UNIT 1

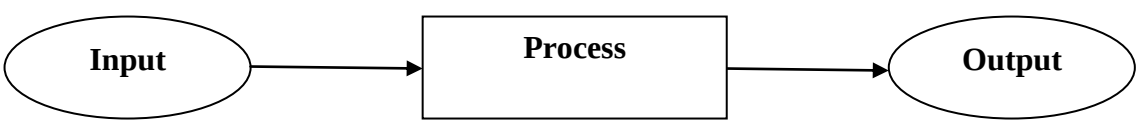
The term 'Computer' is derived from the word 'Compute', which means to calculate. A computer is an electronic machine, devised for performing calculations as well as controlling operations that can be expressed either in logical or numerical terms. In brief words, a computer is an electronic device which performs mathematical and non-mathematical operations with the help of instructions to process the data in order to achieve the desired results. Although the application domain of a computer depends totally on human creativity and imagination, it covers a huge area of applications including education, industries, government, medicine, scientific research, law, social science, and arts like music and painting. They are presently used, among other applications, to design buildings and machines, control space vehicles, assist in railway reservation, control inventories to minimize material cost, grade examinations and process results, aids in teaching learning, systematically store and quickly retrieve data and records, play games like chess and video games, etc.

➔WHAT IS A COMPUTER

A computer is an electronic data processing device which can read and write, compute, store and process large volumes of data with high speed, accuracy and reliability. It can interact with other devices through LAN, WiFi, Bluetooth, etc. Computers are now available in all sizes, shapes and capacity, downsized, can be found in children's toys, pocket calculators, industrial robots, home appliances, etc.

From the basic definition of a computer it is clear that a computer works on the principles followed by the human beings;

- Taking an input
- Processing the input
- Producing the output



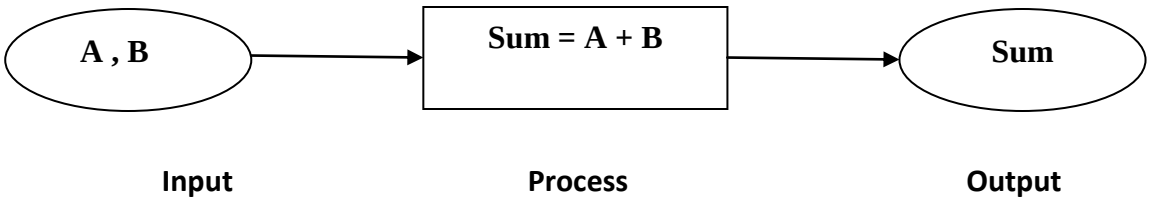
In order to understand the concept of functioning of a computer take some examples.

i. Consider a case when a student is taught a lesson, he is then asked to prepare the same for his exams.
In this example teaching the lesson is an **Input**, Preparing the lesson by the student is the **Process** and expressing the same in exams is the **Output.**

ii. Consider an example when you are asked to prepare a glass of juice, so you will require material like lemon, sugar, water, glass. Further, you require a juice maker for its preparation.

In the above example lemon, sugar and water etc. are **input,** mixing is a **process** and the glass of juice is the **output**.

iii. If we want to add two numbers, we take two numbers to be added then add them and produce the result , i.e, sum of two numbers.
Here in this example taking two numbers is an **Input,** adding the numbers is the **Process** and showing the result, i.e, sum is the **Output.**



The above examples can be summarized as follows:

	Input (Thing(s) to work upon)	***Process*** (The actual work taking place)	***Output*** (The result)
Example1	Learning a lesson	Preparing the lesson	Answering the questions in the
Example 2	Taking raw material like sugar, lemon, water etc.	Mixing different substances	Prepared juice
Example	Taking two numbers	Adding two numbers	Getting the sum

➔ **What is data?**

Data can be defined as a representation of facts, concepts or instructions in a formalized manner which should be suitable for communication, interpretation, or processing by human or electronic machine.

Data is represented with the help of characters like alphabets (A-Z,a-z), digits (0-9) or special characters(+,-,/,*,<,>,= etc.).

➔ **What is Information?**

Information is organised or classified data which has some meaningful values for the receiver. Information is the processed data on which decisions and actions are based.

For the decision to be meaningful, the processed data must qualify for the following characteristics:

Timely - Information should be available when required.

Accuracy - Information should be accurate.

Completeness - Information should be complete.

➔BLOCK DIAGRAM OF A COMPUTER

A Computer can be considered to consist of following components

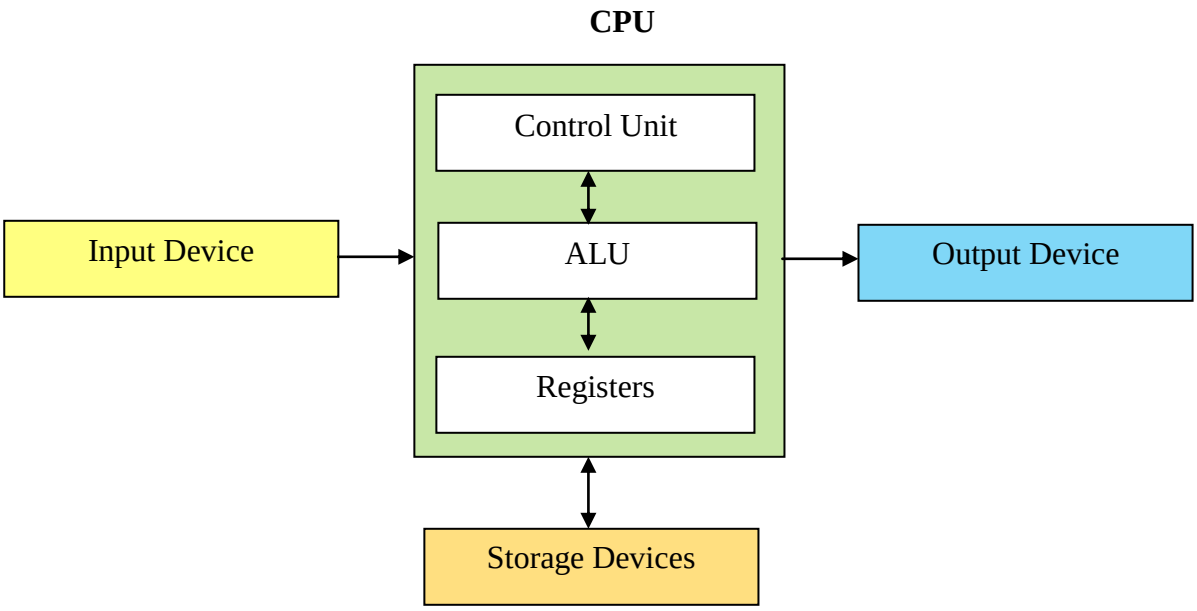


Fig. Block Diagram of a computer

Input Devices

An input device is an electromechanical device that accepts data from outside world and translates them into a form a computer can interpret. Several input devices are available today and are classified as under:
Keyboard devices, Point and draw devices, Speech recognition devices, Scanning devices, Vision based devices, Digitizers, etc.

Output Devices

An output device is an electromechanical device that accepts data from a computer and translates the same into a form suitable for use by the outside world. Several output devices are available today which can be classified as follows:
Monitors, Printers, Plotters, Screen image projectors and voice response system etc.

Central Processing Unit (CPU)

Central Processing Unit (CPU) is known as the brain of a computer. In human body, the brain takes all major decisions and other parts of the body function as directed by the brain.. Similarly, in a computer system, the CPU performs all major calculations and comparisons, and also activates and controls the operations of other units of the computer system.
The CPU basically consists of two main components:

i) An Arithmetic and Logic Unit to perform the arithmetic or logic operation on data.
ii) A Control Unit which plays important role for functioning of CPU itself and transfer of data/information from/to another device to/from CPU.

Arithmetic-Logic Unit (ALU)

An Arithmetic & Logic Unit is the unit where most of the action takes place inside the CPU. For example, if you want to add the value five to the AX register, the CPU:

- Copies the value from AX into the ALU,
- Sends the value five to the ALU,
- Instructs the ALU to add these two values together,
- Moves the result back into the AX register.

Control Unit (CU)

This circuit is responsible for the entire gamut of functions of ALU. It receives instructions from memory and executes them after decoding them. Timing and control signals are generated by this circuit and sent to other circuits for the execution of the any program. It also transfers data between memory and I/O devices.
Let us discuss how the ALU functions while executing a program. A program is a set of instructions stored in a proper sequence in memory.
The ALU has to perform two main steps:

- Execution of an instruction.
- Fetching the next instruction.

The total time taken for execution of an instruction is known as *Instruction Cycle(IC).* A Fetch Cycle(FC) is the time that the fetch operation takes to fetch the machine code of the instruction from memory. The FC is of fixed duration.
An Instruction Cycle consists of fetch Cycle and the Execution Cycle. The Execution Cycle is of variable duration, depending upon the length of the instruction to be executed. This time is known as machine Cycle.

Registers

As a computer's CPU interprets and executes instructions, there is movement of information between various units of computer. To handle this process satisfactorily and to speed up rate of information transfer, the CPU uses a number of special memory units called registers.

A register is a small memory unit. These are used by the processors for temporary storage and manipulation of data and instructions. A register is a set of flip-flop. A flip-flop is an electronic circuit, which at any point of time stores either 0 or 1, which is any of the two states of a switch ON or OFF. The registers are of different sizes and capacities: 8-bit, 16-bit, 32-bit, etc.
Some of the common registers are as follows:

Memory Address Register (MAR)

It holds the address of the active memory location. It is loaded from program control register when the system reads an instruction from memory.

Memory Buffer Register (MBR)

It holds the contents of the accessed memory word. The system transfers an instruction word placed in this register to instruction register. A data word placed in this register is accessible for operation with accumulator register or for transfer to I/O register.

Accumulator Register (AC)

The ALU requires temporary registers or memory locations for all its operations. An accumulator is one of the main registers of the ALU, used to store data and perform arithmetic & logic operations. The results of the operations are stored automatically in this register.

Program Counter Register (PC)

A Program Counter is used as a memory pointer. It stores the address of the next instruction to be executed. This register is used to sequence the execution of instructions.

Instruction Register (IR)

An Instruction Register holds the instruction until it is decoded. As soon as the instruction is stored in this register its operation and address parts are separated. The system sends the address part of the instruction to MAR, while it sends operation part to the control unit, where it is decoded and interpreted.

Internal Memory

Internal memory is used by the computer to temporarily store both data and programs during its operation. These memory devices have included magnetic cores, mercury delay lines and integrated circuits.

Storage Devices

Storage devices allow the computer to retain large amount of data for longer periods. They include magnetic tapes, magnetic drums, magnetic (hard) disks, floppy disks, CDs, DVDs, flash memory, pen drives, portable Hard disk etc.

➔CHARACTERISTICS OF A COMPUTER

Today, computers are everywhere—in our offices, homes, appliances and automobiles—the list is endless. Much of the world's infrastructure runs on computers and the computers have profoundly changed our lives, mostly for the better. Let us discuss some of the characteristics of a computer which make it an essential part of every emerging technology and such a desirable tool in human development.

1. **Speed:** The computers process data at an extremely fast rate, i.e. at millions or billions of instructions per second. In a few seconds, a computer can perform a huge task that a normal human being may take days or even years to complete. The speed of a computer is measured in megahertz (MHz), that is, one million instructions per second.
2. **Accuracy:** Besides being efficient, the computers are also very accurate. The level of accuracy depends on the instructions and the type of machines being used. Since we know that the computer is capable of doing only what it is instructed to do, faulty instructions for processing the data automatically lead to faulty results. The faulty results

due to faulty instructions or incorrect input data are known as *GIGO*, that is, garbage in garbage out.

3. **Storage Capability:** Computers can store large amounts of data and it can recall the required information almost instantaneously.

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

5. **Zero I.**Q. A computer can not think of its own. It possesses no intelligence and as such its I.Q. is zero. It has to be told what to do and in what sequence. Hence , only a user determines what type of task a computer has to carry out.

➔CLASSIFICATION OF COMPUTERS

Today, computers are available in different sizes and with different speeds. One can have a computer that can fit in the palm or those that can occupy the entire room. Some computers are designed to be used by a single user only, whereas some computers can handle the needs of many users simultaneously. Computers also differ based on their data-processing abilities or speeds of their operation. In general, the computers can be classified according to their technologies, and speed of operation.

Classification based on technology:

Computers are classified according to their technologies into following types:

a) Analog b) Digital c) Hybrid

Analog Computers

A computing machine that operates on data in the form of continuously variable physical quantities is known as *analog computer*. These computers do not deal directly with the numbers. They measure continuous physical magnitudes (e.g. temperature, pressure and voltage), which are analogous to the numbers under consideration. For example, the petrol pump may have an analog computer that converts the flow of pumped petrol into two measurements: the quantity of petrol and the price of that quantity.

Analog computers are used for scientific and engineering purposes. One of the characteristics of these computers is that they give approximate results since they deal with quantities that vary continuously. It is very easy to get graphical results directly using analog computer. However, the accuracy of analog computers is less.

Digital Computers

A computer that operates on data in discrete form in known as *digital computer*. Such computers process data (including text, sound, graphics and video) into a digital value (in 0s and 1s). In digital computers, analog quantities must be converted into digital quantity before processing. In this case, the output will also be

digital. If analog output is desired, the digital output has to be converted into analog quantity.

Digital computers can give the results with more accuracy. The accuracy of such computers is limited only by the size of their registers and memory. The desktop PC is a classic example of digital computer.

(Change definition of the following)

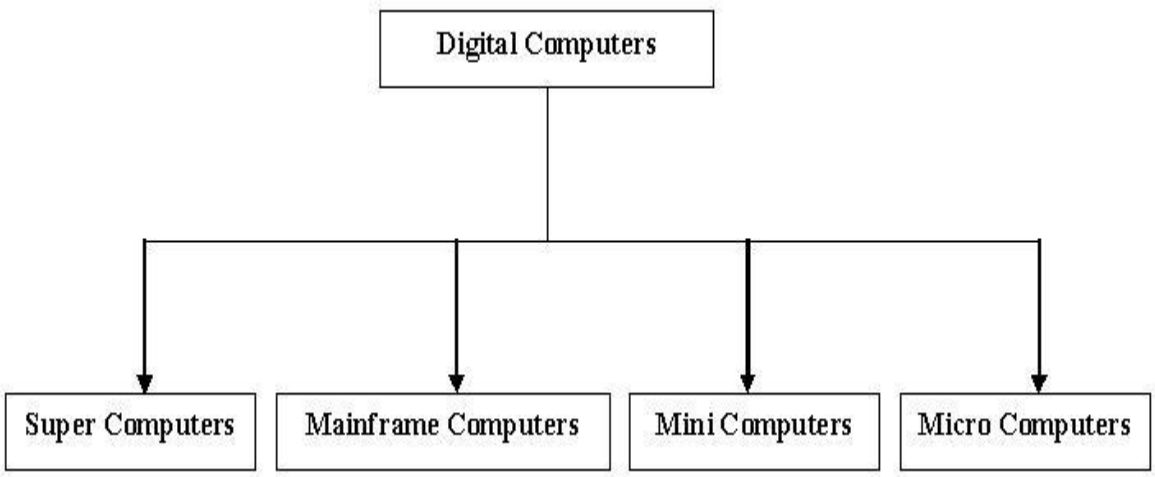
Hybrid Computers

Hybrid computer incorporated the measuring feature of an analog computer and counting feature of a digital computer. For computational purposes, these computers use the analog components and for the storage of intermediate results, digital memories are used. To bind the powers of analog and digital techniques, that is, analog to digital and digital to analog, the hybrid computers comprehensively use converters. Such computers are broadly used in scientific applications, various fields of engineering and industrial control processes.

Classification of Computers on the basis of speed and capacity

Computers can be classified in the following types on the basis of their speed and capacity:

- Micro Computers
- Mini Computers
- Mainframe Computers
- Super Computers



Micro Computers

A *micro computer* is a small, low-cost digital computer, which usually consists of a microprocessor, a storage unit, an input/output unit(e.g, Keyboard, Mouse, Monitor, disk driver) assembled together into a complete system. The addition of a power supply and connecting cables, an operating system and other software programs can provide a complete micro computer system. The micro-computer is generally the smallest of the computer family. Originally, these computers were designed only for individual users, but nowadays they have become powerful tools for many businesses that, when networked together, can serve more than one user. IBM-PC, Pentium-I, Pentium-II are some of the examples of micro computers.

Mini Computers

A *mini computer* is a digital computer, which normally is able to process and store less data than a mainframe, but more than a micro computer, while doing so less rapidly than a mainframe but more rapidly than that of a micro-computer. The processing speed of a mini computer is midway between that of a micro and mainframe computer. A mini computer (sometimes called a *mid-range* computer) is designed to meet the computing needs of several people simultaneously in a small- to medium-sized business environment. It is capable of supporting 4 to about 100 simultaneous users. It serves as a centralized storehouse for a cluster of workstations or as a network server. Mini computers are usually multi-user systems, therefore they are used in interactive applications in industries, research organizations, colleges and universities. Some of the widely used mini computers are PDP 11, IBM 8000 series and VAX 7500.

Mainframes

A mainframe computer is an ultra-high-performance computer with large processing speed and storage capacity. It consists of a high-end processor, with related peripheral devices, capable of supporting large volumes of data processing, high-performance online transaction processing and extensive data storage and retrieval. Normally, it is able to process and store more data than a mini computer and far more than a micro computer. Mainframes are the second largest (in capability and size) of the computer family. However, they can usually execute many programs simultaneously at a high speed.

Mainframe computer is primarily a multi user system. It allows its users to maintain large information storage at a centralized location and is able to access and process this data from different computers located at different locations. Examples are: IBM 3090/600, VAX 8000 and CDC 6600.

Super Computers

Super computers are the special-purpose machines, which are specially designed to maximize the number of FLOPS (floating

point operation per second). Any computer below 1 gigaflop is not considered as a super computer. A super computer has the highest processing speed at a given time for solving scientific and engineering problems. It basically contains a number of CPUs that operate in parallel to make it faster. Its processing speed lies in the range of 400–10,000 MFLOPS (millions of floating point operation per second). Due to this feature, super computers help in many applications such as information retrieval and computer-aided design.

A super computer can process a great deal of information and make extensive calculations very quickly. They can resolve complex mathematical equations in least possible time, which would have been otherwise impossible. Super computers have limited use because of their high cost and limited market. The largest commercial use of super computers is in the weather forecasting and defence. Few examples of super computers are CRAY-3, and PARAM, PACE/PARAM and PACE have been designed in India and are exported to many European countries.

➔INPUT DEVICES

An input device is any hardware component that allows you to enter data and instructions into a computer. Some of the input devices are the keyboard, mouse, microphone, scanner, joystick, light pen, touch screen and Web cam.

KEYBOARD

The most commonly used input device is the keyboard on which data is entered by manually keying in or typing certain keys. The keyboard also contains certain standard function keys, such as the Escape key, tab and cursor movement keys, shift and control keys, and sometimes other manufacturer-customized keys.

The computer keyboard uses the same key arrangement as the mechanical and electronic typewriter keyboards that preceded the computer. The standard arrangement of alphabetic keys is known as the QWERTY (pronounced KWEHR-tee) keyboard, its name deriving from the arrangement of the five keys at the upper left of the three rows of alphabetic keys. This arrangement, invented for one of the earliest mechanical typewriters, dates back to the 1870s. Another well-known key arrangement is the Dvorak (pronounced duh-VOR-ak,) system, which was designed to be easier to learn and use. The Dvorak keyboard was designed with the most common consonants on one side of the middle or home row and the vowels on the other side so that typing tends to alternate key strokes back and forth between hands. Although the Dvorak keyboard has never been widely used, it has adherents.

The keyboard is having characters engraved and printed on the keys as every pressing key typically reflects single written symbol. Whereas most of the keys of the keyboard produces letters, numbers, and signs. Not only this most of keys are made for showing actions and computer commands.

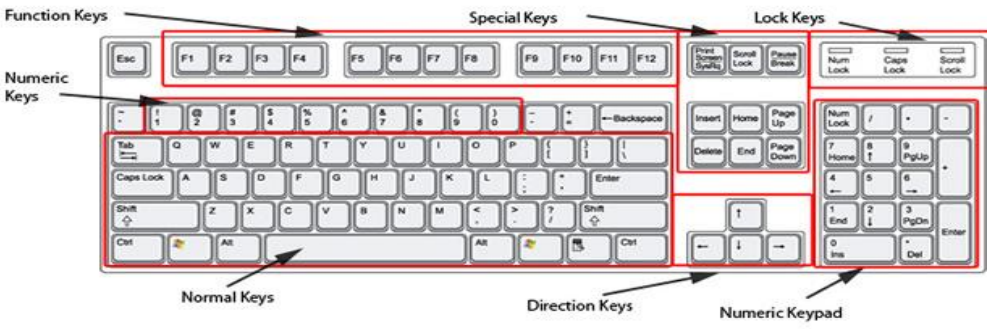


Fig. Standard Keyboard Layout

A typical Keyboard Contains:

Alphanumeric keys – all of the letters and numbers on the keyboard. A-Z and 0-9. These keys can further be classified as Alphabet keys (26 keys), a-z (A-Z) and Number keys (10 number keys) 0-9.
Punctuation keys – All of the keys associated with punctuation such as the comma, period, semicolon, brackets, parenthesis and so on. Also, all of the mathematical operators such as the plus sign, minus sign, and equal sign.
Special keys – All of the other keys on the computer keyboard such as the function keys, control keys, arrow keys, caps lock key, delete key, etc.
Alt key – Short for Alternate, this key is like a second control key.
Arrow Keys – Most keyboards have four arrow keys that enable you to move the cursor (or insertion point) up, down, right, or left. Used in conjunction with the Shift or Alt keys, the arrow keys can move the cursor more than one position at a time, but this depends on which program is running.
Backspace key – Deletes the character just to the left of the cursor (or insertion point) and moves the cursor to that position.
Caps Lock Key – A toggle key that, when activated, causes all alphabetic characters to be uppercase.
Ctrl key – Short for Control, this key is used in conjunction with other keys to produce control characters. The meaning of each control character depends on which program is running.
Delete Key – Sometimes labeled Del, deletes the character at the current cursor position, or the selected object, but does not move the cursor. For graphics- based applications, the Delete key deleted the character to the right of the insertion point.
Enter Key – Used to enter commands or to move the cursor to the beginning of the next line. Sometimes labeled Return instead of Enter.
Esc Key – Short for Escape, this key is used to send special codes to devices and to exit (or escape) from programs and tasks.
Function Keys – Special keys labeled F1 to F12. These keys have different meaning depending on which program is running.

