Send and receive Email to SMS

After [setting up your Email to SMS service](#) and configuring your settings, you can send andreceive Email to SMS using your email account.

To send and receive Email to SMS:

1. Sign in to your email application.
2. The process is mostly the same as sending a normal email.
3. Add the recipient's address as . *(For example - for UK, for US, for AU.)*
4. Write your message.
5. Send your email.
6. The **email will be converted to a text message** and delivered to the numbers that were entered in the recipients box.



To view replies:

If anyone replies to your text message, you will receive it as an email to your inbox. You can also see replies in [SMS chat](#)

1. Sign in to your email application.
2. Check your **Inbox**.
3. All your received text message replies will display as incoming emails.

To edit an email address:

1. Select **Services** and then [Email to SMS](#) from the main menu.
2. Click the **Actions** icon next to the email you want to edit.
3. Select **Edit settings**.
4. Edit the settings as needed.
5. Click **Save**.

Edit email address settings



Email address

Notifications

- Send replies back to this email
- Include recent chat history
- Send email in HTML format

When turned off, email will be sent in plain text format.

[Cancel](#)

Save

UNIT-IV

1. Problem Solving and Programming

Algorithm:

“An algorithm is a step-by-step procedure to solve a given problem.”

(or)

“An algorithm is nothing but the presentation of the sequence of steps involved in solving a problem in a simple language.”

(or)

“An algorithm is defined as an ordered sequence of well-defined effective operations that, when executed, will produce the solution of given problem.”

An algorithm must be simple and unambiguous and a particular order should maintain. It must solve the problem in finite number of steps. Any algorithm must satisfy the following conditions:

1. **Input:** The quantities which are to be supplied externally.
2. **Output:** The quantities which are to be produced by the program.
3. **Definiteness:** Every instruction should be simple and clear.
4. **Finiteness:** The algorithm must have finite number of steps.
5. **Effectiveness:** Every instruction must be a basic instruction and it can be carried out simply.

Ex: 1 Algorithm for addition of two numbers.

Step: 1 Start

Step: 2 Read the values of X and Y

Step: 3 Compute $Z=X+Y$

Step: 4 Print the sum as the result, Z

Step: 5 Stop.

Ex: 2 To find the roots of a quadratic equation of the form ax^2+bx+c .

Step: 1 Start

Step: 2 Read the values of a, b and c

Step: 3 Compute $d=b^2-4ac$

Step: 4 If $d<0$, then print “The roots are complex” and goto last step

Step: 5 If $d=0$, then goto step 6, otherwise goto last step

Step: 6 Compute first root $R_1 = -b/(2a)$

Step: 7 Print “The roots are real and equal”, R_1 and goto last step.

Step: 8 Compute $R_1=(-b + \sqrt{d})/(2*a)$ and $R_2=(-b - \sqrt{d})/(2*a)$

Step: 9 Print “The roots are real and unequal”, R_1 and R_2

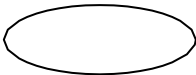
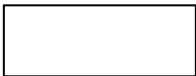

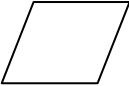
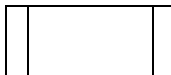




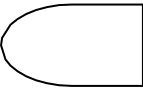
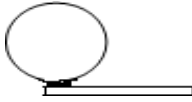


Step: 10 Stop.

Flowcharting:

“A flowchart is a pictorial representation of what the computer has to do in order to solve a particular problem.”

The flowchart represents the operation sequence, data flow, control flow and data processing logic. With the help of flowchart anyone can understand the flow of data, programming logic used from the beginning to the end of the program.

Every flowchart consists different symbols to represent the specific operations. The frequently used symbols and their meaning are as follows:

Symbol	Meaning
	START/STOP
	COMPUTATION or GROUP OF OPERATIONS
	DECISION MAKING
	INPUT/OUTPUT
	PREDEFINED PROCEDURE
	CONNECTOR
	FLOW OF DATA
	TO MAKE COMMENTS
	PUNCHED CARD
	VISUAL DISPLAY
	I/O USING MAGNETIC TAPE or FILE OPERATION
	INPUT USING MANUAL INPUT
	INPUT USING DOCUMENT

Ex:1 Draw a flowchart for addition of two numbers.