MOUSE

A Mouse is a device that controls the movement of the cursor or pointer on a display screen. A mouse is a small object you can roll along a hard, flat surface. Its name is derived from its shape, which looks a bit like a mouse, its connecting wire that one can imagine to be the mouse's tail, and the fact that one must make it scurry along a surface. As you move the mouse, the pointer on the display screen moves in the same direction. Mice contain at least one button and sometimes as many as three, which have different functions depending on what program is running. Some newer mice also include a scroll wheel for scrolling through long documents. Using the mouse involves five techniques:

1. Pointing; Move the mouse to move the on-screen pointer.
2. Clicking; Press and release the left mouse button once.
3. Double-clicking; Press and release the left mouse button twice.
4. Dragging; Hold down the left mouse button as you move the pointer.
5. Right-clicking; Press and release the right mouse button.

The computer mouse is considered an input device. With a click of a button, the mouse sends information to the computer. The

mouse is an interesting device that offers an alternative way to interact with the computer beside a keyboard.
A typical mouse has two buttons. At the top of the device you will find a left and right button which allows for "clicks". There is a scrolling wheel between the two buttons.
The mouse fits in the palm of your hand. Generally all mice are set up for right-hand dominant use but can be customized and adjusted for left-hand use. Your index finger will rest over the left mouse button while the rest of your hand will lightly grip the mouse. You may use your middle and/or your ring finger to use the wheel and/or the right mouse button. Your hand will cup the mouse and your fingers should be relaxed while holding the mouse. Your arm may rest on the table. You hand should not hold, squeeze, or clench the mouse but rather guide the mouse around. Your shoulder and elbow rather than your wrist should be moving the mouse around the mouse pad or table. A mouse pad may be provided as a clean smooth surface to guide your mouse on top. You should have plenty of room for full movement of the mouse. You may pick up your mouse and place it back down in the middle of your mouse pad at any time to readjust your mouse position. Remember-do not tense your hands or arms. The muscles of your hands, fingers, and arms should be relaxed.

MOUSE TYPES

There are three basic types of mice:
Mechanical: Has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.
Optical: Uses a laser to detect the mouse's movement. You must move the mouse along a special mat with a grid so that the optical mechanism has a frame of reference. Optical mice have no mechanical moving parts. They respond more quickly and precisely than mechanical and opt mechanical mice, but they are also more expensive. These mice also come in the form of cordless mouse using Infrared (IR) or radio frequency. With both these types, the mouse relays a signal to a base station wired to the computer's mouse port. The cordless mouse requires power, which comes in the form of batteries.
Opt mechanical: Same as a mechanical mouse, but uses optical sensors to detect motion of the ball.

MOUSE CONNECTIVITY

- Mice connect to PCs in one of several ways:
- Serial mice connect directly to an RS-232C serial port or a PS/2 port. This is the simplest type of connection.
- PS/2 mice connect to a PS/2 port.
- USB mice.
- Cordless mice aren't physically connected at all. Instead they rely on infrared or radio waves to communicate with the computer. Cordless mice are more expensive than both serial and bus mice, but they do eliminate the cord, which can sometimes get in the way

Light Pen

A light pen is an input device that allows a computer user to interact directly with the computer display. The light pen detects which display pixel the user is pointing at. That information is transmitted to

the computer. A light pen also allows the user to draw on the screen as if he or she was drawing a picture with a normal pen on a piece of paper.
Light pen is an input device that is used with a cathode-ray tube display to point at items on the screen or to draw new items or modify existing ones. The light pen had a photo sensor at the tip that responds to the peak illumination that occurs when the CRT scanning spot passes its point of focus. The display system correlated the timing of the pulse from the photo sensor with the item being displayed to determine the position of the light pen. Alight pen can work with any CRT-based display, but not with LCD screens (though Toshiba and Hitachi displayed a similar idea at the "Display 2006"show in Japan), projectors and other display devices. The light pen was used to draw items with the aid of a tracking cross. As the light pen was moved across the screen, the part of the tracking cross sensed changes thus allowing the direction of movement of the light pen to be ascertained. The tracking cross can be redrawn to locate it at the expected new center of the light pen's position and thus appears to follow the light pen. The user brings the pen to the desired point on screen and presses the pen button to make contact. Contrary to what it looks like, the pen does not shine light onto the screen; rather, the screen beams into the pen

TOUCH SCREEN

A touch screen is an electronic visual display that can detect the presence and location of a touch within the display area. The term generally refers to touching the display of the device with a finger or hand.This device allow interacting with the computer without any intermediate device. A touch screen is a computer display screen that acts as an input device. The screens are sensitive to pressure; a user interacts with the computer by touching pictures or words on the screen.

There are three types of touch screen technology:

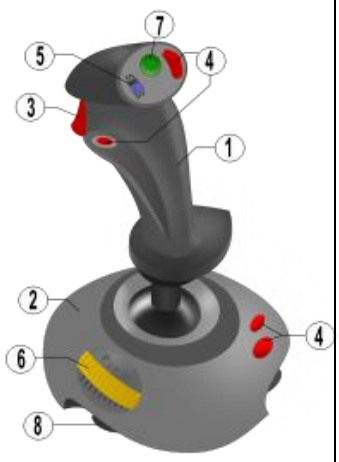
Resistive: A resistive touch screen panel is coated with a thin metallic electrically conductive and resistive layer that causes a change in the electrical current which is registered as a touch event and sent to the controller for processing. Resistive touch screen panels are generally more affordable but offer only 75% clarity and the layer can be damaged by sharp objects. Resistive touch screen panels are not affected by outside elements such as dust or water.

Surface wave: Surface wave technology uses ultrasonic waves that pass over the touch screen panel. When the panel is touched, a portion of the wave is absorbed. This change in the ultrasonic waves registers the position of the touch event and sends this information to the controller for processing. Surface wave touch screen panels are the most advanced of the three types, but they can be damaged by outside elements.

Capacitive: A capacitive touch screen panel is coated with a material that stores electrical charges. When the panel is touched, a small amount of charge is drawn to the point of contact. Circuits located at each corner of the panel measure the charge and send the information to the controller for processing. Capacitive touch screen panels must be touched with a finger unlike resistive and surface wave panels that can use fingers and stylus. Capacitive touch screens are not affected by outside elements and have high clarity.

Touch screen technology is introduced in variety of ways. In a daily life we find the use of touch screen, for example

- When we go to ATM machine to draw money we have to feed information this we can do by using the touch pad.
- For the business presentation to demonstrate the point and navigating by touching the display material.
- Touch screen is mostly user-friendly and make your work quick and easy.
- In shopping mall, touch screen is an important accessory as it makes the work easy for both customer and salesperson.
- In restaurant, menu placement, order point, booking system has been replaced with touch screen technology.



Joystick

A joystick is an input device that allows you to play games on the computer. It is an input device consisting of a stick that pivots on a base and translates its angle or direction as data. Joysticks are often used to control inputs in video games. a joystick is a cursor control device used in computer games and assistive technology . The joystick, which got its name from the control stick used by a pilot to control the ailerons and elevators of an airplane, is a hand-held lever that pivots on one end and transmits its coordinates to a computer. It often has one or more push-buttons, called switches, whose position can also be read by the computer.

Joystick elements: 1. stick, **2.** base, **3.** trigger, **4.** extra buttons, **5.** autofire switch, **6.** throttle, **7.** hat switch (POV hat), **8.** suction cup

A joystick is commonly used to control video games. Joysticks consist of a base and a stick that can be moved in any direction. The stick can be moved slowly or quickly and in different amounts. Some joysticks have sticks that can also be rotated to the left or right. Because of the flexible movements a joystick allows, it can provide much greater control than the keys on a keyboard.

Joysticks typically include several buttons as well. Most joysticks have at least one button on the top of the stick and another button in the front of the stick for the trigger. Many joysticks also include other buttons on the base that can be pressed using the hand that is not guiding the stick. Joysticks typically connect to your computer using a basic USB or serial port connection and often come with software that allows you to assign the function of each button.

Since joysticks emulate the controls of planes and other aircraft, they are best suited for flight simulators and flying action games. However, some gamers like to use joysticks for other types of video games, such as first-person shooters and fighting games. Others prefer using the basic keyboard and mouse, with which they are already accustomed to.

A joystick is a type of gaming controller that may mimic the appearance of an aircraft flight stick. One typically consists of a stick, mounted on a base of some kind, that can be articulated in two or three directions. One of the oldest control methods for video games, joysticks are prevalent on arcade machines and may also be available for home use. Most home video game systems have had a variety of joysticks available as optional peripherals, with older systems even using them as the primary controller. They are often sought out in

situations where a game requires precise inputs and a great deal of control, such as in flight simulators or games in the fighting genre.

While the joystick is typically an analog input device, digital versions have also existed. An analog joystick typically works by transmitting an angle reading to a video game system or computer. This way, the device can detect where the stick is moved, along both x and y axes, at any time. Models with a z axis are also able to transmit this additional date along with the x and y positions.
Analog joysticks often have what may be known as gates. These are a part of the movement mechanism, and allow the user of the stick to easily lock it into four or eight different cardinal positions. While the movement remains analog, this may be useful to some people that use a joystick for fighting-type games. Round gates may also be available, and it is often possible to modify a joystick with a different style of gate according to personal preference.

Digital joysticks operate in much the same way as the analog variety, though they are only capable of reporting that a movement has occurred, rather than the distance the stick was moved in that direction. These may still be capable of reporting in-between movements, such as an up-left movement, a down-right movement, or anything in between. They were commonly seen in many of the earliest home video game systems.

Many home computers may have a port that was originally designed specifically for a joystick connection. This port was later used for all kinds of game controllers, including console-like gamepads in addition to traditional joysticks. While most computers still have this port, modern joysticks may often be connected via universal serial bus (USB) or other ports, like IEEE 1394. Joysticks using these types of connections may include features like force feedback, with which the game can send a signal for the joystick to vibrate or resist movement.

SCANNER

A scanner is an input device that scans documents such as photographs and pages of text. When a document is scanned, it is converted into a digital format. This creates an electronic version of the document that can be viewed and edited on a computer.

Most scanners are flatbed devices, which means they have a flat scanning surface. This is ideal for photographs, magazines, and various documents. Most flatbed scanners have a cover that lifts up so that books and other bulky objects can also be scanned. Another type of scanner is a sheet-fed scanner, which can only accept paper documents. While sheet-fed scanners cannot scan books, some models include an automatic document feeder, or ADF, which allows multiple pages to be scanned in sequence.

Scanners work in conjunction with computer software programs, which import data from the scanner. Most scanners include basic scanning software that allows the user to configure, initiate, and import scans. Scanning plug-ins can also be installed, which allow various software programs to import scanned images directly. For example, if a scanner plug-in is

installed for Adobe Photoshop, a user can create new images in Photoshop directly from the connected scanner.

While Photoshop can edit scanned images, some programs like Acrobat and OmniPage can actually recognize scanned text. This technology is called optical character recognition, or OCR. Scanning software that includes OCR can turn a scanned text document into a digital text file that can be opened and edited by a word processor. Some OCR programs even capture page and text formatting, making it possible to create electronic copies of physical documents.

There are three major types of scanners in common use today: flatbed, film and drum. They have differing uses, strengths and weaknesses.

Flatbed Scanners

The most common scanners are flatbed scanners. These are a type of reflective scanner that commonly sits flat on a desk. Flatbed scanners are adapting at scanning pieces of paper, objects, photo prints, and other opaque items. Using a flatbed scanner is relatively simple. First you open the cover and set your subject on the glass surface, and close the cover. Usually you can then run the scanner software, tell the scanner what resolution to use for the scan and possibly set a few other simple preferences. The scanner will then begin scanning your subject. After the scan is complete, you can remove the subject from the surface. Some scanning software comes with simple editing tools, or you can edit your image by yourself.

Reflective flatbed scanners cannot scan transparent objects such as slide or negatives, however, unless they are equipped with a *transparency adapter*. A transparency adapter allows the scanner to shine light through the film. With a transparency adapter, a flatbed can scan slides and negatives. Generally speaking, the quality of such scans is not as good as those from dedicated film scanners or drum scanners. Some higher end flatbed scanners do a very passable job on films, however. For example, Epson has a number of higher end units such as the V750 that do a fine job on films, particularly when used with fluid mounting techniques.
Flatbed scanners can be very inexpensive, even with a transparency adapter. However, flatbed scanners with good film scanning capabilities are more expensive.

Film Scanners

Film scanners are specialized transmissive scanners made to scan film strips and mounted slides (negatives and positives). Film scanners have optics and electronics specifically catered to scanning film. Because of this specialization, film scanners achieve better results when scanning film than flatbed scanners. Some film scanners include feeder attachments that can make doing many scans easier and faster. Having an automatic feeder is very helpful for more extensive scanning work, such as a large slide collection. Only a few models of film scanners have this capability, and it is generally a fairly expensive optional attachment. Film scanners are relatively easy to operate.

Drum Scanners

The last type of scanner that we discuss here is the drum scanner. Drum scanners work differently than the other two types of scanners. Flatbed and film scanners rely on light from a source hitting a microchip called a CCD (Charged-Coupled Device). The drum scanner,

instead of a CCD, has a photo multiplier tube which is a type of vacuum tube that is highly sensitive to light. A beam of light, which can be focused quite small, is then moved across the image and the photo multiplier tube picks up the reflection. Drum scanners can generally scan any type of film.

Fluid Mounting

Film is mounted in the drum scanner using a special kind of oil, instead of simply inserted into the scanner. This use of *fluid mounting* reduces the effect of dust and scratches in the film and reduces the effect of the film grain structure. Fluid mounting can be used in some flatbed and film scanners, though this is rather uncommon because of the expense, effort and mess involved.
The table below summarizes a few of the key differences between flatbed, film and drum scanners.

Scanner Type	Scanner Expense	Difficulty of Operation	Flexibility	Film Scan Quality	Scan Speed	Batch Scanning Capabilities
Flatbed	Low to Moderate	Easy	High	OK Good (with fluid mounting)	Moderate	Minimal
Film	Moderate to High	Easy To Moderate	Low to Moderate	Very Good (better with fluid mounting)	Fast	Moderate (with feeder attachments)
Drum	High	Very Hard	Moderate	Excellent	Slow	None

Microphone

A Microphone (also called a mic or mike) is an input device that can be used in a computer for many different applications. One way to use a microphone is to record audio or video tutorials. Another use for a microphone is for performances such as karaoke or professional audio recording. A microphone is available as a hand-held model as well as a headset.

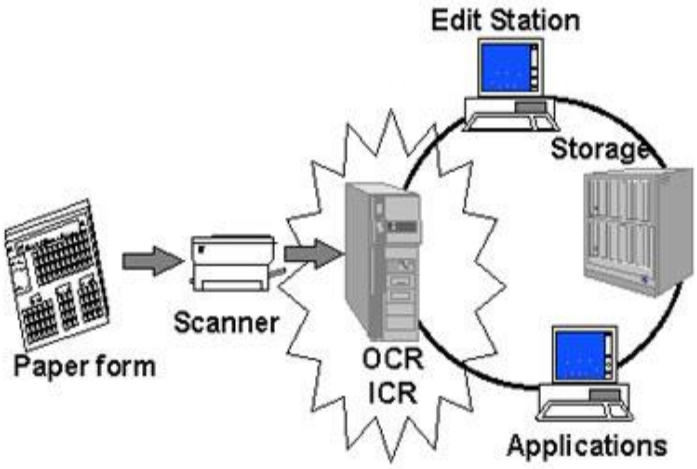
Microphones are used to input sound. In computing they can be used with voice recognition software and a word processing application to enter text. Webcams commonly have microphones built-in too.
Microphone allows a user to send audio signals to a computer for processing, recording, or carrying out commands. It also allow user to speak to the computer in order to record a voice message or navigate software. Microphones are used with line-in or microphone-in settings within a recording software package. Most operating systems, including Windows, come with basic recording capability built in. You can archive spoken messages, verbal notes, generate audio journals or make podcasts. You can also customize sound events on your operating system by making your own wave files.

The Microphone is a speech Input device. To operate it we require using a microphone to talk to the computer. Also we need to add a sound card to the computer. The Sound card digitizes

audio input into 0/1s .A speech recognition program can process the input and convert it into machine-recognized commands or input.

OCR

Optical character recognition, abbreviated as OCR, is used to convert images of text into machine editable text. It is the mechanical or electronic conversion of scanned images of handwritten, typewritten or printed text into machine-encoded text. It is widely used as a form of data entry from some sort of original paper data source, whether documents, sales receipts, mail, or any number of printed records. It is a common method of digitizing printed texts so that they can be electronically searched, stored more compactly, displayed on-line, and used in machine processes



OCR systems can recognize many different OCR fonts, as well as typewriter and computer-printed characters. Advanced OCR systems can recognize hand printing. When a text document is scanned into the computer, it is turned into a bitmap, which is a picture of the text. OCR software analyzes the light and dark areas of the bitmap in order to identify each alphabetic letter and numeric digit.

Advantages of OCR

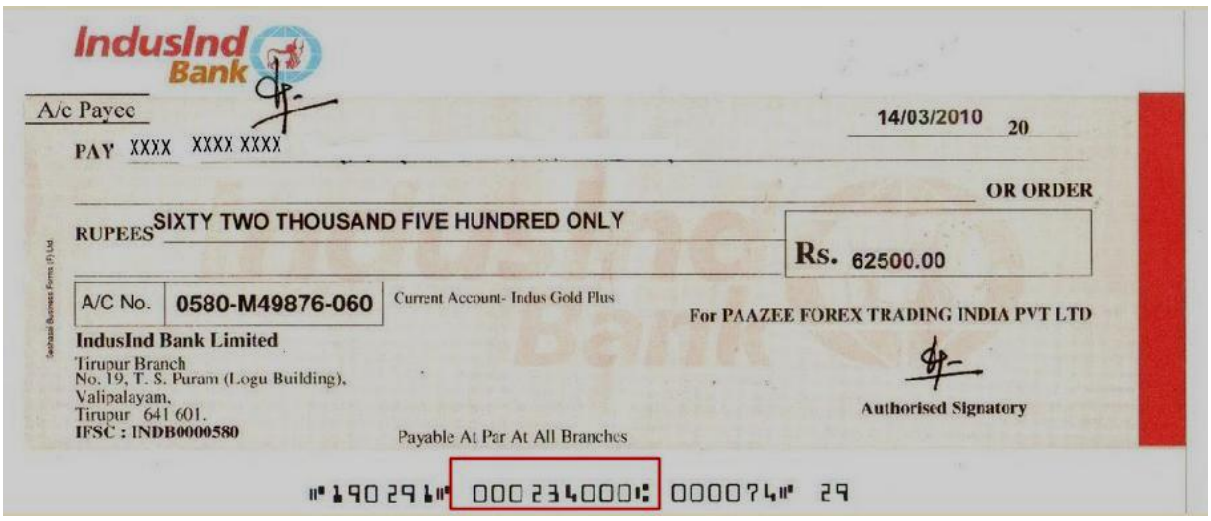
- OCR increases the efficiency and effectiveness of office work
- OCR makes documents 100% text-searchable – it is easy to search through documents for names, reference numbers, addresses etc.
- OCR allows to documents to be made editable, copy and paste from the document – whether in PDF format or MS Word file
- OCR is also known to boost staff morale due to their working environment being easier to work within and less paper-centric.

MICR

Magnetic Ink Character Recognition, or MICR, is a character recognition technology used primarily by the banking industry to facilitate the processing of cheques and makes up the routing number and account number at the bottom of a cheque. The technology allows computers to read information (such as account numbers) of printed documents. MICR is a method of character recognition which decodes the magnetic signature of each character. MICR uses magnetic ink in order to print routing and account numbers on the bottom of checks. The system was created in the 1950s by the American Bankers Association. MICR helps banks mechanize the process of check processing, which allows them to process large volumes of checks.

MICR characters are printed in the form of either an E-13B or CMC-7 Font. Each font series is made up of a series of numbers and symbols specifically designed for readability on cheque sorting machines which read at extremely high rates of speed. The symbols provide a

beginning and ending point for each group of numbers allowing the machine to quickly determine what each series of number signifies. Line placement, character placement, skew and quality are several critical components of printing MICR; the line must be precisely positioned in the MICR Clear Band area. To create consistency in the cheque clearing process it is critical that each character is readable and that the printing methods are reliable.
The MICR Code is a numeric code that uniquely identifies a bank-branch. This is a 9 digit code to identify the location of the bank branch; the first 3 characters represent the city, the next 3 the bank and the last 3 the branch. The MICR Code allotted to a bank branch is printed on the MICR band of cheque leaves issued by bank branches.



Advantages of MICR

Standardization: All cheques include the same standardized information, which includes the cheque number, the account number, and the routing number of the bank. Since all cheques within a country use the same font, banks are able to easily read the cheques.
Accuracy: The error rate when using MICR cheques is almost zero, which protects consumers and banks from routing funds to the wrong bank or pulling funds from the wrong account.
Speed*: Banks usually possess a larger MICR machine which will take stacks of cheques and sort them by their destination, as the sending bank will send the cheques to the receiving bank in order for the cheque to clear. The bank can then send out batches of cheques to the proper destination electronically or by mail.*
Fraud Prevention*:* The process for manufacturing cheques is extremely demanding, making it difficult for thieves to create a facsimile of a cheque. MICR also makes it difficult for a criminal to manipulate the E-13B numbers on an existing cheque.

➔OUTPUT DEVICES

Output is anything that comes out of a computer. Output can be meaningful information and it can appear in a variety of forms as binary numbers, characters, pictures, and as printed pages. This output is used by decision makers at all levels of an organization to solve a business problem or capitalize on a competitive opportunity. In addition, output from one computer system can be used as input into another, within the same information system. An output device is a hardware unit that represents information from a computer. Put it another way, any device that is capable of representing information on a computer is called an Output device. Output devices receive information from the CPU and present it to the user in the desired form.

An output device is any peripheral device that converts machine-readable information into people-readable form. Output devices communicate information to the user. Any device that outputs information from a computer is called an output device. Since most information from a computer is output in either a visual or auditory format, the most common output devices are the monitor and speakers. These two devices provide instant feedback to the user's input, such as displaying characters as they are typed or playing a song selected from a playlist.
While monitors and speakers are the most common output devices, there are many others. Some examples include headphones, printers, projectors, lighting control systems, audio recording devices, and robotic machines. A computer without an output device connected to it is pretty useless, since the output is what we interact with.

VISUAL DISPLAY UNIT

A VDU (Visual Display Unit) displays images generated by a computer or other electronic device. The term VDU is often used synonymously with "monitor," but it can also refer to another type of display, such as a digital projector. Visual display units may be peripheral devices or may be integrated with the other components. For example, the Apple iMac uses an all-in-one design, in which the screen and computer are built into a single unit.
Early VDUs were primarily cathode ray tube (CRT) displays and typically had a diagonal size of 13 inches or less. During the 1990s, 15" and 17" displays became standard, and some manufacturers began producing displays over 20" in size. At the turn of the century, flat panel displays became more common, and by 2006, CRT displays were hard to find.
Today, it is common for computers to come with VDUs that are 20" to 30" in size. Today we have LCD, plasma, and LED technology, resulting in manufacturing of large screens is much more cost effective than before.

MONITOR

The term "monitor" is often used synonymously with "computer screen" or "display." The monitor displays the computer's user interface and open programs, allowing the user to interact with the computer, typically using the keyboard and mouse.
Older computer monitors were built using cathode ray tubes (CRTs), which made them rather heavy and caused them to take up a lot of desk space. Most modern monitors are built using LCD technology and are commonly referred to as flat screen displays. These thin monitors take up much less space than the older CRT displays.

Monochrome Monitors

A monochrome monitor has two colors, one for foreground and the other for background. The colors can be white, amber or green on a dark (black) background. The monochrome monitors display both text and graphics modes.

Color Monitors

A color monitor is a display peripheral that displays more than two colors. Color monitors have been developed through the following paths.

- **CGA:** This stands for *Color Graphics Adapter*. It is a circuit board introduced by IBM and the first graphics standard for the IBM PC. With a CGA monitor, it is harder to read than with a monochrome monitor, because the CGA (320 X 200) has much fewer pixels than the monochrome monitor (640 X 350). It supports 4 colors.
- **EGA:** It stands for *Enhanced Graphics Adapter*. EGA is a video display standard that has a resolution of 640 by 350 pixels and supports 16 colors. EGA supports previous display modes and requires a new monitor.
- **VGA:** VGA stands for *Video Graphics Array*. This is a video display standard that provides medium to high resolution. In a text mode, the resolution of this board is 720 by 400 pixels. It supports 16 colors with a higher resolution of 640 by 480 pixels and 256 colors with 320 X 200 pixels.
- **Super VGA:** This is a very high resolution standard that displays up to 65,536 colors. Super VGA can support a 16.8 million colors at 800 by 600 pixels and 256 colors at 1024 by 768 pixels. A high-priced super VGA allows 1280 by 1024 pixels. Larger monitors (17" or 21" and larger) with a high resolution of 1600 by 1280 pixels are available. *VESA* (*Video Electronics Standards Association*) has set a standard for super VGA.

There are two forms of display: *cathode-ray tubes* (CRTs) and *flat-panel display*.

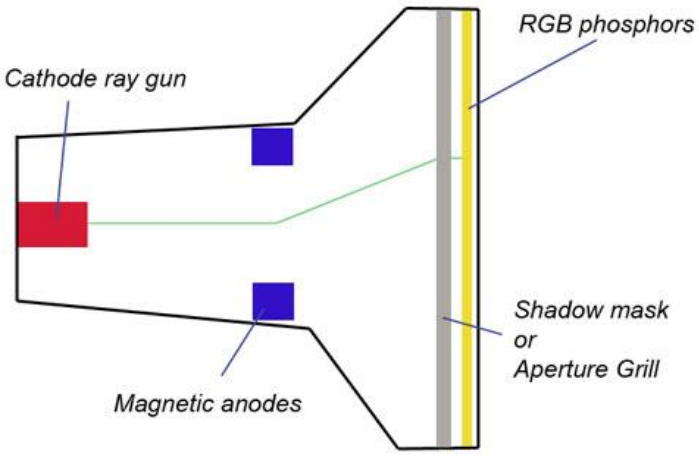
Cathode Ray Tube (**CRT**)

CRT is the technology used in traditional computer monitors and televisions. The image on a CRT display is created by firing electrons from the back of the tube to phosphors located towards the front of the display. Once the electrons hit the phosphors, they light up and are projected on the screen. The color you see on the screen is produced by a blend of red, blue, and green light, often referred to as RGB.

The stream of electrons is guiding by magnetic charges, which is why you may get interference with unshielded speakers or other magnetic devices that are placed close to a CRT monitor. CRT displays are still used by graphics professionals because of their vibrant and accurate color,

A *CRT* is a vacuum tube used as a display screen for a computer output device. Although the CRT means only a tube, it usually refers to all monitors. IBM and IBM compatible microcomputers operate two modes unlike Macintosh based entirely on graphics mode. They are a text mode and a graphics mode. Application programs switch computers into appropriate display mode

CRTs receive their picture through an analogue cable, and that signal is decoded by the display controller, which handles the internal components of the monitor - think of it as the mini-CPU for the monitor. CRTs have a distinctive funnel shape. At the very back of a monitor is an electron gun. The electron gun fires electrons towards the front through a vacuum which exists in the tube of the monitor. The gun can also be referred to as a cathode - hence the electrons fired forward are called Cathode Rays. These rays correspond to to the red, green and blue channels of the display and video card. At the neck of the funnel-shaped monitor is an anode, which is magnetized according to instructions from the display controller. As electrons pass the anode, they are shunted or pulled in one direction or the other depending on how magnetic the anode is at that time. This moves the electrons towards the correct part of the screen.



The electrons pass through a mesh, and this mesh defines the individual pixels and resolution on the screen. Electrons that pass through the mesh then hit the phosphor coating which is on the inside of the glass screen. When the particles hit the phosphor, they immediately light up - causing the light to shine through the front of the monitor, thus making up the picture on the screen. There are three differently coloured phosphorus for each pixel (known as phosphor triads), and depending on which phosphor the electron hits, that's which colour the pixel will light up.

LCD

LCDs (Liquid Crystal Display) are super-thin displays that are used in laptop computer screens and flat panel monitors. Smaller LCDs are used in handheld TVs, PDAs, and portable video game devices. The image on an LCD screen is created by sandwiching an electrically reactive substance between two electrodes. This color of this substance can be changed by increasing or reducing the electrical current. Since LCD screens are based on the principle of blocking light (rather than emitting it), they use up much less power than standard CRT (Cathode-Ray Tube) monitors.

LCD is a display technology that creates characters by means of reflected light and is commonly used in digital watches and laptop computers. LCDs replaced LEDs (light emitting diodes) because LCDs use less power. LCDs are difficult to read in a strong light, because they do not emit their own light. Portable computers wanted to have brighter and easier to read displays. Backlit LCDs are used for the purpose now.

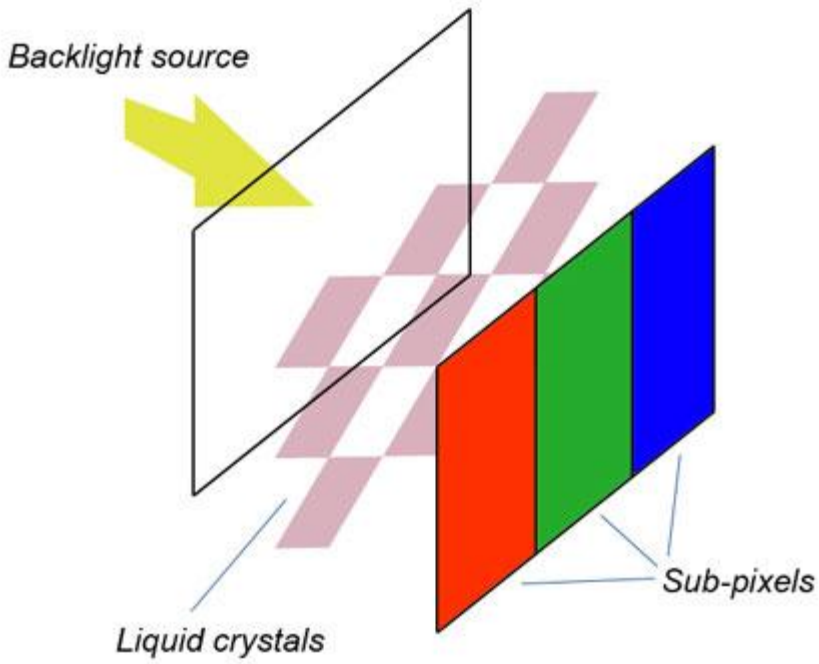


Fig. Perspective view

PRINTER

A printer is an external hardware device responsible for taking computer data and generating a hard copy of that data. Printers are one of the most commonly used peripherals and they print text and still images on the paper. A printer is an output device that produces text and graphics on a physical medium such as paper (a *hard copy* of data). Printed information is often called hard copy because the information exists physically and is a more permanent form of output than that presented on a VDU (Monitor).
Printers can be classified into different types in several ways.

First, the printers can be divided into three categories by the way they print.

- **Serial Printers**: Also called a character printer. Print a single character at a time. They are usually inexpensive and slow.
- **Line Printers**: Print a line at a time. They are expensive and very fast. Line printers use a band, a chain, etc.
- **Page Printers**: Also called a laser printer. Print a page at a time. They usually use a laser to produce page images. Quality is best. This is a little bit expensive, but the price of the personal laser printer is decreasing.

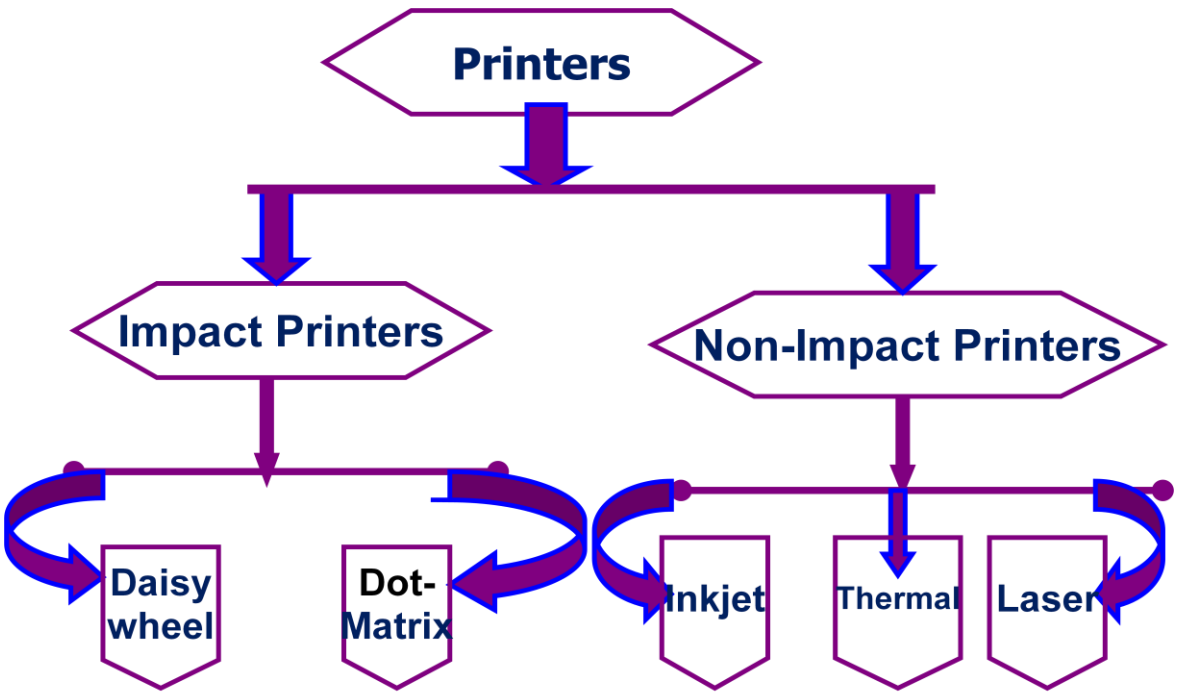
Second, printers can be classified into two forms according to the use of a hammer.

- **Impact Printers**: Hammer hits ribbons, papers or print head. Dot-matrix and daisy-wheel printers are the example. Noisy.

- **Nonimpact Printers**: They do not have the hammer and do not hit. An example is an ink-jet and laser printer.

Another classification can be made by the way they form characters.

- **Bit-Mapped Printers**: Images are formed from groups of dots and can be placed anywhere on the page. They have many printing options and good printing quality. They use *PostScript* as a standard language for instructing a microcomputer.
- **Character-based Printers**: Printer print characters into the lines and columns of a page. These printers use predefined set of characters and are restricted in position of characters.



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Impact Printer

These printers have a mechanism that touches the paper to create an image. These printers work by banging a print head containing a number of metal pins which strike an inked ribbon placed between the print head and the paper.

Non-Impact Printers

These printers create an image on the print medium without the use of force. They don't touch the paper while creating an image. Non-impact printers are much quieter than impact printers as they don't strike the paper.

Daisy-Wheel Printer

Daisy-Wheel is a printer mechanism that uses any kind of hub (wheel) having a set of spokes at the margin of the hub. The wheel can be removed to use a different character set. The end of each spoke is a raised image of a type character. When the wheel is turned and the required character is aligned to the print hammer, the character is then struck into a ribbon and onto a paper with the hammer.
Daisy-Wheel Printer prints typewriter-like very high quality characters. However, they are slower and less reliable than dot-matrix printers. Microcomputer users seldom use this printer, because the better dot-matrix printers and inexpensive laser printers are available today.

Dot-Matrix Printer

Dot-matrix printers are printers that write characters and form graphic images using one or two columns of tiny dots on a print head. The dot hammer moving serially across the paper strikes an inked-ribbon and creates images on paper. Dot matrix printers are popular printers used with microcomputers, because the printers are highly reliable and inexpensive. They are used for tasks where a high-quality image is not essential. Many users, however, move from dot printers to laser printers, because the price of laser printers is falling down. Several kinds of dot matrix printers are available with print heads that have 7, 9, 18, or 24 pins.

Ink-Jet Printer

Ink-jet is a printer mechanism that sprays one or more color of ink at high speed onto the paper and produces high-quality printing. This printer also produces color printing as well as high-quality image. That is, ink-jet printers can be used for variety of color printing at a relatively low cost. Ink-jet printing has two methods: Continuous stream method and drop-on- demand method.

Thermal Printer

Thermal printers are in-expensive printers mostly used in fax machines. The Thermal printers are further classified into two types.

- **Electro thermal printers** is a printer that uses heated pins to "burn" images onto heat-sensitive paper. These printers are commonly used in calculators and fax machines; and although they are inexpensive and print relatively fast, they produce low resolution print jobs.
- **Thermal Wax printers** is a high quality printer invented by Jack Kilby that commonly utilizes a thermal wax ribbon that melts a colored wax onto the paper creating near photo-realistic images.

Laser Printer

A *laser printer* is a printer that uses the electrophotograpic method used in a copy machine. The printer uses a laser beam light source to create images on a photographic drum. Then the images on the drum are treated with a magnetically charged toner and then are transferred onto a paper. A heat source is usually applied to make the images adhere. In 1984, Hewlett-Packard introduced the first desktop laser printer, called the LaserJet. The laser printer revolutionized personal computer printing and has spawned desktop publishing. The laser printer produces high-resolution letters and graphics quality images, so it is adopted in applications requiring high-quality output. Although a high-priced colour laser printer is also available in the market, a less expensive, desktop gray scale laser printer is widely used. Recently, the laser printer is gaining its market share dramatically, mainly because the lowered price and the quality

➔MEMORY

All of the components in your computer, such as the CPU, the hard drive and the operating system, work together as a team, and memory is one of the most essential parts of this team. From the moment you turn your computer on until the time you shut it down, your CPU is constantly using memory. The term "memory" can be used for anything in a computer that stores data, even temporarily.

Characteristics of Memory

The main characteristics of a memory are:

- **Capacity**, representing the global volume of information (in bits) that the memory can store
- **Access time**, corresponding to the time interval between the read/write request and the availability of the data
- **Cycle time**, representing the minimum time interval between two successive accesses
- **Throughput**, which defines the volume of information exchanged per unit of time, expressed in bits per second
- **Non-volatility**, which characterizes the ability of a memory to store data when it is not being supplied with electricity
- The ideal memory has a large capacity with restricted access time and cycle time, a high throughput and is non-volatile. However, fast memories are also the most expensive. This is why memories that use different technologies are used in a computer, interfaced with each other and organised hierarchically. The fastest memories are located in small

numbers close to the processor. Auxiliary memories, which are not as fast, are used to store information permanently.

The following terms are most commonly used for identifying comparative behaviour of various memory devices and technologies.

Storage Capacity: It is a representative of the size of the memory. The capacity of internal memory and main memory can be expressed in terms of number of words or bytes. The storage capacity of external memory is normally measured in terms of bytes.

Access Modes: A memory is considered to consist of various memory locations. The information from these memory locations can be accessed in the following ways:

- **Random Access :** It is the mode in which and memory location can be accessed in any order in the same amount of time. Ferrite and Semiconductor memories, which generally constitute main memory, are of this nature. The storage locations can be accessed independently and there exist separate access mechanism for each location.

- **Sequential Access**: On the other hand we have memories which can be accessed in a pre-defined sequence for example, the songs stored on a cassette can be accessed only one by one. The example of sequential access memory is Magnetic Tape. Here the access mechanism needs to be shared among different locations. Thus, either the location or the read/write head or both should be moved to access the desired location.
- **Direct Access:** In certain cases the information is neither accessed randomly nor in sequence but something in between. In direct access, a separate read/write head exist for a track and on a track the information can be accessed serially. This semi-random mode of operations exists in magnetic disks.

Access Time: The access time is the time required between the request made for a read or write operation till the time the data is made available or written at the requested location. Normally it is measured for read operation. The access time depends on the physical characteristics and access mode used for that device.

TYPES OF MEMORY

We know that the term "memory" applies to any electronic component capable of temporarily storing data. There are two main categories of memories:

- **Internal Memory** that temporarily stores data while programs are running. Internal memory is volatile in nature, i.e. the data in this type of memory gets lost once we switch of the computer. Example of internal memory is RAM (Random Access Memory)
- **External Memory** (also called physical memory or auxiliary memory) that stores information over the long term, including after the computer is turned off. External memory corresponds to magnetic storage devices such as the hard drive, optical storage devices such as CD-ROMs and DVD-ROMs, as well as read-only memories.

We can also differentiate computer memory as: primary and secondary. Primary memory is accessible directly by the processing unit. RAM is an example of primary memory. As soon as the computer is switched off the contents of the primary memory is lost. You can store and

retrieve data much faster with primary memory compared to secondary memory. Primary memory is more expensive than secondary memory. Because of this the size of primary memory is less than that of secondary memory. Computer memory is used to store two things: i) instructions to execute a program and ii) data. When the computer is doing any job, the data that have to be processed are stored in the primary memory. This data may come from an input device like keyboard or from a secondary storage device like a floppy disk.

PRIMARY MEMORY

Random Access Memory (RAM) The primary storage is referred to as Random Access Memory (RAM) because it is possible to randomly select and use any location of the memory directly store and retrieve data. It takes same time to any address of the memory. It is also called read/write memory. The storage of data and instructions inside the primary storage is temporary i.e. it loses its contents as soon as the power to the computer is switched off. The memories, which lose their content on failure of power supply, are known as volatile memories .So now we can say that RAM is volatile memory.
There are two types of Random Access Memory or RAM, Static RAM (SRAM) and Dynamic RAM (DRAM) each has its own advantages and disadvantages compared to the other. Both holds data but, in a different ways. DRAM requires the data to be refreshed periodically in order to retain the data. SRAM does not need to be refreshed as the transistors inside would continue to hold the data as long as the power supply is not cut off. Here we compare the two:

- SRAM is faster compared to DRAM.
- SRAM consumes less power than DRAM.
- SRAM uses more transistors per bit of memory compared to DRAM.
- SRAM is more expensive than DRAM.
- Cheaper DRAM is used in main memory while SRAM is commonly used in cache memory.

Typically, a desktop system will have no more than a few megabytes of SRAM, but hundreds or thousands of megabytes of DRAM.