Algorithm:

Step: 1 Start

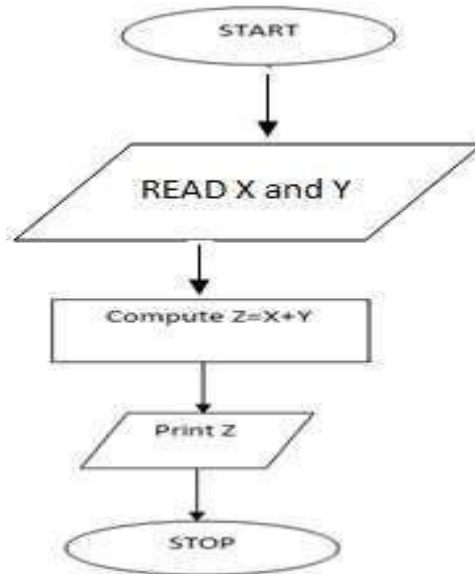
Step: 2 Read the values of X and Y

Step: 3 Compute $Z=X+Y$

Step: 4 Print the sum as the result, Z

Step: 5 Stop.

Flowchart:



Ex:2 Draw a flowchart for finding the largest number in the given three numbers.

Algorithm:

Step: 1 Start

Step: 2 Read the values a, b and c

Step: 3 Compare a and b

Step: 4 If $a > b$, compare a with c, otherwise goto step 7

Step: 5 If $a > c$, print „a“ is the largest and goto last step, otherwise goto step 8

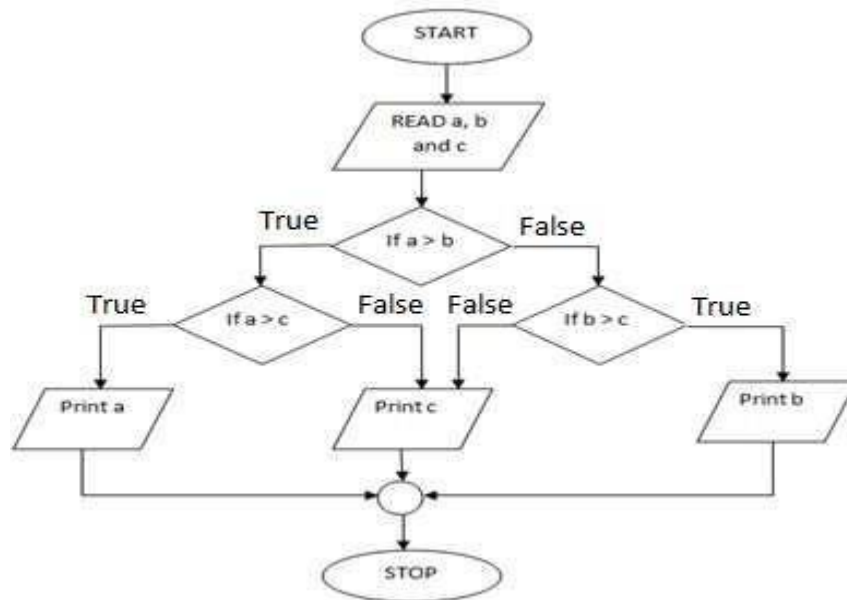
Step: 6 Compare b with c

Step: 7 If $b > c$, print „b“ is the largest and goto last step, otherwise goto next step

Step: 8 Print „c“ is the largest

Step: 9 Stop.

Flowchart:



Looping:

In computer science, a loop is a programming structure that repeats a sequence of instructions until a specific condition is met. Programmers use loops to cycle through values, add sums of numbers, repeat functions, and many other things.

(OR)

A loop is used for executing a block of statements repeatedly until a particular condition is satisfied. For example, when you are displaying number from 1 to 100 you may want set the value of a variable to 1 and display it 100 times, increasing its value by 1 on each loop iteration.

Loops are supported by all modern programming languages, though their implementations and syntax may differ. Two of the most common types of loops are the while loop and the for loop.

Programming Features:

A programming language must be simple, easy to learn and use, have good readability and human recognizable. Abstraction is a must-have Characteristics for a programming language in which ability to define the complex structure and then its degree of usability comes.