Read Only Memory (ROM) There is another memory in computer, which is called Read Only Memory (ROM). The storage of program and data in the ROM is permanent. The ROM stores some standard processing programs supplied by the manufacturers to operate the personal computer. The ROM can only be read by the CPU but it cannot be changed. The basic input/output program is stored in the ROM that examines and initializes various equipment attached to the PC when the switch is made ON. The memories, which do not lose their content on failure of power supply, are known as non-volatile memories. ROM is non-volatile memory.

PROM There is another type of primary memory in computer, which is called Programmable Read Only Memory (PROM). You know that it is not possible to modify or erase programs stored in ROM, but it is possible for you to store your program in PROM chip. Once the programmes are written it cannot be changed and remain intact even if power is switched off. Therefore programs or instructions written in PROM or ROM cannot be erased or changed.

EPROM This stands for Erasable Programmable Read Only Memory, which overcome the problem of PROM & ROM. EPROM chip can be programmed time and again by erasing the information stored earlier in it. Information stored in EPROM exposing the chip for some time ultraviolet light and it erases chip is reprogrammed using a special programming facility. When the EPROM is in use information can only be read.

Cache Memory The speed of CPU is extremely high compared to the access time of main memory. Therefore the performance of CPU decreases due to the slow speed of main memory. To decrease the mismatch in operating speed, a small memory chip is attached between CPU and Main memory whose access time is very close to the processing speed of CPU. It is called CACHE memory. CACHE memories are accessed much faster than conventional RAM. It is used to store programs or data currently being executed or temporary data frequently used by the CPU. So each memory makes main memory to be faster and larger than it really is. It is also very expensive to have bigger size of cache memory and its size is normally kept small.

Registers The CPU processes data and instructions with high speed; there is also movement of data between various units of computer. It is necessary to transfer the processed data with high speed. So the computer uses a number of special memory units called registers. They are not part of the main memory but they store data or information temporarily and pass it on as directed by the control unit.

SECONDARY MEMORY

The operating speed of primary memory or main memory should be as fast as possible to cope up with the CPU speed. These high-speed storage devices are very expensive and hence the cost per bit of storage is also very high. Also the storage capacity of the main memory is very limited. Often it is necessary to store hundreds of millions of bytes of data for the CPU to process. Therefore additional memory is required in all the computer systems. This memory is called auxiliary memory or secondary storage. In this type of memory the cost per bit of storage is low. However, the operating speed is slower than that of the primary storage. Huge volume of data are stored here on permanent basis and transferred to the primary storage as and when required. Most widely used secondary storage devices are magnetic tapes and magnetic disk.

Magnetic Tape Magnetic tapes are used for large computers like mainframe computers where large volume of data is stored for a longer time. In PC also you can use tapes in the form of cassettes. The cost of storing data in tapes is inexpensive. Tapes consist of magnetic materials that store data permanently. It can be 12.5 mm to 25 mm wide plastic film-type and 500 meter to 1200 meter long which is coated with magnetic material. The deck is connected to the central processor and information is fed into or read from the tape through the processor. It similar to cassette tape recorder.

Advantages of Magnetic Tape

a. **Compact**: A 10-inch diameter reel of tape is 2400 feet long and is able to hold 800, 1600 or 6250 characters in each inch of its length. The maximum capacity of such tape is 180 million characters. Thus data are stored much more compactly on tape.

b**. Economical:** The cost of storing characters is very less as compared to other storage devices.

c. **Fast**: Copying of data is easier and fast.

d. **Long term Storage and Re-usability**: Magnetic tapes can be used for long term storage and a tape can be used repeatedly without loss of data.

Magnetic Disk

You might have seen the gramophone record, which is circular like a disk and coated with magnetic material. Magnetic disks used in computer are made on the same principle. It rotates with very high speed inside the computer drive. Data is stored on both the surface of the disk. Magnetic disks are most popular for direct access storage device. Each disk consists of a number of invisible concentric circles called tracks. Information is recorded on tracks of a disk surface in the form of tiny magnetic spots. The presence of a magnetic spot represents one bit and its absence represents zero bit. The information stored in a disk can be read many times without affecting the stored data. So the reading operation is non-destructive. But if you want to write a new data, then the existing data is erased from the disk and new data is recorded.

Floppy Disk

It is similar to magnetic disk discussed above. They are 5.25 inch or 3.5 inch in diameter. They come in single or double density and recorded on one or both surface of the diskette. The capacity of a 5.25-inch floppy is 1.2 mega bytes whereas for 3.5 inch floppy it is 1.44 mega bytes. It is cheaper than any other storage devices and is portable. The floppy is a low cost device particularly suitable for personal computer system.

Optical Disk

With every new application and software there is greater demand for memory capacity. It is the necessity to store large volume of data that has led to the development of optical disk storage medium. Optical disks can be divided into the following categories:

a. **Compact Disk/ Read Only Memory (CD-ROM)**: CD-ROM disks are made of reflective metals.

CD-ROM is written during the process of manufacturing by high power laser beam. Here the storage density is very high, storage cost is very low and access time is relatively fast. Each disk is approximately 4 1/2 inches in diameter and can hold over 600 MB of data. As the CD-ROM can be read only we cannot write or make changes into the data contained in it.

b. **Write Once, Read Many (WORM):** The inconvenience that we cannot write anything in to a CD-ROM is avoided in WORM. A WORM allows the user to write data permanently on to the disk. Once the data is written it can never be erased without physically damaging the disk. Here data can be recorded from keyboard, video scanner, OCR equipment and other devices. The advantage of WORM is that it can store vast amount of data amounting to gigabytes (109 bytes). Any document in a WORM can be accessed very fast, say less than 30 seconds.

c. **Erasable Optical Disk**: These are optical disks where data can be written, erased and rewritten.

This also applies a laser beam to write and re-write the data. These disks may be used as alternatives to traditional disks. Erasable optical disks are based on a technology known as magnetic optical (MO). To write a data bit on to the erasable optical disk the MO drive's laser beam heats a tiny, precisely defined point on the disk's surface and magnetises it.

➔Computer - Hardware

Hardware represents the physical and tangible components of a computer i.e. the components that can be seen and touched.

Examples of Hardware are following:

- **Input devices --** keyboard, mouse etc.
- **Output devices --** printer, monitor etc.
- **Secondary storage devices --** Hard disk, CD, DVD etc.
- **Internal components --** CPU, motherboard, RAM etc.

Relationship between Hardware and Software

- Hardware and software are mutually dependent on each other. Both of them must work together to make a computer produce a useful output.
- Software cannot be utilized without supporting hardware.
- Hardware without set of programs to operate upon cannot be utilized and is useless.
- To get a particular job done on the computer, relevant software should be loaded into the hardware
- Hardware is a one-time expense.
- Software development is very expensive and is a continuing expense.
- Different software applications can be loaded on a hardware to run different jobs.
- A software acts as an interface between the user and the hardware.
- If hardware is the 'heart' of a computer system, then software is its 'soul'. Both are complimentary to each other.

➔Computer - 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

System Software

Application Software

System Software

The system software is collection of programs designed to operate, control, and extend the processing capabilities of the computer itself. System software are generally prepared by computer manufactures. 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 hardware and the end users.

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

Features of system software are as follows:

- Close to system
- Fast in speed
- Difficult to design

- Difficult to understand
- Less interactive
- Smaller in size
- Difficult to manipulate
- Generally written in low-level language

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 a Microsoft's notepad for writing and editing 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 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:

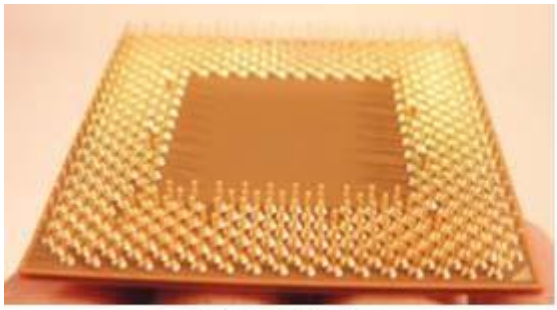
- Close to user
- Easy to design
- More interactive
- Slow in speed
- Generally written in high-level language
- Easy to understand
- Easy to manipulate and use
- Bigger in size and requires large storage space

➔Central Processing Unit (CPU)

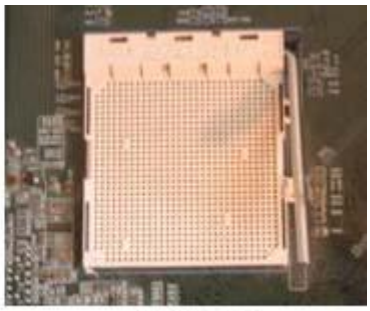
The Central Processing Unit (Normally called a processor or CPU) is the brain of the PC. It executes instructions, allowing a computer to perform all kinds of tasks. From burning CDs or DVDs to something as simple as a mouse click, the CPU is always at work. Processors consist of two parts: The Arithmetic Unit, which performs math and logical operations, & the Control Unit, which decodes instructions. Over the years, processors have become extremely fast. AMD and Intel are the two primary manufacturers.

CPU technology constantly changes, probably faster than any other type of hardware.When looking at a CPU, you don't really see the processor itself. The little piece of silicon that contains the circuitry is very small. What you actually see is the package that it's in. Both AMD and Intel have had many types over the years. Packages are usually square with pins underneath that fit into holes on the CPU's slot. This arrangement is known as Pin Grid Array (PGA) and is now

only used by AMD.



PGA Processor



PGA Slot

Intel abandoned PGA years ago and now have the pins located on the slots themselves, called Land Grid Array (LGA).

LGA Processor

LGA Slot

Dual Core & Multicore Processors:
Most computer processors today are dual core or multicore. Both terms are generic for any processor that literally contains two or more CPUs in one package. Both Intel and AMD produce versions of these processors. AMD's Athlon x2, Turion x2, and Intel's Core 2 Duo and Core 2 Extreme are examples of dual core CPUs. Multicore examples are the AMD Phenom x3 and x4 and Intel's Core 2 Quad and the Core i7. These powerful CPUs allow users to run several applications simultaneously as well as play the latest games.

Core i3 Series

Intel's Core i3 processor line has always been a budget option. These processors remain dual-core, unlike the rest of the Core line, which is made up of quad core processors. Intel's Core i3 processors also have many features restricted.

The main feature that is kept from the Core i3 processors is Turbo Boost, the dynamic overclocking available on most Intel processors. This, alongside with the dual-core design, accounts for most of the performance difference between Core i3 processors and the i5 and i7 options.

Core i3 processors also lack Intel's vPro technology virtualization and AES encryption acceleration technology. These are features unlikely to appeal to your average user anyway, and are instead targeted towards enterprise users. Still, the lack of these features should be kept in mind.

One feature that Core i3 has - and i5 doesn't - is hyper-threading. This is Intel's logic-core duplication technology which allows each physical core to be used as two logic cores. The result of this is that Windows will display a dual-core Core i3 processor as if it were a quad-core.

Finally, Core i3 processors have their integrated graphics processor restricted to a maximum clock speed of 1100 MHz, and all Core i3 processors have the 2000 series IGP, which is restricted to 6 execution cores. This will result in slightly lower IGP performance overall, but the difference is frankly inconsequential in many situations.

Core i5 Series

Intel used to split the Core i5 processor brand into two different lines, one of which was dual-core and one of which was quad-core. This was, needless to say, a bit confusing for buyers.

Thankfully, the behavior has stopped (for now). All Sandy Bridge Core i5 processors are quad-core processors, they all have Turbo Boost, and they all lack Hyper-Threading. Most of the Core i5 processors, besides the K series (explained later) us the same 2000 series IGP with a maximum clock speed of 1100 MHz and six execution cores.

In the i3 vs i5 vs i7 battle, the Core i5 processor is now obviously the main-stream option no matter which product you buy. The only substantial difference between the Core i5 options is the clock speed, which ranges from 2.8 GHz to 3.3 GHz. Obviously, the products with a quicker clock speed are more expensive than those that are slower.

Core i7 Series

The Intel Core i7 series has also been cleaned up. In fact, it has perhaps been cleaned up too much, because at the moment Intel is offering only two Sandy Bridge Core i7 processors.

These processors are virtually identical to the Core i5. They have a 100 MHz higher base clock speed, which is inconsequential in most situations. The real feature difference is the addition of hyper-threading on the Core i7, which means that the processor will appear as an 8-core processor in Windows. This improves threaded performance and can result in a substantial boost if you're using a program that is able to take advantage of 8 threads.

Of course, most programs can't take advantage of 8 threads. Those that can are almost usually meant for enterprise or advanced video editing applications - 3D rendering programs, photo editing programs, and scientific programs are categories of software frequently designed to use 8 threads. The average user is unlikely to see the full benefit of the hyper-threading feature. In the Core i3 vs i5 vs i7 battle, the i7 has limited appeal.

The IGP on Core i7 processors can also reach a higher maximum clock speed of 1350 MHz. As I've said before, however, this difference is largely inconsequential when measuring real-world performance.

The Core i3, i5 and i7 are among Intel's fastest processors, but they vary in terms of features, performance and price. Finding the best Intel Core CPU requires that you take a look at all of the options and the different performance and features they offer.

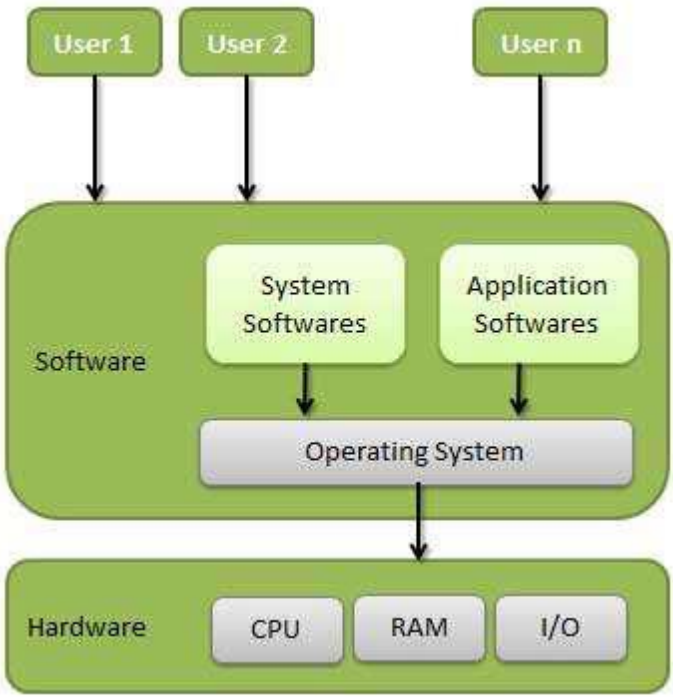
UNIT II

An operating System (OS) is an intermediary between users and computer hardware. It provides users an environment in which a user can execute programs conveniently and efficiently.

In technical terms, it is software which manages hardware. An operating System controls the allocation of resources and services such as memory, processors, devices and information.

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 access directly by the CPU. So for a program to be executed, it must in the main memory. Operating System does the following activities for memory management.

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

Processor Management

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

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

Device Management

OS manages device communication via their respective drivers. Operating System 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 thedevice 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. 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 Operating System does.

- Security-- By means of password and similar other techniques, preventing 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 software and users-- Coordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

➔Components of Operating System

Even though, not all systems have the same structure many modern operating systems share the same goal of supporting the following types of system components.

Process Management

The operating system manages many kinds of activities ranging from user programs to system programs like printer spooler, name servers, file server etc. Each of these activities is encapsulated in a process. A process includes the complete execution context (code, data, PC, registers, OS resources in use etc.).

It is important to note that a process is not a program. A process is only ONE instant of a program in execution. There are many processes can be running the same program. The five major activities of an operating system in regard to process management are

- Creation and deletion of user and system processes.
- Suspension and resumption of processes.
- A mechanism for process synchronization.
- A mechanism for process communication.
- A mechanism for deadlock handling.

Main-Memory Management

Primary-Memory or Main-Memory is a large array of words or bytes. Each word or byte has its own address. Main-memory provides storage that can be access directly by the CPU. That is to say for a program to be executed, it must in the main memory.

The major activities of an operating in regard to memory-management are:

- Keep track of which part of memory are currently being used and by whom.
- Decide which process are loaded into memory when memory space becomes available.
- Allocate and deallocate memory space as needed.

File Management

A file is a collected of related information defined by its creator. Computer can store files on the disk (secondary storage), which provide long term storage. Some examples of storage media are magnetic tape, magnetic disk and optical disk. Each of these media has its own properties like speed, capacity, data transfer rate and access methods.

A file systems normally organized into directories to ease their use. These directories may contain files and other directions.

The five main major activities of an operating system in regard to file management are

1. The creation and deletion of files.
2. The creation and deletion of directions.
3. The support of primitives for manipulating files and directions.
4. The mapping of files onto secondary storage.
5. The back up of files on stable storage media.

I/O System Management

I/O subsystem hides the peculiarities of specific hardware devices from the user. Only the device driver knows the peculiarities of the specific device to whom it is assigned.

Secondary-Storage Management

Generally speaking, systems have several levels of storage, including primary storage, secondary storage and cache storage. Instructions and data must be placed in primary storage or cache to be referenced by a running program. Because main memory is too small to accommodate all data and programs, and its data are lost when power is lost, the computer system must provide secondary storage to back up main memory. Secondary storage consists of tapes, disks, and other media designed to hold information that will eventually be accessed in primary storage (primary, secondary, cache) is ordinarily divided into bytes or words consisting of a fixed number of bytes. Each location in storage has an address; the set of all addresses available to a program is called an address space.

The three major activities of an operating system in regard to secondary storage management are:

1. Managing the free space available on the secondary-storage device.
2. Allocation of storage space when new files have to be written.
3. Scheduling the requests for memory access.

Networking

A distributed systems is a collection of processors that do not share memory, peripheral devices, or a clock. The processors communicate with one another through communication lines called network. The communication-network design must consider routing and connection strategies, and the problems of contention and security.

Protection System

If a computer systems has multiple users and allows the concurrent execution of multiple processes, then the various processes must be protected from one another's activities. Protection refers to mechanism for controlling the access of programs, processes, or users to the resources defined by a computer systems.

Command Interpreter System

A command interpreter is an interface of the operating system with the user. The user gives commands with are executed by operating system (usually by turning them into system calls). The main function of a command interpreter is to get and execute the next user specified command. Command-Interpreter is usually not part of the kernel, since multiple command interpreters (shell, in UNIX terminology) may be support by an operating system, and they do not really need to run in kernel mode. There are two main advantages to separating the command interpreter from the kernel.

1. If we want to change the way the command interpreter looks, i.e., I want to change the interface of command interpreter, I am able to do that if the command interpreter is separate from the kernel. I cannot change the code of the kernel so I cannot modify the interface.
2. If the command interpreter is a part of the kernel it is possible for a malicious process to gain access to certain part of the kernel that it showed not have to avoid this ugly scenario it is advantageous to have the command interpreter separate from kernel.

➔Types of Operating System

Operating systems are there from the very first computer generation. Operating systems keep evolving over the period of time. Following are few of the important types of operating system which are most commonly used.

Batch operating system

The users of batch operating system do not interact with the computer directly. Each user prepares his job on an off-line device like punch cards and submits it to the computer operator. To speed up processing, jobs with similar needs are batched together and run as a group. Thus, the programmers left their programs with the operator. The operator then sorts programs into batches with similar requirements. The problems with Batch Systems are following.

- Lack of interaction between the user and job.

- CPU is often idle, because the speeds of the mechanical I/O devices are slower than CPU.

- Difficult to provide the desired priority.

Time-sharing operating systems

Time sharing is a technique which enables many people, located at various terminals, to use a particular computer system at the same time. Time-sharing or multitasking is a logical extension of multiprogramming. Processor's time which is shared among multiple users simultaneously is termed as time-sharing. The main difference between Multiprogrammed Batch Systems and Time-Sharing Systems is that in case of multiprogrammed batch systems, objective is to maximize processor use, whereas in Time-Sharing Systems objective is to minimize response time. Multiple jobs are executed by the CPU by switching between them, but the switches occur so frequently. Thus, the user can receive an immediate response. For example, in a transaction processing, processor execute each user program in a short burst or quantum of computation. That is if n users are present, each user can get time quantum. When the user submits the command, the response time is in few seconds at most.

Operating system uses CPU scheduling and multiprogramming to provide each user with a small portion of a time. Computer systems that were designed primarily as batch systems have been modified to time-sharing systems.

Advantages of Timesharing operating systems are following

- Provide advantage of quick response.
- Avoidsduplication of software.
- Reduces CPU idle time.

Disadvantages of Timesharing operating systems are following.

- Problem of reliability.
- Question of security and integrity of user programs and data.
- Problem of data communication.

Distributed operating System

Distributed systems use multiple central processors to serve multiple real time application and multiple users. Data processing jobs are distributed among the processors accordingly to which one can perform each job most efficiently.

The processors communicate with one another through various communication lines (such as high-speed buses or telephone lines). These are referred as loosely coupled systems or distributed systems. Processors in a distributed system may vary in size and function. These processors are referred as sites, nodes, and computers and so on.

The advantages of distributed systems are following.

- With resource sharing facility user at one site may be able to use the resources available at another.
- Speedup the exchange of data with one another via electronic mail.
- If one site fails in a distributed system, the remaining sites can potentially continue operating.
- Better service to the customers.
- Reduction of the load on the host computer.
- Reduction of delaysin data processing.

Network operating System

Network Operating System runs on a server and and provides server the capability to manage data, users, groups, security, applications, and other networking functions. The primary purpose of the network operating system is to allow shared file and printer access among multiple computers in a network, typically a local area network (LAN), a private network or to other networks. Examples of network operating systems are Microsoft Windows Server 2003, Microsoft Windows Server 2008, UNIX, Linux, Mac OS X, Novell NetWare, and BSD.

The advantages of network operating systems are following.

- Centralized servers are highly stable.
- Security is server managed.
- Upgrades to new technologies and hardware can be easily integrated into the system.
- Remote access to servers is possible from different locations and types of systems.

The disadvantages of network operating systems are following.

- High cost of buying and running a server.
- Dependency on a central bcation for most operations.
- Regular maintenance and updates are required.

Real Time operating System

Real time system is defines as a data processing system in which the time interval required to process and respond to inputs is so small that it controls the environment. Real time processing is always on line whereas on line system need not be real time. The time taken by the system to respond to an input and display of required updated information is termed as response time. So in this method response time is very less as compared to the online processing.

Real-time systems are used when there are rigid time requirements on the operation of a processor or the flow of data and real-time systems can be used as a control device in a dedicated application. Real-time operating system has well-defined, fixed time constraints otherwise system will fail. For example Scientific experiments, medical imaging systems, industrial control systems, weapon systems, robots, and home-appliance controllers, Air traffic control system etc.

There are two types of real-time operating systems.

Hard real-time systems

Hard real-time systems guarantee that critical tasks complete on time. In hard real-time systems secondary storage is limited or missing with data stored in ROM. In these systems virtual memory is almost never found.

Soft real-time systems

Soft real time systems are less restrictive. Critical real-time task gets priority over other tasks and retains the priority until it completes. Soft real-time systems have limited utility than hard real-time systems. For example, Multimedia, virtual reality, Advanced Scientific Projects like undersea exploration and planetary rovers etc.

➔ Windows Operating System

Windows is the operating system sold by the Seattle-based company Microsoft. Microsoft, originally christened "Traf-O-Data" in 1972, was renamed "Micro-soft" in November 1975, then "Microsoft" on November 26, 1976.

Microsoft entered the marketplace in August 1981 by releasing version 1.0 of the operating system Microsoft DOS (MS-DOS), a 16-bit command-line operating system

The first version of Microsoft Windows (Microsoft Windows 1.0) came out in November 1985. It had a graphical user interface, inspired by the user interface of the Apple computers of the time. Windows 1.0 was not succesful with the public, and Microsoft Windows 2.0, launched December 9, 1987, did not do much better. It was on May 22, 1990 that Microsoft Windows became a success, with Windows 3.0, then Windows 3.1 in 1992, and finally Microsoft Windows for Workgroups, later renamed Windows 3.11, which included network capabilities. Windows 3.1 cannot be considered an entirely separate operating system because it was only a graphical user interface running on top of MS-DOS.

On August 24, 1995, Microsoft launched the operating system Microsoft Windows 95. Windows 95 signified Microsoft's willingness to transfer some of MS-DOS's capabilities into Windows, but this new version was based more heavily on 16-bit DOS and retained the limitations of the FAT16 file system, so that it was not possible to use long file names.

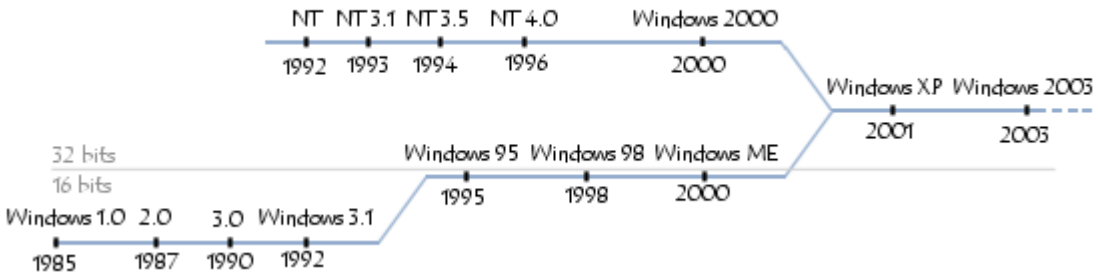
After minor revisions of Microsoft Windows 95, named Windows 95A OSR1, Windows 95B OSR2, Windows 95B OSR2.1 and Windows 95C OSR2.5, Microsoft released the next version of Windows on June 25, 1998: Windows 98. Windows 98 natively supported features other than those of MS-DOS but was still based upon it. What's more, Windows 98 suffered from poor memory handling when multiple applications were running, which could cause system malfunctions. A second edition of Windows 98 came out on February 17, 2000; it was named Windows 98 SE (for "Second Edition").

On September 14, 2000, Microsoft released Windows Me (for Millennium Edition), also called Windows Millennium. Windows Millennium was based largely on Windows 98 (and therefore on MS-DOS), but added additional multimedia and software capabilities. Furthermore, Windows Millennium included a system-restore mechanism for returning to a previous state in the event of a crash.

Concurrent with these releases, Microsoft had been selling (since 1992) an entirely 32-bit operating system (which therefore was not based on MS-DOS) for professional use, at a time when business primarily used mainframes. It was Windows NT (for Windows "New Technology"). Windows NT was not a new version of Windows 95 or an improvement on it, but an entirely different operating system

On May 24, 1993, the first version of Windows NT was released. It was called Windows NT 3.1, and was followed by Windows NT 3.5 in September 1994 and Windows 3.51 in June 1995. With Windows NT 4.0, launched for sale on August 24, 1996, Windows NT finally became a true success.

In July 1998, Microsoft released Windows NT 4.0 TSE (Terminal Server Emulation), the first Windows system that allowed terminals to be plugged into a server, i.e. use thin clients to open a session on the server.
On February 17, 2000, the next version of NT 4.0 was renamed Windows 2000 (instead of Windows NT 5.0) in order to highlight the unification of "NT" with the "Windows 9x" systems. Windows 2000 is an entirely 32-bit system with characteristics of Windows NT, as well as an improved task manager and full compatibility with USB and FireWire peripherals.
Then, on October 25, 2001, Windows XP arrived on the scene. This was a merger of the preceding operating systems.
Finally, on April 24, 2003, a server operating system was released by Microsoft: Windows Server 2003.



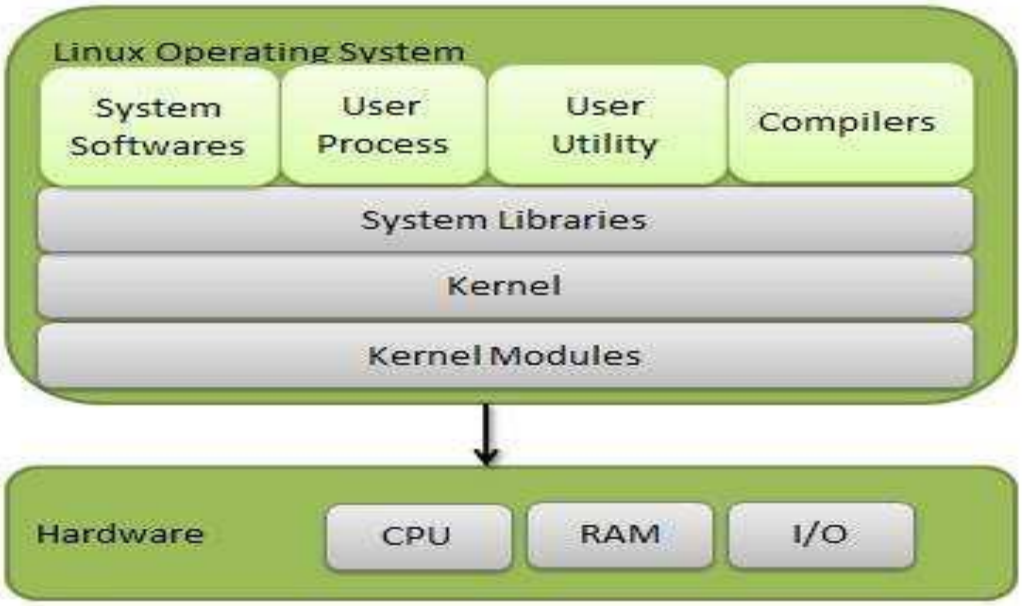
➔Linux Operating System

Linux is one of popular version of UNIX operating System. It is open source as its source code is freely available. It is free to use. Linux was designed considering UNIX compatibility. Its functionality list is quite similar to that of UNIX.

Components of Linux System

Linux Operating System has primarily three components

- **Kernel** - Kernel is the core part of Linux. It is responsible for all major activities of this operating system. It consists of various modules and it interacts directly with the underlying hardware. Kernel provides the required abstraction to hide low level hardware details to system or application programs.
- **System Library** - System libraries are special functions or programs using which application programs or system utilities accesses Kernel's features. These libraries implement most of the functionalities of the operating system and do not requires kernel module's code access rights.
- **System Utility** - System Utility programs are responsible to do specialized, individual level tasks.



Basic Features

Following are some of the important features of Linux Operating System.

- **Portable** - Portability means software can works on different types of hardware in same way. Linux kernel and application programs supports their installation on any kind of hardware platform.
- **Open Source** - Linux source code is freely available and it is community based development project. Multiple teams work in collaboration to enhance the capability of Linux operating system and it is continuously evolving.
- **Multi-User** - Linux is a multiuser system means multiple users can access system resources like memory/ ram/ application programs at same time.
- **Multiprogramming** - Linux is a multiprogramming system means multiple applications can run at same time.
- **Hierarchical File System** - Linux provides a standard file structure in which system files/ user files are arranged.
- **Shell** - Linux provides a special interpreter program which can be used to execute commands of the operating system. It can be used to do various types of operations, call application programs. etc.
- **Security** - Linux provides user security using authentication features like password protection/ controlled access to specific files/ encryption of data.

➔Unix Operating System

UNIX is an operating system which was first developed in the 1960s, and has been under constant development ever since. By operating system, we mean the suite of programs which make the computer work. It is a stable, multi-user, multi-tasking system for servers, desktops and laptops.

UNIX systems also have a graphical user interface (GUI) similar to Microsoft Windows which provides an easy to use environment. However, knowledge of UNIX is required for operations which aren't covered by a graphical program, or for when there is no windows interface available, for example, in a telnet session.

Types of Unix

There are many different versions of UNIX, although they share common similarities. The most popular varieties of UNIX are Sun Solaris, GNU/Linux, and MacOS X.

The Unix Operating System

The UNIX operating system is made up of three parts; the kernel, the shell and the programs.

The kernel

The kernel of UNIX is the hub of the operating system: it allocates time and memory to programs and handles the filestore and communications in response to system calls.
As an illustration of the way that the shell and the kernel work together, suppose a user types rm myfile (which has the effect of removing the file myfile). The shell searches the filestore for the file containing the program rm, and then requests the kernel, through system calls, to execute the program rm on myfile. When the process rm myfile has finished running, the shell then returns the UNIX prompt % to the user, indicating that it is waiting for further commands.

The shell

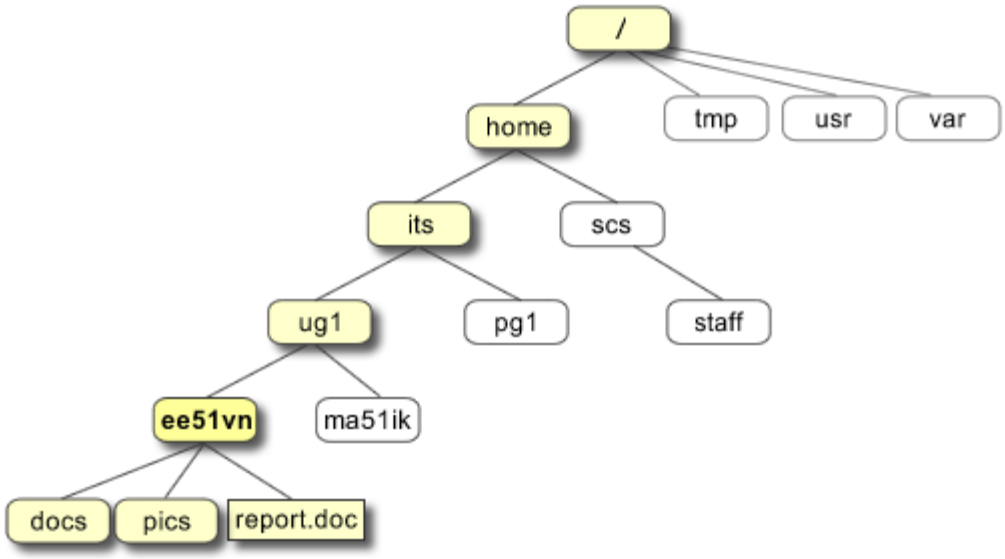
The shell acts as an interface between the user and the kernel. When a user logs in, the login program checks the username and password, and then starts another program called the shell. The shell is a command line interpreter (CLI). It interprets the commands the user types in and arranges for them to be carried out. The commands are themselves programs: when they terminate, the shell gives the user another prompt (% on our systems).
The adept user can customise his/her own shell, and users can use different shells on the same machine. Staff and students in the school have the tcsh shell by default.
The tcsh shell has certain features to help the user inputting commands.
Filename Completion - By typing part of the name of a command, filename or directory and pressing the [Tab] key, the tcsh shell will complete the rest of the name automatically. If the shell finds more than one name beginning with those letters you have typed, it will beep, prompting you to type a few more letters before pressing the tab key again.
History - The shell keeps a list of the commands you have typed in. If you need to repeat a command, use the cursor keys to scroll up and down the list or type history for a list of previous commands.

File and Process

Everything in UNIX is either a file or a process.
A process is an executing program identified by a unique PID (process identifier).
A file is a collection of data. They are created by users using text editors, running compilers etc.
Examples of files:
a document (report, essay etc.)
the text of a program written in some high-level programming language
instructions comprehensible directly to the machine and incomprehensible to a casual user, for example, a collection of binary digits (an executable or binary file);
a directory, containing information about its contents, which may be a mixture of other directories (subdirectories) and ordinary files.

The Directory Structure

All the files are grouped together in the directory structure. The file-system is arranged in a hierarchical structure, like an inverted tree. The top of the hierarchy is traditionally called root (written as a slash /)



In the diagram above, we see that the home directory of the undergraduate student **"ee51vn"** contains two sub-directories (**docs** and **pics**) and a file called **report.doc**.

The full path to the file **report.doc** is **"/home/its/ug1/ee51vn/report.doc"**

What is the difference between Linux and UNIX operating systems?

UNIX is copyrighted name only big companies are allowed to use the UNIX copyright and name, so IBM AIX and Sun Solaris and HP-UX all are UNIX operating systems. The Open Group holds the UNIX trademark in trust for the industry, and manages the UNIX trademark licensing program.

Most UNIX systems are commercial in nature.

Linux is a UNIX Clone

But if you consider Portable Operating System Interface (POSIX) standards then Linux can be considered as UNIX. To quote from Official Linux kernel README file:

Linux is a Unix clone written from scratch by Linus Torvalds with assistance from a loosely-knit team of hackers across the Net. It aims towards POSIX compliance.

However, "Open Group" do not approve of the construction "Unix-like", and consider it misuse of their UNIX trademark.

Linux Is Just a Kernel

Linux is just a kernel. All Linux distributions includes GUI system + GNU utilities (such as cp, mv, ls,date, bash etc) + installation & management tools + GNU c/c++ Compilers + Editors (vi) + and various applications (such as OpenOffice, Firefox). However, most UNIX operating systems are considered as a complete operating system as everything come from a single source or vendor.

As I said earlier Linux is just a kernel and Linux distribution makes it complete usable operating systems by adding various applications. Most UNIX operating systems comes with A-Z programs such as editor, compilers etc. For example HP-UX or Solaris comes with A-Z programs.

License and cost

Linux is Free (as in beer [freedom]). You can download it from the Internet or redistribute it under GNU licenses. You will see the best community support for Linux. Most UNIX like operating systems are not free (but this is changing fast, for example OpenSolaris UNIX). However, some Linux distributions such as Redhat / Novell provides additional Linux support, consultancy, bug fixing, and training for additional fees.

User-Friendly

Linux is considered as most user friendly UNIX like operating systems. It makes it easy to install sound card, flash players, and other desktop goodies. However, Apple OS X is most popular UNIX operating system for desktop usage.

Security Firewall Software

Linux comes with open source netfilter/iptables based firewall tool to protect your server and desktop from the crackers and hackers. UNIX operating systems comes with its own firewall product (for example Solaris UNIX comes with ipfilter based firewall) or you need to purchase a 3rd party software such as Checkpoint UNIX firewall.

Backup and Recovery Software

UNIX and Linux comes with different set of tools for backing up data to tape and other backup media. However, both of them share some common tools such as tar, dump/restore, and cpio etc.

➔ **What is the difference between mobile OS and a computer OS?**

The difference between a mobile operating system (OS) and a computer OS has to do with how individual tech companies have rolled out various versions of the operating systems that supply the fundamental environments for traditional software applications as well as new mobile apps.

Mobile and computer operating systems have been developed in different ways and for different uses. Computer OS products are older and more familiar to larger groups of users. Through the last 20 or 30 years, the simple idea of a computer operating system has been continually built on and improved. Through this time, Microsoft Windows and Apple's Mac OS have emerged as the two dominant operating system designs. There have also been some open-source operating systems designed for traditional computers as alternatives to Microsoft or Apple licensed operating systems. These include Linux, FreeBSD, OpenBSD and GNU.

There are a lot of details involved in computer OS design, but one prominent fact is that computer operating systems were not really designed for mobile use over wireless networks. Instead, they evolved, and were understood, as part of a wired system, most commonly, as parts of a single physical machine. As such, developers and engineers focused on a lot of technical specifics related to items like boot protocols, program threads, multiple process handling, CPU operation, and other elements of the traditional OS.

The mobile operating system is a newer concept. In many ways, the mobile OS has built on what the computer OS has accomplished. In fact, many modern developers working with mobile operating systems tend to take the traditional elements of computer operating systems largely for granted as they focus on newer issues like responsive design, consistent network access, and other elements of providing software applications used across diverse wireless environments.

For a look at the difference between mobile and computer operating systems, take a look at how a new smartphone operating system works differently from a traditional Windows XPor 2000 OS. Or take a look at the iOS operating system used on the iPhone compared to the operating system for a traditional Apple computer or even a newer Apple laptop. What you'll find is that while many of the Apple operating system elements are branded and visually created in the same way, when you get down below to the technical areas of the operating system, mobile operating systems are quite different because they are designed to work on different devices and do different things.

UNIT III

➔Internet

Internet is defined as an Information super Highway, to access information over the web. However, It can be defined in many ways as follows:

- Internet is a world-wide global system of interconnected computer networks.
- Internet uses the standard Internet Protocol (TCP/IP).
- Every computer in internet is identified by a unique IP address.
- IP Address is a unique set of numbers (such as 110.22.33.114) which identifies a computer location.
- A special computer DNS (Domain Name Server) is used to give name to the IP Address so that user can locate a computer by a name.
- For example, a DNS server will resolve a name **http://www.google.com** to a particular IP address to uniquely identify the computer on which this website is hosted.
- Internet is accessible to every user all over the world.

Evolution

The concept of Internet was originated in 1969 and has undergone several technological & Infrastructural changes as discussed below:

- The origin of Internet devised from the concept of **Advanced Research Project Agency Network (ARPANET).**
- **ARPANET** was developed by United States Department of Defense.
- Basic purpose of ARPANET was to provide communication among the various bodies of government.
- Initially, there were only four nodes, formally called **Hosts.**
- In 1972, the **ARPANET** spread over the globe with 23 nodes located at different countries and thus became known as **Internet.**
- By the time, with invention of new technologies such as TCP/IP protocols, DNS, WWW, browsers, scripting languages etc.,Internet provided a medium to publish and access information over the web.

Advantages

Internet covers almost every aspect of life, one can think of. Here, we will discuss some of the advantages of Internet:

- Internet allows us to communicate with the people sitting at remote locations. There are various apps available on the wed that uses Internet as a medium for communication. One can find various social networking sites such as:
    - Facebook
    - Twitter
    - Yahoo
    - Google+
    - Flickr
    - Orkut
- One can surf for any kind of information over the internet. Information regarding various topics such as Technology, Health & Science, Social Studies, Geographical Information, Information Technology, Products etc can be surfed with help of a search engine.
- Apart from communication and source of information, internet also serves a medium for entertainment. Following are the various modes for entertainment over internet.
    - Online Television
    - Online Games
    - Songs
    - Videos
    - Social Networking Apps
- Internet allows us to use many services like:
    - Internet Banking
    - Matrimonial Services
    - Online Shopping
    - Online Ticket Booking
    - Online Bill Payment
    - Data Sharing
    - E-mail
- Internet provides concept of **electronic commerce**, that allows the business deals to be conducted on electronic systems

Disadvantages

However, Internet has proved to be a powerful source of information in almost every field, yet there exists many disadvantages discussed below:

- There are always chances to loose personal information such as name, address, credit card number. Therefore, one should be very careful while sharing such information. One should use credit cards only through authenticated sites.
- Another disadvantage is the **Spamming**.Spamming corresponds to the unwanted e-mails in bulk. These e-mails serve no purpose and lead to obstruction of entire system.
- **Virus** can easily be spread to the computers connected to internet. Such virus attacks may cause your system to crash or your important data may get deleted.
- Also a biggest threat on internet is pornography. There are many pornographic sites that can be found, letting your children to use internet which indirectly affects the children healthy mental life.
- There are various websites that do not provide the authenticated information. This leads to misconception among many people.

Intranet

Intranet is defined as private network of computers within an organization with its own server and firewall. Moreover we can define Intranet as:

- Intranet is system in which multiple PCs are networked to be connected to each other. PCs in intranet are not available to the world outside of the intranet.
- Usually each company or organization has their own Intranet network and members/employees of that company can access the computers in their intranet.
- Every computer in internet is identified by a unique IP address.
- Each computer in Intranet is also identified by a IP Address, which is unique among the computers in that Intranet.

Benefits

Intranet is very efficient and reliable network system for any organization. It is beneficial in every aspect such as collaboration, cost-effectiveness, security, productivity and much more.