The main features of programming are as follows:

1. Sophisticated parsing
2. Looping and branching
3. Markup and control language
4. Access to internal system variables
5. Binary and text file I/O
6. JDBC support New
7. ODBC/SQL support
8. Access to files on the Internet

9. List processing
10. Path and file utilities
11. Extensive set of functions for string and data manipulation, including regular expressions and Unicode
12. Window management
13. Automation

What is meant by Pseudo Code?

Pseudo code is an artificial and informal language that helps programmers develop algorithms. Pseudo code is a "text-based" detail (algorithmic) design tool. The rules of Pseudo code are reasonably straightforward. All statements showing "dependency" are to be indented. These include while, do, for, if, switch.

Structured Programming (Good Programming):

“Structured Programming is nothing but organizing the program procedures in a fashion that makes it in order, efficient and easy to understand the logic that exist in the program.”

Structured Programming is useful in writing logically clear and efficient programs. When the program is too large, it is divided into smaller portions are known as modules. *A module is a logically separable of a program.* The logic and functions of each module will be described in the program design.

The main objective of structured programming is to provide methodologies such that

- ❖ The program can be developed at a faster rate without many errors.
- ❖ Programs can well be understood and maintained.
- ❖ Modification of the programs will be easy whenever it is necessary.

The principles of structured programming are

- ❖ Structuring of control flow
- ❖ Division of program into modules
- ❖ Top-down approach towards program design

Structuring of Control Flow:

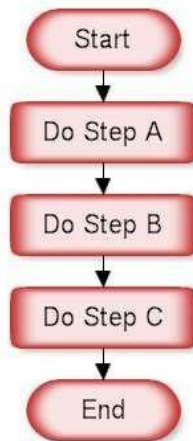
There are two basic programming language structures. They are

- a. Process
- b. Branching or Decision Making

In process, a single operation or group of operations will be performed. In branching or decision making, a condition will be tested and based on the result of the test, the program flow will be decided. There are some more commonly used structures in programming. They are the combination of basic structures. They are

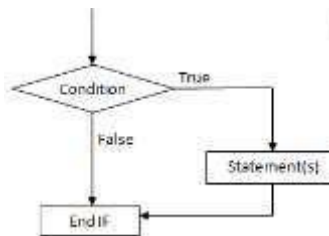
1. Sequence:

A combination of two or more processes.



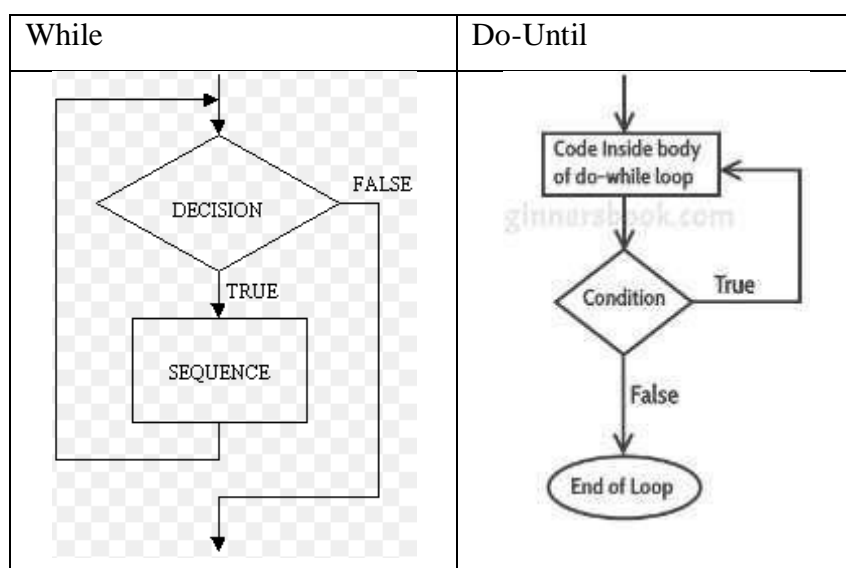
2. if-then-else:

A combination of two process blocks and a decision block.