Communication

Intranet offers easy and cheap communication within an organization. Employees can communicate using chat, e-mail or blogs.

Time Saving

Information on Intranet is shared in real time.

Collaboration

Information is distributed among the employees as according to requirement and it can be accessed by the authorized users, resulting in enhanced teamwork.

Platform Independency

Intranet can connect computers and other devices with different architecture.

Cost Effective

Employees can see the data and other documents using browser rather than printing them and distributing duplicate copies among the employees, which certainly decreases the cost.

Workforce Productivity

Data is available at every time and can be accessed using company workstation. This helps the employees work faster.

Business Management

It is also possible to deploy applications that support business operations.

Security

Since information shared on intranet can only be accessed within an organization, therefore there is almost no chance of being theft.

Specific Users

Intranet targets only specific users within an organization therefore, once can exactly know whom he is interacting.

Immediate Updates

Any changes made to information are reflected immediately to all the users.

Issues

Apart from several benefits of Intranet, there also exist some issues.. These issues are shown in the following diagram:

Applications

Intranet applications are same as that of Internet applications. Intranet applications are also accessed through a web browser. The only difference is that, Intranet applications reside on local server while

Internet applications reside on remote server. Here, we've discussed some of these applications:

Document publication applications

Document publication applications allow publishing documents such as manuals, software guide, employee profits etc without use of paper.

Electronic resources applications

It offers electronic resources such as software applications, templates and tools, to be shared across the network.

Interactive Communication applications

Like on internet, we have e-mail and chat like applications for Intranet, hence offering an interactive communication among employees.

Support for Internet Applications

Intranet offers an environment to deploy and test applications before placing them on Internet.

Internet vs. Intranet

Apart from similarities there are some differences between the two. Following are the differences between Internet and Intranet:

Intranet	**Internet**
Localized Network.	Worldwide Network
Doesn't have access to Intranet	Have access to Internet.
More Expensive	Less Expensive
More Safe	Less Safe
More Reliability	Less Reliability

➔WWW Overview

WWW stands for **World Wide Web.** A technical definition of the World Wide Web is : all the resources and users on the Internet that are using the Hypertext Transfer Protocol (HTTP).

A broader definition comes from the organization that Web inventor **Tim Berners-Lee** helped found, the **World Wide Web Consortium (W3C).**

The World Wide Web is the universe of network-accessible information, an embodiment of human knowledge.

In simple terms, The World Wide Web is a way of exchanging information between computers on the Internet, tying them together into a vast collection of interactive multimedia resources.

Internet and **Web** is not the same thing: Web uses internet to pass over the information.

Evolution

World Wide Web was created by **Timothy Berners Lee** in 1989 at **CERN** in **Geneva.** World Wide Web came into existence as a proposal by him, to allow researchers to work together effectively and efficiently at **CERN.** Eventually it became **World Wide Web.**

The following diagram briefly defines evolution of World Wide Web:

WWW Architecture

WWW architecture is divided into several layers as shown in the following diagram:

Identifiers and Character Set

Uniform Resource Identifier (URI) is used to uniquely identify resources on the web and **UNICODE** makes it possible to built web pages that can be read and write in human languages.

Syntax

XML (Extensible Markup Language) helps to define common syntax in semantic web.

Data Interchange

Resource Description Framework (RDF) framework helps in defining core representation of data for web. RDF represents data about resource in graph form.

Taxonomies

RDF Schema (RDFS) allows more standardized description of **taxonomies**and other **ontological** constructs.

Ontologies

Web Ontology Language (OWL) offers more constructs over RDFS. It comes in following three versions:

- OWL Lite for taxonomies and simple constraints.

- OWL DL for full description logic support.
- OWL for more syntactic freedom of RDF

Rules

RIF and **SWRL** offers rules beyond the constructs that are available from **RDFs**and **OWL.** Simple Protocol and **RDF Query Language (SPARQL)** is SQL like language used for querying RDF data and OWL Ontologies.

Proof

All semantic and rules that are executed at layers below Proof and their result will be used to prove deductions.

Cryptography

Cryptography means such as digital signature for verification of the origin of sources is used.

User Interface and Applications

On the top of layer **User interface and Applications** layer is built for user interaction.

WWW Operation

WWW works on client- server approach. Following steps explains how the web works:

1. User enters the URL (say, **http://www.google.com**) of the web page in the address bar of web browser.
2. Then browser requests the Domain Name Server for the IP address corresponding to www.google.com.
3. After receiving IP address, browser sends the request for web page to the web server using HTTP protocol which specifies the way the browser and web server communicates.
4. Then web server receives request using HTTP protocol and checks its search for the requested web page. If found it returns it back to the web browser and close the HTTP connection.
5. Now the web browser receives the web page, It interprets it and display the contents of web page in web browser's window.

Future

There had been a rapid development in field of web. It has its impact in almost every area such as education, research, technology, commerce, marketing etc. So the future of web is almost unpredictable.

Apart from huge development in field of WWW, there are also some technical issues that W3 consortium has to cope up with.

User Interface

Work on higher quality presentation of 3-D information is under deveopment. The W3 Consortium is also looking forward to enhance the web to full fill requirements of global communities which would include all regional languages and writing systems.

Technology

Work on privacy and security is under way. This would include hiding information, accounting, access control, integrity and risk management.

Architecture

There has been huge growth in field of web which may lead to overload the internet and degrade its performance. Hence more better protocol are required to be developed.

Web Page

web page is a document available on world wide web. Web Pages are stored on web server and can be viewed using a web browser.

A web page can contain huge information including text, graphics, audio, video and hyper links. These hyper links are the link to other web pages.

Collection of linked web pages on a web server is known as **website.**There is unique **Uniform Resource Locator (URL)** is associated with each web page.

Static Web page

Static web pages are also known as flat or stationary web page. They are loaded on the client's browser as exactly they are stored on the web server. Such web pages contain only static information. User can only read the information but can't do any modification or interact with the information.

Static web pages are created using only HTML. Static web pages are only used when the information is no more required to be modified.

Dynamic Web page

Dynamic web page shows different information at different point of time. It is possible to change a portion of a web page without loading the entire web page. It has been made possible using **Ajax** technology.

SERVER-SIDE DYNAMIC WEB PAGE

It is created by using server-side scripting. There are server-side scripting parameters that determine how to assemble a new web page which also include setting up of more client-side processing.

CLIENT-SIDE DYNAMIC WEB PAGE

It is processed using client side scripting such as JavaScript. And then passed in to **Document Object Model (DOM).**

How to find information in the WWW

All the search engines are a little complicated to use for the first time. Their individual values will only start to appear after a little bit of experience acquired through usage. Each one employs different techniques and programs to accumulate information. Therefore, before starting a search in any of them for the first time, always read your restrictions. Adopt one of the following strategies based on what you know of your search: · Do you know which general topic is related to the information? You can use one of the directories like Yahoo and follow the links of each page with the site that you feel may lead to the information. · Do you know a specific name or title? Use one of the search engines that searches through titles and keywords like AltaVista. · Do you know one or more qualities and characteristics? This strategy frequently requires various search and evaluation sessions. Some additional information, like the author, geographic location, related organizations, story, etc., may be used to find a specific reference. · Use different words for the search. The extremely common words, such as articles and prepositions contribute very little to the search and are completely ignored. Nevertheless, upon combining common words with logical operators the results may be more promising. · Understand the results of the search. The form by which the information has been grouped in one of the engines or directories can dramatically affect the search process. One word or phrase can work marvelously in one and poorly in another. Try to understand the relation of the keywords and the results. When your search does not produce any entry, check the following: · Be sure to have understood the description, options, rules and restrictions of the tools you are using. · Make sure that the spelling is correct. · If you used logical operators, revise your syntax. · Try to be less specific in your question. · Use synonyms and a variation of the words. · Go on to another search engine. · Your search produces too many entries. · Be more specific in you request. · Identify and use the common words that may be important Problems with the server. The server can return an error message (or simply not allow you to connect) if it is busy or temporarily down. · Error 404, page/file not found: There are various reasons due to which this can happen. Maybe the link doesn't exist, that the URL address of the page has been modified or that simply the command is not valid. Check the capital letters and the small letters. The URL addresses are partially sensitive to these. In the first part they are not so but in all the rest yes. · No answer, Time out, Too busy. These are the three types of problems that you can most find. If it happens to you, try again after a few minutes, wait to work during the less congested hours of the day or check the server location. If the server is far from your station the response may be low in contrast to that of a local server. What to do with the information that you find. The user has three options to use the information found in the Net: · Read it directly in the computer screen. If you can satisfy your curiosity with a simple glance over. Save it in your hard disk or in a diskette. To carry out this operation the user has to use the command "save as" from the file option of the main menu. If the document is already open, place the cursor on the selected link, sound or image and click on the right button of the mouse, on the command "save image as", if you want to save it without opening it. Next, choose the format and the location in the hard disk or diskette where you want to save this file. If the format chosen was originally an HTML file, you can see it without the need of being connected to the server, using the normal menu option file/open. If the selection was a normal text, the file will only contain text (instructions for Netscape users). Normally, a saved page only contains text. In order for the document to include graphics there are several shortcuts to achieve this: with Netscape it is not necessary to save the page nor the images, since everything remains in the cache. First go to options/preferences of the Network from the main menu, and press “never” in the “verify documents” option. After disconnecting from the Network you enter the command "cache" in the open option of the main menu. A list of the latest visited addresses will appear; after selecting the one that interests you (in case of an error message, it shall be accepted), you can call the page and its images (in order to use this method, it is mandatory that the user navigates with the command "load images automatically" activated. Another procedure for fully downloading the document, only available in Netscape Navigator Gold or Communicator, is clicking on the edit option of the file menu. After approving the remote save, you select the directory where you want to save it. By following these instructions you can see the complete page without being online. A last method is to download

the complete site. In order to accomplish this it is necessary to install a program specially designed for this purpose. One of the most popular ones in Teleprot Pro; through this you can download a complete website, allowing the user to consult it without being connected to the Network.

➔Router

- A router is a networking device that forwards data packets between computer networks. Routers perform the "traffic directing" functions on the Internet. A data packet is typically forwarded from one router to another through the networks that constitute the internetwork until it reaches its destination node.[1]
- A router is connected to two or more data lines from different networks (as opposed to a network switch, which connects data lines from one single network). When a data packet comes in on one of the lines, the router reads the address information in the packet to determine its ultimate destination. Then, using information in its routing table or routing policy, it directs the packet to the next network on its journey. This creates an overlay internetwork.
- The most familiar type of routers are home and small office routers that simply pass data, such as web pages, email, IM, and videos between the home computers and the Internet. An example of a router would be the owner's cable or DSL router, which connects to the Internet through an ISP. More sophisticated routers, such as enterprise routers, connect large business or ISP networks up to the powerful core routers that forward data at high speed along the optical fiber lines of the Internet backbone. Though routers are typically dedicated hardware devices, use of software-based routers has grown increasingly common.

➔Cable Modem

- A modem designed to operate over cable TV lines. Because the coaxial cable used by cable TV provides much greater bandwidth than telephone lines, a cable modem can be used to achieve extremely fast access to the World Wide Web. This, combined with the fact that millions of homes are already wired for cable TV, has made the cable modem something of a holy grail for Internet and cable TV companies.
- There are a number of technical difficulties, however. One is that the cable TV infrastructure is designed to broadcast TV signals in just one direction - from the cable TV company to people's homes. The Internet, however, is a two-way system where data also needs to flow from the client to the server. In addition, it is still unknown whether the cable TV networks can handle the traffic that would ensue if millions of users began using the system for Internet access.

➔Switches

- In a telecommunications network, a switch is a device that channels incoming data from any of multiple input ports to the specific output port that will take the data toward its intended destination. In the traditional circuit-switched telephone network, one or more switches are used to set up a dedicated though temporary connection or circuit for an exchange between two or more parties. On an Ethernet local area network (LAN), a switch determines from the physical device (Media Access Control or MAC) address in each incoming message frame which output port to forward it to and out of. In a wide area packet-switched network such as the Internet, a switch determines from the IP address in each packet which output port to use for the next part of its trip to the intended destination.

➔Server

- In computing, a server is a computer program or a device that provides functionality for other programs or devices, called "clients". This architecture is called the client–server model, and a single overall computation is distributed across multiple processes or devices. Servers can provide various functionalities, often called "services", such as sharing data or resources among multiple clients, or performing computation for a client. A single server can serve multiple clients, and a single client can use multiple servers. A client process may run on the same device or may connect over a network to a server on

a different device.[1] Typical servers are database servers, file servers, mail servers, print servers, web servers, game servers, and application servers.[2]

➔**Client–**server systems are today most frequently implemented by (and often identified with) the request–response model: a client sends a request to the server, which performs some action and sends a response back to the client, typically with a result or acknowledgement. Designating a computer as "server-class hardware" implies that it is specialized for running servers on it. This often implies that it is more powerful and reliable than standard personal computers, but alternatively, large computing clusters may be composed of many relatively simple, replaceable server components.

- 1) In information technology, a server is a computer program that provides services to other computer programs (and their users) in the same or other computers.
- 2) The computer that a server program runs in is also frequently referred to as a server (though it may be used for other purposes as well).
- 3) In the client/server programming model, a server is a program that awaits and fulfills requests from client programs in the same or other computers. A given application in a computer may function as a client with requests for services from other programs and also as a server of requests from other programs.
- Specific to the Web, a Web server is the computer program (housed in a computer) that serves requested HTML pages or files. A Web client is the requesting program associated with the user. The Web browser in your computer is a client that requests HTML files from Web servers.
- A client is a piece of computer hardware or software that accesses a service made available by a server. The server is often (but not always) on another computer system, in which case the client accesses the service by way of a network.
-
- A client is the requesting program or user in a client/server relationship. For example, the user of a Web browser is effectively making client requests for pages from servers all over the Web. The browser itself is a client in its relationship with the computer that is getting and returning the requested HTML file. The computer handling the request and sending back the HTML file is a server.

➔**Port**

- In computer hardware, a port serves as an interface between the computer and other computers or peripheral devices. In computer terms, a port generally refers to the female part of connection. Computer ports have many uses, to connect a monitor, webcam, speakers, or other peripheral devices.

➔Computer Virus

Computer viruses are big news in the world of computer security and in the world of Windows operating systems. Now that many people use always-connected broadband internet, it has become increasingly easy for viruses to spread between machines

Despite what you may have heard, computer viruses are not magical. They cannot be transmitted through the air and while some of them are able to erase information from your computer, they cannot erase backup CD-ROM's you have made and they cannot cause your computer to explode! Computer viruses are computer programs, just like every other bit of software that runs on your PC. What makes computer viruses different however is the fact that

they are designed to copy themselves, throughout your computer's memory or hard drive, or even across the internet. Many computer viruses have malicious components too, and may try to cause all sorts of mischief from slowing down your computer to allowing hackers to gain entry.

What is the Difference Between Computer Viruses and Spyware?

Spyware is software specifically designed to watch things you do on your PC, perhaps to gather data on the websites you visit, or music you listen to. Plain spyware does not copy itself or exhibit other malicious behaviour, although many computer viruses are also spyware or contain spyware components. Not all spyware is necessarily bad. The popular music utility LastFM for example, is considered by some to be spyware, as it tracks what music you listen to. However, it uses that data to recommend bands and music to you that you might like, which makes it great fun to use and highly recommended!

What about "Trojans" ?

Beware of Greeks bearing gifts. Actually, beware of any shady website offering freebies on the net.

You remember the story of the Trojan horse, right? The Greeks manage to convince the Trojans that a giant wooden horse, containing lots of their warriors, was actually a gift from the Gods. The Trojans, thinking the Gods had smiled on them, took the horse inside their giant walled city, and then the Greeks burst out surprising them and overthrowing the city. Trojans that you get on your computer don't look like horses, but they may look like games, or pictures, or other files which may seem to be fun to play with. In actual fact when you click the file you will get a nasty surprise as a computer virus or malicious program lurks inside. Trojans can be computer viruses or spyware and are generally to be avoided.

What about "Scumware", "Parasites", "Malware" etc

Ok so there are many buzzwords going around but they all boil down to one thing, computer programs that are bad news for you, the owner and user of your computer. So, we know that this bad software is out there, what can we do to avoid it?

➔Software Piracy

Software piracy is the illegal copying, distribution, or use of software. It is such a profitable "business" that it has caught the attention of organized crime groups in a number of countries. According to the Business Software Alliance (BSA), about 36% of all software in current use is stolen. Software piracy causes significant lost revenue for publishers, which in turn results in higher prices for the consumer.

When you purchase a commercial software package, an end user license agreement (EULA) is included to protect that software program from copyright infringement. Typically, the license states that you can install the original copy of software you bought on one computer and that you can make a backup copy in case the original is lost or damaged. You agree to the licensing agreement when you open the software package (this is called a shrink wrap license), when you open the envelope that contains the software disks, or when you install the software.

Software piracy applies mainly to full-function commercial software. The time-limited or function-restricted versions of commercial software called shareware are less likely to be pirated since they are freely available. Similarly, freeware , a type of software that is copyrighted but freely distributed at no charge, also offers little incentive for piracy.

Types of software piracy include:

- **Softlifting:** Borrowing and installing a copy of a software application from a colleague.
- **Client-server overuse:** Installing more copies of the software than you have licenses for.
- **Hard-disk loading:** Installing and selling unauthorized copies of software on refurbished or new computers.
- **Counterfeiting:** Duplicating and selling copyrighted programs.
- **Online piracy:** Typically involves downloading illegal software from peer-to-peer network, Internet auction or blog. (In the past, the only place to download software was from a bulletin board system and these were limited to local areas because of long distance charges while online.)

Difference Between Ethical Hacking, Cracking, Phishing, Tracking

- **Difference Between Backing And Ethical Hacking** – **Hacking** is unauthorized use of computer and network resources. A hacking is commonly used to gain unauthorized access to a PC to insert **worms, viruses, & Trojan horses**. Hacking consists of two types. Ethical and Non-ethical. Hacking is very common in it. Hacking is not illegal. A hacker is a person who breaks your computer/data/network. Hackers modify the code. Hackers usually have a bad reputation in our country, but hacking skills in itself can be helpful to us. Most often, hackers are the expert programmers. **Ethical hacking** also involves “hacking”. But the difference lies in the terminology. An ethical hacker is a computer expert, who attacks a highly protected to security system on the prevents the exploitation of the program that an unethical hacker. Ethical hacker makes use of methods as their less principled counterparts but unethical hacker utilizes each resources. It can be well termed as the fight between Police Force and Criminals. We know the Gmail is one of the popular and secure mailing service known but hackers even hack them easily.

- **Difference Between Hacking Cracking And Ethical Hacking** –
  Hacking is **different** from cracking & ethical hacking. It is done for accessing data or information. **Crackers** are not used by experts. Every programmer does a minute mistake while developed the software. All the mistakes are used by hackers and break their security. A criminal does hacking usually. Every criminal is experts. These are called as **Black hats**. **Cracking** is done both legally & illegally. If anyone has authorized rights it is, legal if not it is illegal. Cracking is done only to software or hardware components. Hacking is usually changing the memory of a game or hacking into its system. It is an information security. We should need to use internet security to avoid hacking our system. These are many types of hacking like**Trojan House, Denial of services (DOS), spoofing** etc.
- **Ethical Hacking** is also known as the **penetration and intrusion testing and red teaming**. Ethical hackers are used to check the software security. Ethical Hacking is three different classes: **Black hats, white hats, Gray hats.** Ethical hacking refers to the act of locating weaknesses and vulnerabilities of computer and information systems by duplicating the intent and actions of malicious hackers. Ethical Hacking is the process of planning,enumeration,Analysis,exploitation,Deliverable,integration. Ethical hackers are popularly called as **White hats**.
- **Modes of Ethical Hacking**:
- • Insider Attack
  • Outsider Attack
  • Physical Attack
  • Stolen Equipment Attack
  • Social Engineering Attack
-

- **Difference Between Backing and Phishing** – **Hacking** is using exploits to gain access to something you do not normally have access to.
  Phishing is the process of source in an attempt to bait a user to surrender sensitive information such as a username, password, credit card number, etc.
- **What's the difference?**
  Hacking and phishing are related in that they are both ways of obtaining information, but they differ in their choice of methods. **Phishing** is a continual threat that keeps growing to these days. The risk grows even larger in social media such as **Face book** etc. **Hackers** commonly use these sites to attack persons using these **media sites** and **security informatio**n that can affect the use. The damage caused by phishing ranges from denial of access to email to substantial financial loss. Hackers are adept at **HTML** design, so the untrained person can be easily fooled. Hacking is when someone uses software or some other special device that allows someone to enter a user's computer without them knowing (or knowing) to get information.
- **Difference Between Hacking And Tracking** – **Hacker** is a term that is used to mean a variety of different things in computing. Today, mainstream usage of "hacker" mostly refers to computer criminals. In computer security, a hacker is someone who focuses on security mechanisms ofcomputersystems.It is used by the popular culture to refer to those who seek access despite these security measures. **Tracking**is used for recording the position of objects in the sky. It is basically used for security purpose.
- **Tracking is specifies the:**
- • Text messages (old & deleted).
  • Call logs
  • Photos & Videos
  • Emails
  • Browser history
  • GPS location (position will be shown on a Google map in five-minute intervals).
  • Social networking sites.
  • Remotely lock phone (very helpful if device is lost or stolen).
  • Remote picture taking.

➔Internet Service Providers (ISP)

Internet Service Provider (ISP) is a company offering access to internet. They offer various services:

- Internet Access
- Domain name registration
- Dial-up access
- Leased line access

ISP Types

ISPs can broadly be classified into six categories.

ACCESS PROVIDERS

They provide access to internet through telephone lines, cable wi-fi or fiber optics.

MAILBOX PROVIDER

Such providers offer mailbox hosting services.

HOSTING ISPS

Hosting ISPs offers e-mail, and other web hosting services such as virtual machines, clouds etc.

VIRTUAL ISPS

Such ISPs offer internet access via other ISP services.

FREE ISPS

Free ISPs do not charge for internet services.

Connection Types

There exist several ways to connect to the internet. Following are these connection types available:

1. Dial-up Connection
2. ISDN
3. DSL
4. Cable TV Internet connections
5. Satellite Internet connections
6. Wireless Internet Connections

Dial-up Connection

Dial-up connection uses telephone line to connect PC to the internet. It requires a modem to setup dial-up connection. This modem works as an interface between PC and the telephone line.

There is also a communication program that instructs the modem to make a call to specific number provided by an ISP.

Dial-up connection uses either of the following protocols:

1. Serial Line Internet Protocol (SLIP)
2. Point to Point Protocol (PPP)

The following diagram shows the accessing internet using modem:

ISDN

ISDN is acronym of **Integrated Services Digital Network.** It establishes the connection using the phone lines which carry digital signals instead of analog signals.

There are two techniques to deliver ISDN services:

1. Basic Rate Interface (BRI)
2. Primary Rate Interface (PRI)

Key points:

- The BRI ISDN consists of three distinct channels on a single ISDN line: t1o 64kbps B (Bearer) channel and one 16kbps D (Delta or Data) channels.
- The PRI ISDN consists of 23 B channels and one D channels with both have operating capacity of 64kbps individually making a total transmission rate of 1.54Mbps.

The following diagram shows accessing internet using ISDN connection:

DSL

DSL is acronym of **Digital Subscriber Line.** It is a form of broadband connection as it provides connection over ordinary telephone lines.

Following are the several versions of DSL technique available today:

1. Asymmetric DSL (ADSL)
2. Symmetric DSL (SDSL)
3. High bit-rate DSL (HDSL)

4. Rate adaptive DSL (RDSL)
5. Very high bit-rate DSL (VDSL)
6. ISDN DSL (IDSL)

All of the above mentioned technologies differ in their upload and download speed, bit transfer rate and level of service.

The following diagram shows that how we can connect to internet using DSL technology:

Cable TV Internet Connection

Cable TV Internet connection is provided through Cable TV lines. It uses coaxial cable which is capable of transferring data at much higher speed than common telephone line.

Key Points:

- A cable modem is used to access this service, provided by the cable operator.
- The Cable modem comprises of two connections: one for internet service and other for Cable TV signals.
- Since Cable TV internet connections share a set amount of bandwidth with a group of customers, therefore, data transfer rate also depends on number of customers using the internet at the same time.

The following diagram shows that how internet is accessed using Cable TV connection:

Satellite Internet Connection

Satellite Internet connection offers high speed connection to the internet. There are two types of satellite internet connection: one way connection or two way connection.

In one way connection, we can only download data but if we want to upload, we need a dialup access through ISP over telephone line.

In two way connection, we can download and upload the data by the satellite. It does not require any dialup connection.

The following diagram shows how internet is accessed using satellite internet connection:

Wireless Internet Connection

Wireless Internet Connection makes use of radio frequency bands to connect to the internet and offers a very high speed. The wireless internet connection can be obtained by either WiFi or Bluetooth.

Key Points:

- Wi Fi wireless technology is based on IEEE 802.11 standards which allow the electronic device to connect to the internet.
- Bluetooth wireless technology makes use of short-wavelength radio waves and helps to create personal area network (PAN).

➔Email

Email is a service which allows us to send the message in electronic mode over the internet. It offers an efficient, inexpensive and real time mean of distributing information among people.

E-Mail Address

Each user of email is assigned a unique name for his email account. This name is known as E-mail address. Different users can send and receive messages according to the e-mail address.

E-mail is generally of the form username@domainname. For example, webmaster@tutorialspoint.com is an e-mail address where webmaster is username and tutorialspoint.com is domain name.

- The username and the domain name are separated by **& (at)** symbol.
- E-mail addresses are not case sensitive.
- Spaces are not allowed in e-mail address.

E-mail Message Components

E-mail message comprises of different components: E-mail Header, Greeting, Text, and Signature. These components are described in the following diagram:

E-mail Header

The first five lines of an E-mail message is called E-mail header. The header part comprises of following fields:

- From
- Date
- To

- Subject
- CC
- BCC

FROM

The **From** field indicates the sender's address i.e. who sent the e-mail.

DATE

The **Date** field indicates the date when the e-mail was sent.

TO

The **To** field indicates the recipient's address i.e. to whom the e-mail is sent.

SUBJECT

The **Subject** field indicates the purpose of e-mail. It should be precise and to the point.

CC

CC stands for Carbon copy. It includes those recipient addresses whom we want to keep informed but not exactly the intended recipient.

BCC

BCC stands for Black Carbon Copy. It is used when we do not want one or more of the recipients to know that someone else was copied on the message.

GREETING

Greeting is the opening of the actual message. Eg. Hi Sir or Hi Guys etc.

TEXT

It represents the actual content of the message.

SIGNATURE

This is the final part of an e-mail message. It includes Name of Sender, Address, and Contact Number.

Advantages

E-mail has proved to be powerful and reliable medium of commmunication. Here are the benefits of **E-mail:**

- Reliable
- Convenience
- Speed

- Inexpensive
- Printable
- Global
- Generality

Reliable

Many of the mail systems notify the sender if e-mail message was undeliverable.

Convenience

There is no requirement of stationary and stamps. One does not have to go to post office. But all these things are not required for sending or receiving an mail.

Speed

E-mail is very fast. However, the speed also depends upon the underlying network.

Inexpensive

The cost of sending e-mail is very low.

Printable

It is easy to obtain a hardcopy of an e-mail. Also an electronic copy of an e-mail can also be saved for records.

Global

E-mail can be sent and received by a person sitting across the globe.

Generality

It is also possible to send graphics, programs and sounds with an e-mail.

Disadvantages

Apart from several benefits of E-mail, there also exists some disadvantages as discussed below:

- Forgery
- Overload
- Misdirection
- Junk
- No response

Forgery

E-mail doesn't prevent from forgery, that is, someone impersonating the sender, since sender is usually not authenticated in any way.

Overload

Convenience of E-mail may result in a flood of mail.

Misdirection

It is possible that you may send e-mail to an unintended recipient.

Junk

Junk emails are undesirable and inappropriate emails. Junk emails are sometimes referred to as spam.

No Response

It may be frustrating when the recipient does not read the e-mail and respond on a regular basis.

E-mail Protocols are set of rules that help the client to properly transmit the information to or from the mail server. Here in this tutorial, we will discuss various protocols such as **SMTP, POP,** and **IMAP.**

➔Creating Email Account

There are various email service provider available such as **Gmail, hotmail, ymail, rediff mail** etc. Here we will learn how to create an account using Gmail.

- Open gmail.com and click **create an account.**
- Now a form will appear. Fill your details here and click **Next Step.**
- This step allows you to add your picture. If you don't want to upload now, you can do it later. Click **Next Step.**
- Now a welcome window appears. Click **Continue to Gmail.**
- Wow!! You are done with creating your email account with Gmail. It's that easy. Isn't it?
- Now you will see your Gmail account as shown in the following image:

Key Points:

- Gmail manages the mail into three categories namely **Primary, Social**and **Promotions.**
- **Compose** option is given at the right to compose an email message.

- **Inbox, Starred, Sent mail, Drafts** options are available on the left pane which allows you to keep track of your emails.

Composing and Sending Email

Before sending an email, we need to compose a message. When we are composing an email message, we specify the following things:

- Sender's address in To field
- Cc (if required)
- Bcc (if required)
- Subject of email message
- Text
- Signature

You should specify the correct email address; otherwise it will send an error back to the sender.

Once you have specified all the above parameters, It's time to send the email. The mailer program provides a Send button to send email, when you click Send, it is sent to the mail server and a message **mail sent successfully** is shown at the above.

Reading Email

Every email program offers you an interface to access email messages. Like in Gmail, emails are stored under different tabs such as primary, social, and promotion. When you click one of tab, it displays a list of emails under that tab.

In order to read an email, you just have to click on that email. Once you click a particular email, it gets opened.

The opened email may have some file attached with it. The attachments are shown at the bottom of the opened email with an option called **download attachment.**

Replying Email

After reading an email, you may have to reply that email. To reply an email, click **Reply** option shown at the bottom of the opened email.

Once you click on Reply, it will automatically copy the sender's address in to the To field. Below the To field, there is a text box where you can type the message.

Once you are done with entering message, click Send button. It's that easy. Your email is sent.

Forwarding Email

It is also possible to send a copy of the message that you have received along with your own comments if you want. This can be done using **forward** button available in mail client software.

The difference between replying and forwarding an email is that when you reply a message to a person who has send the mail but while forwarding you can send it to anyone.

When you receive a forwarded message, the message is marked with a > character in front of each line and **Subject:** field is prefixed with **Fw.**

Deleting Email

If you don't want to keep email into your inbox, you can delete it by simply selecting the message from the message list and clicking **delete** or pressing the appropriate command.

Some mail clients offers the deleted mails to be stored in a folder called deleted items or trash from where you can recover a deleted email.

Now a day, the mail client comes with enhanced features such as attachment, address book, and MIME support. Here in this chapter we will discuss all of these features which will give you a better understanding of added feature of a mail client program.

Attachment

Ability to attach file(s) along with the message is one of the most useful features of email. The attachment may be a **word document, PowerPoint presentation, audio/video files,** or **images.**

- In order to attach file(s) to an email, click the attach button. As a result, a dialog box appears asking for specifying the name and location of the file you want to attach.
- Once you have selected the appropriate file, it is attached to the mail.
- Usually a paper clip icon appears in the email which indicates that it has an attachment.
- When adding an attachment it is better to compress the attached files so as to reduce the file size and save transmission time as sending and downloading large files consumes a lot of space and time.

Address Book

Address book feature of a mail program allows the users to store information about the people whom they communicate regularly by sending emails. Here are some of the key features of an Address book:

- Address book includes the nick names, email addresses, phone number etc. of the people.

- Using address book allows us not to memorize email of address of a person, you just have to select recipient name from the list.
- When you select a particular name from the list, the corresponding email address link automatically get inserted in to the **To:** field.
- Address book also allows creating a group so that you can send a email to very member of the group at once instead of giving each person email address one by one.

➔Web Browser

web Browser is an application software that allows us to view and explore information on the web. User can request for any web page by just entering a URL into address bar.

Web browser can show text, audio, video, animation and more. It is the responsibility of a web browser to interpret text and commands contained in the web page.

Earlier the web browsers were text-based while now a days graphical-based or voice-based web browsers are also available. Following are the most common web browser available today:

Browser	Vendor
Internet Explorer	Microsoft
Google Chrome	Google
Mozilla Firefox	Mozilla
Netscape Navigator	Netscape Communications Corp.
Opera	Opera Software
Safari	Apple
Sea Monkey	Mozilla Foundation
K-meleon	K-meleon

Architecture

There are a lot of web browser available in the market. All of them interpret and display information on the screen however their capabilities and structure varies depending upon implementation. But the most basic component that all web browser must exhibit are listed below:

- Controller/Dispatcher
- Interpreter
- Client Programs

Controller works as a control unit in CPU. It takes input from the keyboard or mouse, interpret it and make other services to work on the basis of input it receives.

Interpreter receives the information from the controller and execute the instruction line by line. Some interpreter are mandatory while some are optional For example, HTML interpreter program is mandatory and java interpreter is optional.

Client Program describes the specific protocol that will be used to access a particular service. Following are the client programs tat are commonly used:

- HTTP
- SMTP
- FTP
- NNTP
- POP

Starting Internet Explorer

Internet explorer is a web browser developed by Microsoft. It is installed by default with the windows operating system howerver, it can be downloaded and be upgraded.

To start internet explorer, follow the following steps:

- Go to **Start** button and click **Internet Explorer.**

The **Internet Explorer** window will appear as shown in the following diagram:

Accessing Web Page

Accessing web page is very simple. Just enter the **URL** in the address bar as shown the following diagram:

Navigation

A web page may contain **hyperlinks.** When we click on these links other web page is opened. These hyperlinks can be in form of text or image.

When we take the mouse over an hyperlink, pointer change its shape to hand.

Key Points

- In case, you have accessed many web pages and willing to see the previous webpage then just click back button.
- You can open a new web page in the same tab, or different tab or in a new window.

Saving Webpage

You can save web page to use in future. In order to save a webpage, follow the steps given below:

- Click **File > Save As.** Save Webpage dialog box appears.
- Choose the location where you want to save your webpage from **save in:** list box. Then choose the folder where you want to save the webpage.
- Specify the file name in the **File name** box.
- Select the type from **Save as** type list box.
    - Webpage, complete
    - Web Archive
    - Webpage HTML only
    - Text File
- From the **encoding** list box, choose the character set which will be used with your webpage. By default, **Western European** is selected.
- Click **save** button and the webpage is saved.

Saving Web Elements

Web elements are the pictures, links etc. In order to save these elements follow the steps given below:

- **Right click** on the webpage element you want to save. Menu options will appear. These options may vary depending on the element you want to save.

Save Picture As: This option let you save the picture at specific location with its name. When you click this option, a dialog box is opened where you can sepcify its name and location.

Favourites

The Favourites option helps to save addresses of the webpages you visited oftenly. Hence you need not to remember long and complex address of websites you visit often.

In order to open any webpage, you just need to double click on the webpage that you have marked from bookmarks list.

ADDING A WEB PAGE TO YOUR FAVOURITES

In ordered to add website to your favourite list, follow the steps given below:

- Open webpage that you want to add to your favourite.
- Click on **favourite menu** and then click on **Add to Favourites** opton. **Addfavourites** dialog box appears.

You can also click **Favourites** button available in the toolbar. Favourites panel will open in the left corner of the internet explorer window. Click **add** button, **Add Favourites** dialog box will apppear.

- In **Add Favourites** dialog box, the **Name:** text box will contains the name of the web page that you want to add to favourites.
- Click the **Create in** button, Favoutites folder will appear. Move to the folder where you want to store the favourites by clicking on the folder name.
- Now click **OK** button to save the favourites.

OPENING FAVOURITES

In order to open favourites, follow the steps given below:

- In the Favourite Panel, take the mouse over the site that you want to open. Now click on the address to open that site.
- Favourite can also be opened from the **Favourites** menu by selecting the appropriate one.

ORGANIZING FAVOURITES

Favourites can be organized by categorizing web pages, creating folder for each category and then storing web pages into them. In order to organize favourites, follow the steps given below:

- Click **Favourites menu > Organize Favourites.** Organize favourites dialog box will appears.
- In order to organize the webpages, drag the individual webpage to the respective folder. Similarly to delete a favourite, Click on **delete** button.

➔Search Engines

Search Engine refers to a huge database of internet resources such as web pages, newsgroups, programs, images etc. It helps to locate information on World Wide Web.

User can search for any information by passing query in form of keywords or phrase. It then searches for relevant information in its database and return to the user.

Search Engine Components

Generally there are three basic components of a search engine as listed below:

1. Web Crawler
2. Database
3. Search Interfaces

Web crawler

It is also known as **spider** or **bots.** It is a software component that traverses the web to gather information.

Database

All the information on the web is stored in database. It consists of huge web resources.

Search Interfaces

This component is an interface between user and the database. It helps the user to search through the database.

Search Engine Working

Web crawler, database and the search interface are the major component of a search engine that actually makes search engine to work. Search engines make use of Boolean expression AND, OR, NOT to restrict and widen the results of a search. Following are the steps that are performed by the search engine:

- The search engine looks for the keyword in the index for predefined database instead of going directly to the web to search for the keyword.
- It then uses software to search for the information in the database. This software component is known as web crawler.

- Once web crawler finds the pages, the search engine then shows the relevant web pages as a result. These retrieved web pages generally include title of page, size of text portion, first several sentences etc.

These search criteria may vary from one search engine to the other. The retrieved information is ranked according to various factors such as frequency of keywords, relevancy of information, links etc.

- User can click on any of the search results to open it.

Architecture

The search engine architecture comprises of the three basic layers listed below:

- Content collection and refinement.
- Search core
- User and application interfaces

➔Online Chatting

Online chatting is a text-based communication between two or more people over the network. In this, the text message is delivered in real time and people get immediate response.

Talkomatic was the world first online chat system. It was developed by **Doug Brown** and **David R. Woolley** in 1973.

Chat Etiquette

Chat etiquette defines rules that are supposed to be followed while online chatting:

- Avoid chat slang
- Try to spell all words correctly.
- Don’t write all the words in capital.
- Don’t send other chat users private messages without asking them.
- Abide by the rules created by those running the chat.
- Use emoticons to let other person know your feelings and expressions.

Web Based Chat Services

Following web sites offers browser based chat services:

Website	Description
Facebook	It was founded by **Mark Zuckerberg** with his college roommates at Harvard university. Facebook lets the user to create personal profile, post status & photos, and receive notifications.
eBuddy	It is an instant messaging service. It supports multiprotocol instant messaging clients.

Convore	It offers real time web based chat system.
MeBeam	It offers video based chat between the clients to create video conferencing rooms for up to 16 people.
Yahoo! Messenger	It offers PC-PC, PC-phone, Phone-to-PC, file transfer, webcam hosting, text messaging service etc.
WhatsApp	It is an instant messaging service application available on smart phones.
Gmail	It offers instant chatting, sending and receiving mails, and video calling services.

➔Instant Messaging (IM)

Instant messaging is a software utility that allows IM users to communicate by sending text messages, files, and images. Some of the IMs also support voice and video calls.

Application	Description
Nimbuzz	It is native iPhone app. It supports voice and video chats, file sharing, and group chats with panache.
eBuddy	eBuddy IM helps to have all your buddies from multiple IM accounts in one single list.
Imo.in	It has capability to link all your IM accounts together. You can log on to all of your IM accounts by just logging into imo.in.
MeBeam	It offers video based chat between the clients to create video conferencing rooms for up to 16 people.
Yahoo! Messenger	It offers PC-PC, PC-phone, Phone-to-PC, file transfer, webcam hosting, text messaging service etc.
GoogleTalk	It is an IM by Google and one of the most widely used.
Lync	Lync is an IM developed by Microsoft. It is widely used in corporate sector for internal and external communication as well.

➔Video Conferencing

Video conferencing or **Video teleconferencing** is a method of communicating by two-way video and audio transmission with help of telecommunication technologies.

Modes of Video Conferencing

POINT-TO-POINT

This mode of conferencing connects two locations only.

MULTI-POINT

This mode of conferencing connects more than two locations through **Multi-point Control Unit (MCU).**

➔Mailing List

In order to send same email to a group of people, an electron list is created which is know as Mailing List. It is the list server which receives and distributes postings and automatically manages subscriptions.

Mailing list offers a forum, where users from all over the globe can answer questions and have them answered by others with shared interests.

Types of Mailing List

Following are the various types of mailing lists:

RESPONSE LIST

It contains the group of people who have responsed to an offer in some way. These people are the customers who have shown interest in specific product or service.

COMPILED LIST

The compiled list is prepared by collecting information from various sources such as surveys, telemarketing etc.

ANNOUNCEMENTS

These lists are created for sending out coupans , new product announcements and other offers to the customers.

DISCUSSION LIST

This list is created for sharing views on a specific topic suchas computer, environment , healt, education etc.

How does mailing list work?

Before joining a mailing list, it is mandatory to subscribe to it. Once you are subscribed, your message will be sent to all the persons who have subscribed to the list. Similarly if any subscriber posts a message, then it will be received by all subscribers of the list.

➔Digital Signature

Digital signatures allow us to verify the author, date and time of signatures, authenticate the message contents. It also includes authentication function for additional capabilities.

A digital signature should not only be tied to the signing user, but also to the message.

Applications

There are several reasons to implement digital signatures to communications:

Authentication

Digital signatures help to authenticate the sources of messages. For example, if a bank's branch office sends a message to central office, requesting for change in balance of an account. If the central office could not authenticate that message is sent from an authorized source, acting of such request could be a grave mistake.

Integrity

Once the message is signed, any change in the message would invalidate the signature.

Non-repudiation

By this property, any entity that has signed some information cannot at a later time deny having signed it.

➔**Firewall** is a barrier between Local Area Network (LAN) and the Internet. It allows keeping private resources confidential and minimizes the security risks. It controls network traffic, in both directions.

The following diagram depicts a sample firewall between LAN and the internet. The connection between the two is the point of vulnerability. Both hardware and the software can be used at this point to filter network traffic.

There are two types of Firewall system: One works by using filters at the network layer and the other works by using proxy servers at the user, application, or network layer.

Key Points

- Firewall management must be addressed by both system managers and the network managers.
- The amount of filtering a firewall varies. For the same firewall, the amount of filtering may be different in different directions.

➔Basics of networking

Network

- A network is a set of devices (often referred to as nodes) connected by communication links.
- A node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network.

Or

- A network consists of two or more computers that are linked in order to share resources (such as printers and CD-ROMs), exchange files, or allow electronic communications. The computers on a network may be linked through cables, telephone lines, radio waves, satellites, or infrared light beams.

Or

- A computer network is interconnection of various computer systems located at different places. In computer network two or more computers are linked together with a medium and data communication devices for the purpose of communicating data and sharing resources. The computer that provides resources to other computers on a network is known as server. In the network the individual computers, which access shared network resources, are known as nodes.

TYPES OF NETWORKS

The three basic types of networks include: LAN, MAN and WAN.