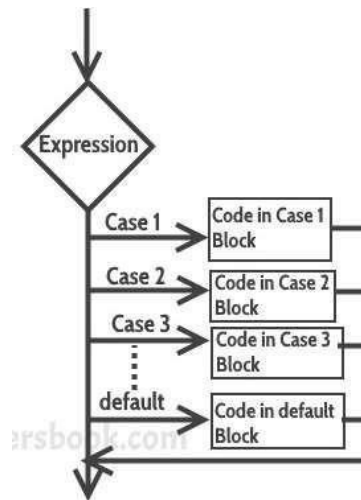
3. Loops:

A combination of a single process block and a decision block. The process block can be executed either before or after testing the condition. If the condition is tested before the process, the structure is called WHILE structure. If the condition tested after the process, the structure is called DO-UNTIL or REPEAT-UNTIL or Do-While structure.



4. Case:

A combination of several decision blocks and several process blocks arranged such that when the first decision is true, the first process will be carried out; if the second decision is true, the second process will be carried out and so on.



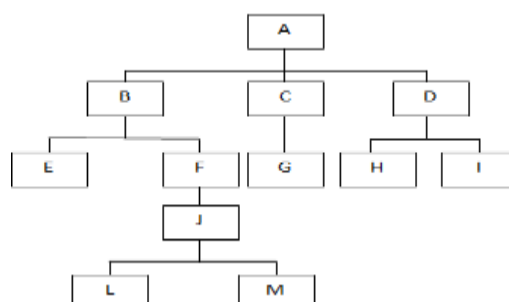
Modular Programming:

The modular programming is a strategy where the program is divided into number of smaller units called modules. A module is a logically separable of a program. Every module can also be divided into sub-modules. The number of modules can be merged into a larger module is known as *Superior module*.

The advantage of modular programming is how effectively the modules were designed. Each module must be designed such that it performs a specific task and accomplish a particular function. This feature provides the program greater modification flexibility. To replace a module by some other module can be very easily replaced without disturbing the other modules and other parts of the program.

Top-down approach:

The basic principle of top-down modular programming is based on the division of a problem into a hierarchy of tasks and then developing a solution from the highest level task to lowest level task. This is called *Top-down approach*. This approach begins with the specification of the function to be done by the program and division of it into subsidiary functions. The following diagram describes the top-down structure:



In the above diagram, „A“ represents a program is also known as main module. This is divided into three modules B, C and D. These are known as sub-modules and they are also divided into some more sub-modules.

The top-down approach is a widely accepted approach and has the following advantages:

- ❖ It resembles the human tendency to solve a problem by outlining concepts first and going into later.
- ❖ The details of a module can be worked almost without changing the previously outlined concepts regarding its function.
- ❖ The programmer will be in touch with the assumptions made at the previous levels at all the stages.
- ❖ All the modules can be developed in parallel and independently.

These advantages make the top-down approach as a better approach for program design. Using this approach the program can be developed easily, quickly and without errors.

Bottom-up approach:

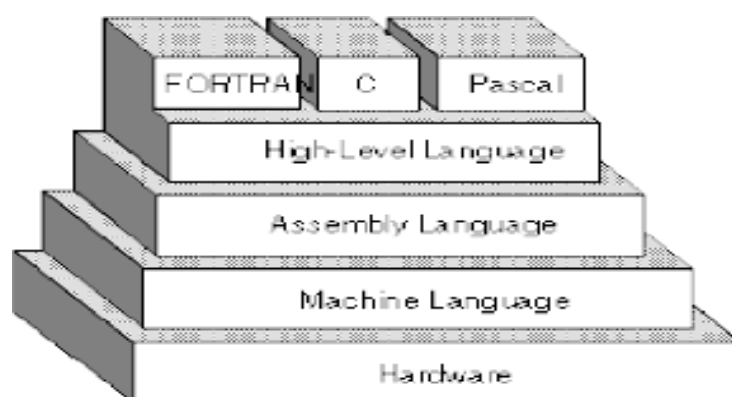
This approach is exactly reverse of top-down approach. This involves the identification of set of modules which are available or to be constructs and combining them in order to form a module of high level. This process continues till the complete program is realized through modules.

2. Programming Languages

A programming language is a formal language (a *formal language* is a set of strings of symbols that may be constrained by rules that are specific to it) designed to communicate instructions to a machine, particularly a computer.

The languages can be classified into following categories:

1. Machine language
2. Assembly language
3. High level language



Computer Languages

Machine Language:

Machine language or machine code is the native language directly understood by the computer's central processing unit or CPU. This type of computer language is not easy to understand, as it only uses a binary system, an element of notations containing only a series of numbers consisting of one and zero, to produce commands.

Assembly Level Language:

Assembly Level Language is a set of codes that can run directly on the computer's processor. This type of language is most appropriate in writing operating systems and maintaining desktop applications. With the assembly level language, it is easier for a programmer to define commands. It is easier to understand and use as compared to machine language.

High Level Language:

High Level Languages are user-friendly languages which are similar to English with vocabulary of words and symbols. These are easier to learn and require less time to write.

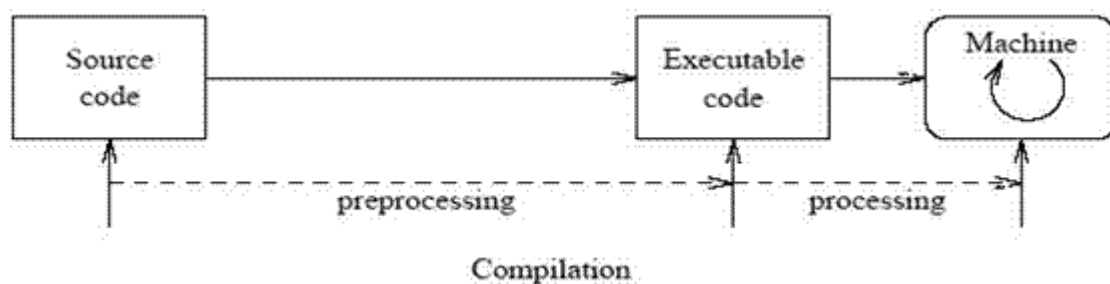
They are problem oriented rather than „machine“ based. Program written in a high-level language can be translated into many machine languages and therefore can run on any computer for which there exists an appropriate translator.

Assembler:

An assembler is a program that converts assembly language into machine code. It takes the basic commands and operations from assembly code and converts them into binary code that can be recognized by a specific type of processor. Assemblers are similar to compilers in that they produce executable code.

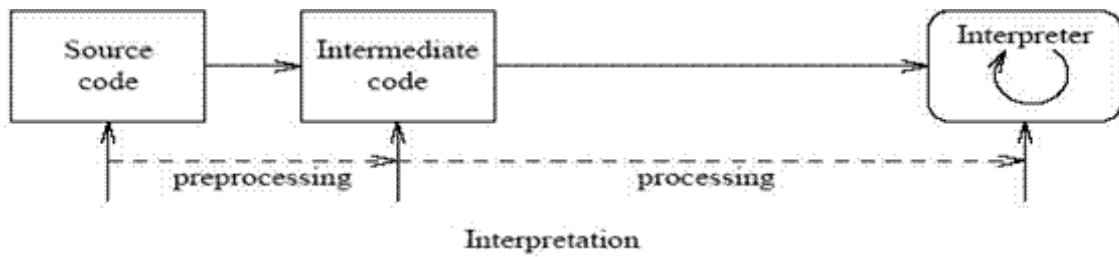
Compiler and Interpreter:

“A *compiler* is a piece of code that translates the high level language into object code.”



In the above diagram shows basic outline of the compilation process. Here program written in higher level language is known as source program and the converted one is called object program.

Interpreters are not much different than compilers. They also convert the high level language into machine readable binary equivalents. Each time when an interpreter gets a high level language code to be executed, it converts the code into an intermediate code before converting it into the machine code. Each part of the code is interpreted and then execute separately in a sequence and an error is found in a part of the code it will stop the interpretation of the code without translating the next set of the codes.



The above diagram shows that first a source code is converted to an intermediate form and then that is executed by the interpreter.

Difference between Compiler and Interpreter

No	Compiler	Interpreter
1	Compiler Takes Entire program as input	Interpreter Takes Single instruction as input .
2	Intermediate Object Code is Generated	No Intermediate Object Code is Generated
3	Conditional Control Statements are Executes faster	Conditional Control Statements are Executes slower
4	Memory Requirement : More (Since Object Code is Generated)	Memory Requirement is Less
5	Program need not be compiled every time	Every time higher level program is converted into lower level program
6	Errors are displayed after entire program is checked	Errors are displayed for every instruction interpreted (if any)
7	Example : C Compiler	Example : BASIC