LOCAL AREA NETWORK (LAN)

- A **local area network** (LAN) is usually privately owned and links the devices in a single office, building, or campus. LANs are designed to allow resources to be shared between personal computers or workstations. The resources to be shared can include hardware (e.g., a printer),software (e.g., an application program), or data LAN configuration consists of:
- ○ **A file server** - stores all of the software that controls the network, as well as the software that can be shared by the computers attached to the network.
- ○ **A workstation** - computers connected to the file server (Mac or PCs). These are less powerful than the file server
- ○ **Cables** - used to connect the network interface cards in each computer.
- Most LANs connect workstations and personal computers.
- Each node (individual computer) in a LAN has its own CPU with which it executes programs, but it is also able to access data and devices anywhere on the LAN. This means that many users can share expensive devices, such as laser printers, as well as data. Users can also use the LAN to communicate with each other, by sending e-mail or engaging in chart sessions.
- LANs are capable of transmitting data at very fast rates, much faster than data can be transmitted over a telephone line; but the distance are limited, and there is also a limit on the number of computers that can be attached to a single LAN.
- Small LANs first became popular in the early 1980s. At that time, LANs might have consisted of a handful of computers connected in a peer-to-peer fashion. Today's LANs are typically much larger and more complex client/server networks.

METROPOLITAN AREA NETWORK (MAN)

- **Metropolitan Area Network (MAN)** covers larger geographic areas, such as cities or towns.
- Often used by local libraries and government agencies often to connect to citizens and private industries.
- A metropolitan area network (MAN) is a network with a size between a LAN and a WAN. It is designed for customers who need a high-speed connectivity, normally to the Internet, and have endpoints

- spread over a city or part of city. A good example of a MAN is the part of the telephone company network that can provide a high-speed DSL line to the customer.

WIDE AREA NETWORK (WAN)

- A **wide area network** (WAN) provides long-distance transmission of data, image, audio, and video
- Information over large geographic areas that may comprise a country, a continent, or even the whole world.
- A WAN is a computer network that spans a relatively large geographical area.
- Typically, A WAN consists of two or more local-area networks (LANs).
- Computers connected to a wide-area network are often connected through public networks, such as the telephone system. They can also be connected through leased lines or satellites.
- The largest WAN in existence is the Internet.

Advantages and Disadvantages of network

- **Advantages**
- 1. Peripherals such as printers can be shared amongst many different users. Sharing printers, plotters, modems etc saves money and time.
- 2. Software can be shared amongst different users.
- 3. Communication across the network is cheap and fast.
- 4. A user can logon to a computer anywhere on the network and access their work files from
- the file server
- **Disadvantages**
- 1. Cabling can be expensive to install and replace.
- 2. A fault with the server will prevent the whole network from working.
- 3. Security measures are needed to restrict access to the network.
- 4. WANs are vulnerable to hackers and viruses.
- 5. Network faults can cause loss of data.
- 6. Users may use up too much of the storage space and this may cause problems on the
- Network
- 7. It can be frustrating to print to a print printer in another room - and then find after a long trek - that there is no paper in the printer

➔Domain Name Servers (DNS)

- Domain Name Servers (DNS) are the Internet's equivalent of a phone book. They maintain a directory of domain names and translate them to Internet Protocol (IP) addresses.
  This is necessary because, although domain names are easy for people to remember, computers or machines, access websites based on IP addresses.
  Information from all the domain name servers across the Internet are gathered together and housed at the Central Registry. Host companies and Internet Service Providers interact with the Central Registry on a regular schedule to get updated DNS information.
  When you type in a web address, e.g., www.jimsbikes.com, your Internet Service Provider views the DNS associated with the domain name, translates it into a machine friendly IP address (for example 216.168.224.70 is the IP for jimsbikes.com) and directs your Internet connection to the correct website.

After you register a new domain name or when you update the DNS servers on your domain name, it usually takes about 12-36 hours for the domain name servers world-wide to be updated and able to access the information. This 36-hour period is referred to as propagation.

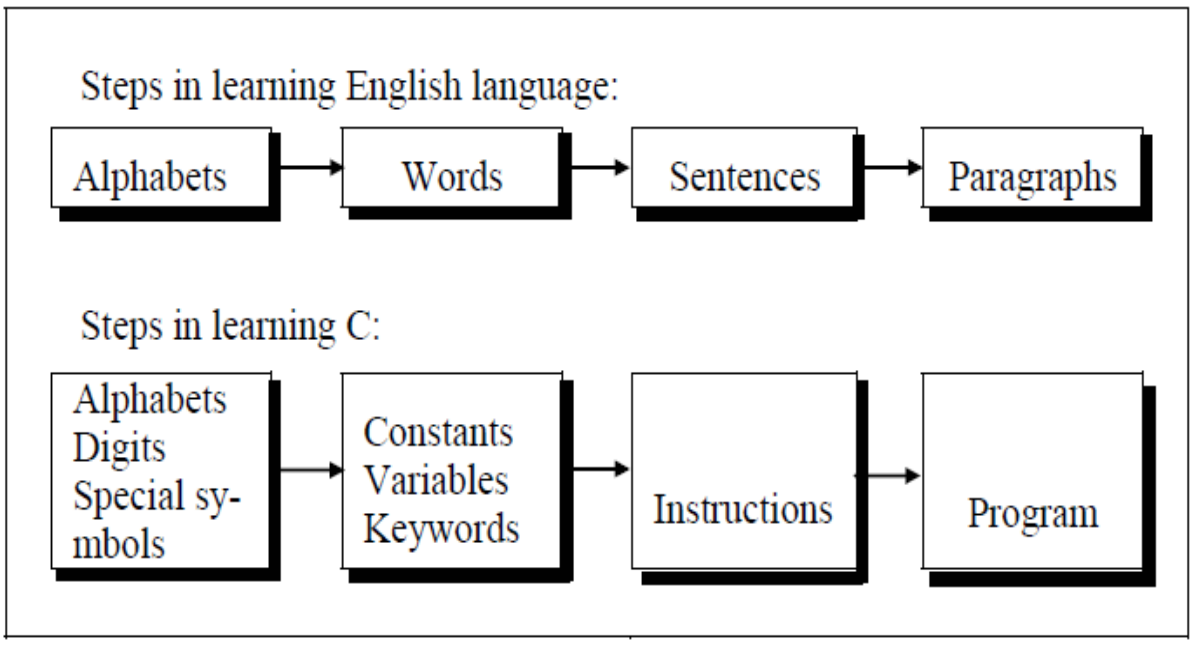
UNIT IV

Introduction to C Programming

C is a programming language developed at AT & T's Bell Laboratories of USA in 1972. It was designed and written by a man named Dennis Ritchie. In the late seventies C began to replace the more familiar languages of that time like PL/I, ALGOL, etc. No one pushed C. It wasn't made the 'official' Bell Labs language. Thus, without any advertisement C's reputation spread and its pool of users grew. Ritchie seems to have been rather surprised that so many programmers preferred C to older languages like FORTRAN or PL/I, or the newer ones like Pascal and APL. But, that's what happened.

Possibly why C seems so popular is because it is reliable, simple and easy to use. Moreover, in an industry where newer languages, tools and technologies emerge and vanish day in and day out, a language that has survived for more than 3 decades has to be really good.

Communicating with a computer involves speaking the language the computer understands, which immediately rules out English as the language of communication with computer. However, there is a close analogy between learning English language and learning C language. The classical method of learning English is to first learn the alphabets used in the language, then learn to combine these alphabets to form words, which in turn are combined to form sentences and sentences are combined to form paragraphs. Learning C is similar and easier. Instead of straight-away learning how to write programs, we must first know what alphabets, numbers and special symbols are used in C, then how using them constants, variables and keywords are constructed, and finally how are these combined to form an instruction. A group of instructions would be combined later on to form a program. This is illustrated in the Figure given below



The C Character Set

A character denotes any alphabet, digit or special symbol used to represent information. Below Figure shows the valid alphabets, numbers and special symbols allowed in C.

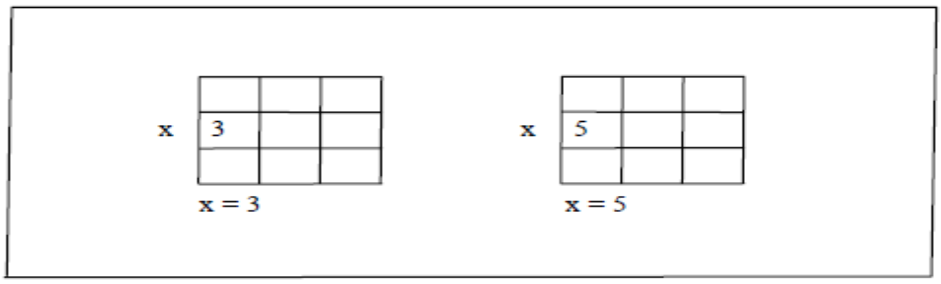
Alphabets	A, B, ….., Y, Z a, b, ……, y, z
Digits	0, 1, 2, 3, 4, 5, 6, 7, 8, 9
Special symbols	~ ‘ ! @ # % ^ & * ( ) _ - + = | \ { } [ ] : ; " ' < > , . ? /

Constants, Variables and Keywords

The alphabets, numbers and special symbols when properly combined form constants, variables and keywords. Let us see what are ‘constants’ and ‘variables’ in C. A constant is an entity that doesn’t change whereas a variable is an entity that may change.

In any program we typically do lots of calculations. The results of these calculations are stored in computers memory. Like human memory the computer memory also consists of millions of cells. The calculated values are stored in these memory cells. To make the retrieval and usage of these values easy these memory cells (also called memory locations) are given names. Since the value stored in each location may change the names given to these locations are called variable names. Consider the following example.

Here 3 is stored in a memory location and a name **x** is given to it. Then we are assigning a new value 5 to the same memory location **x**. This would overwrite the earlier value 3, since a memory location can hold only one value at a time. This is shown in Figure below.



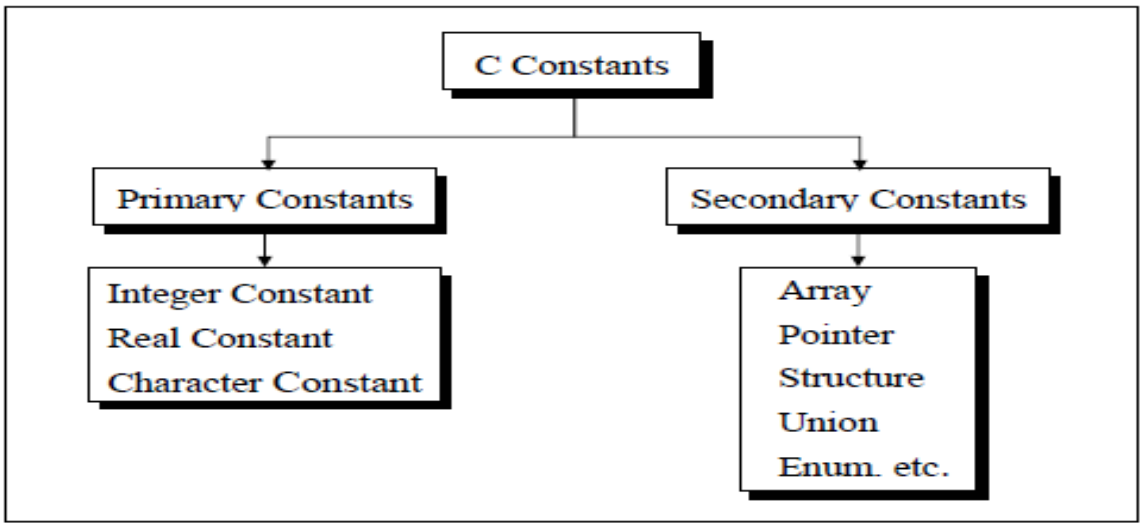
Since the location whose name is **x** can hold different values at different times **x** is known as a variable. As against this, 3 or 5 do not change, hence are known as constants.

Types of C Constants

C constants can be divided into two major categories:

Primary Constants
Secondary Constants

These constants are further categorized as shown below



Types of C Variables

As we saw earlier, an entity that may vary during program execution is called a variable. Variable names are names given to locations in memory. These locations can contain integer, real or character constants. In any language, the types of variables that it can support depend on the types of constants that it can handle. This is because a particular type of variable can hold only the same type of constant. For example, an integer variable can hold only an integer constant, a real variable can hold only a real constant and a character variable can hold only a character constant.

The rules for constructing different types of constants are different. However, for constructing variable names of all types the same set of rules apply. These rules are given below.

Rules for Constructing Variable Names

A variable name is any combination of 1 to 31 alphabets, digits or underscores. Some compilers allow variable names whose length could be up to 247 characters. Still, it would be safer to stick to the rule of 31 characters. Do not create unnecessarily long variable names as it adds to your typing effort.

The first character in the variable name must be an alphabet or underscore.

No commas or blanks are allowed within a variable name.

No special symbol other than an underscore (as in **gross_sal**) can be used in a variable name.

Ex.: si_int
m_hra
pop_e_89

These rules remain same for all the types of primary and secondary variables. Naturally, the question follows... how is C able to differentiate between these variables? This is a rather simple

matter. C compiler is able to distinguish between the variable names by making it compulsory for you to declare the type of any variable name that you wish to use in a program. This type declaration is done at the beginning of the program. Following are the examples of type declaration statements:

```
Ex.: int si, m_hra ;
float bassal ;
char code ;
```

Since, the maximum allowable length of a variable name is 31 characters, an enormous number of variable names can be constructed using the above-mentioned rules. It is a good practice to exploit this enormous choice in naming variables by using meaningful variable names.

Thus, if we want to calculate simple interest, it is always advisable to construct meaningful variable names like **prin**, **roi**, **noy** to represent Principle, Rate of interest and Number of years rather than using the variables **a**, **b**, **c**.

C Keywords

Keywords are the words whose meaning has already been explained to the C compiler (or in a broad sense to the computer). The keywords **cannot** be used as variable names because if we do so we are trying to assign a new meaning to the keyword, which is not allowed by the computer. Some C compilers allow you to construct variable names that exactly resemble the keywords. However, it would be safer not to mix up the variable names and the keywords. The keywords are also called 'Reserved words'.

There are only 32 keywords available in C. Figure 1.5 gives a list of these keywords for your ready reference. A detailed discussion of each of these keywords would be taken up in later chapters wherever their use is relevant.

auto	double	int	struct
break	else	long	switch
case	enum	register	typedef
char	extern	return	union
const	float	short	unsigned
continue	for	signed	void
default	goto	sizeof	volatile
do	if	static	while

Algorithms and Flowchart

Algorithms

1. A sequential solution of any program that written in human language, called algorithm.

2. Algorithm is first step of the solution process, after the analysis of problem, programmer writes the algorithm of that problem.
3. Example of Algorithms:

Rules for constructing an Algorithm

When you are going to create an algorithms, keep following point in mind as:

Input: There should be zero or more values which are to be supplied.

Output: At least one result is to be produced.

Definiteness: Each step must be clear and unambiguous.

Finiteness: If we trace the steps of an algorithm, then for all cases, the algorithm must terminate after a finite number of steps.

Effectiveness: Each step must be sufficiently basic that a person using only paper and pencil can in principle carry it out. In addition, not only each step is definite, it must also be feasible.

Comment Session: Comment is additional info of program for easily modification. In algorithm comment would be appear between two square bracket []. For example: [this is a comment of an algorithm]

Write a algorithm to find out number is odd or even?

```
step 1 : start
step 2 : input number
step 3 : rem=number mod 2
step 4 : if rem=0 then
             print "number even"
         else
             print "number odd"
         endif
step 5 : stop
```

Flowchart

1. Graphical representation of any program is called flowchart.
2. There are some standard graphics that are used in flowchart as following:

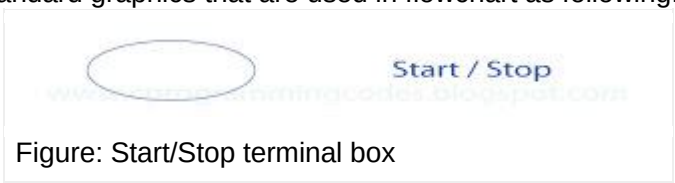


Figure: Start/Stop terminal box

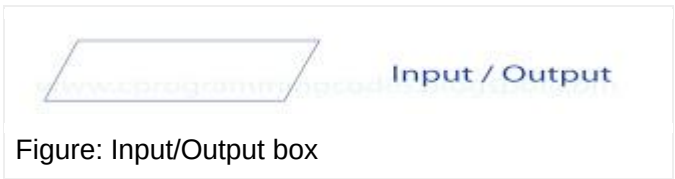


Figure: Input/Output box

Figure: Process/Instruction box

Figure: Lines or Arrows

Figure: Decision box

Figure: Connector box

Figure: Comment box

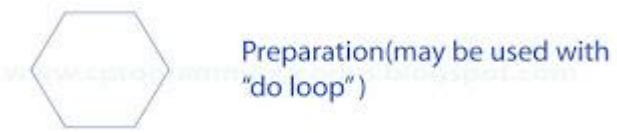


Figure: Preparation box

Figure: Separate box

Make a flowchart to input temperature, if temperature is less than 32 then print "below freezing" otherwise print "above freezing"?

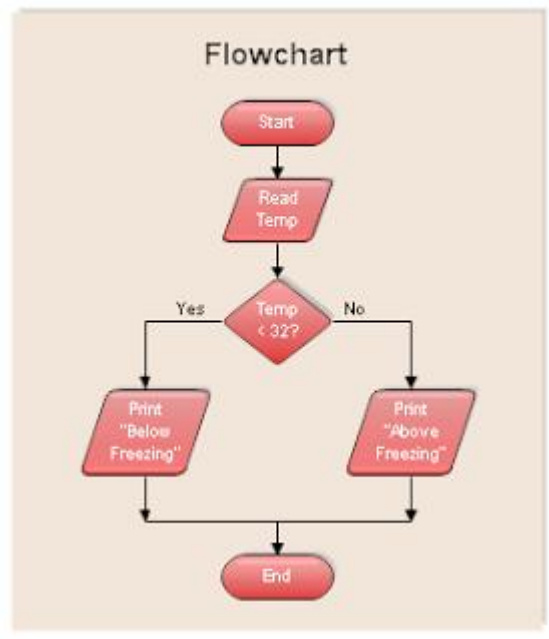


Figure: Flowchart example of C program

The First C Program

Armed with the knowledge about the types of variables, constants & keywords the next logical step is to combine them to form instructions. However, instead of this, we would write our first C program now. Once we have done that we would see in detail the instructions that it made use of.

Before we begin with our first C program do remember the following rules that are applicable to all C programs:

i) Each instruction in a C program is written as a separate statement. Therefore a complete C program would comprise of a series of statements.
ii) The statements in a program must appear in the same order in which we wish them to be executed; unless of course the logic of the problem demands a deliberate 'jump' or transfer of control to a statement, which is out of sequence.
iii) Blank spaces may be inserted between two words to improve the readability of the statement. However, no blank spaces are allowed within a variable, constant or keyword.
iv) All statements are entered in small case letters.
v)C has no specific rules for the position at which a statement is to be written. That's why it is often called a free-form language.
vi) Every C statement must end with a **;**. Thus **;** acts as a statement terminator.

C Instructions

There are basically three types of instructions in C:

Type Declaration Instruction
Arithmetic Instruction
Control Instruction

Type declaration instruction	To declare the type of variables used in a C program.
Arithmetic instruction	To perform arithmetic operations between constants and variables.
Control instruction	To control the sequence of execution of various statements in a C program.

Type Declaration Instruction

This instruction is used to declare the type of variables being used in the program. Any variable used in the program must be declared before using it in any statement. The type declaration statement is written at the beginning of **main( )** function.

```
Ex.: int bas ;
float rs, grosssal ;

char name, code ;
```

Arithmetic Instruction

A C arithmetic instruction consists of a variable name on the left hand side of = and variable names & constants on the right hand side of =. The variables and constants appearing on the right hand side of = are connected by arithmetic operators like **+, -, *,** and /.

```
Ex.: int ad ;
float kot, deta, alpha, beta, gamma ;
ad = 3200 ;
kot = 0.0056 ;
deta = alpha * beta / gamma + 3.2 * 2 / 5 ;
```

Here,

***, /, -,** + are the arithmetic operators.
= is the assignment operator.
2, 5 and 3200 are integer constants.
3.2 and 0.0056 are real constants.
ad is an integer variable.

kot, deta, alpha, beta, gamma are real variables.

Control Instructions in C

As the name suggests the 'Control Instructions' enable us to specify the order in which the various instructions in a program are to be executed by the computer. In other words the control instructions determine the 'flow of control' in a program. There are four types of control instructions in C. They are:

(a) Sequence Control Instruction
(b) Selection or Decision Control Instruction
(c) Repetition or Loop Control Instruction
(d) Case Control Instruction

The Sequence control instruction ensures that the instructions are executed in the same order in which they appear in the program. Decision and Case control instructions allow the computer to take a decision as to which instruction is to be executed next. The Loop control instruction helps computer to execute a group of statements repeatedly.

Selection or Decision Control Instruction

In fact to execute the instructions sequentially, we don't have to do anything at all. By default the instructions in a program are executed sequentially. However, in serious programming situations, seldom do we want the instructions to be executed sequentially. Many a times, we want a set of instructions to be executed in one situation, and an entirely different set of instructions to be executed in another situation. This kind of situation is dealt in C programs using a decision control instruction. A decision control instruction can be implemented in C using:

a) The **if** statement
b) The **if-else** statement
c) The conditional operators

The *if* Statement

Like most languages, C uses the keyword **if** to implement the decision control instruction. The general form of **if** statement looks like this:

```
if ( this condition is true )
execute this statement ;
```

The keyword **if** tells the compiler that what follows is a decision control instruction. The condition following the keyword **if** is always enclosed within a pair of parentheses. If the condition, whatever it is, is true, then the statement is executed. If the condition is not true then the statement is not executed; instead the program skips past it. But how do we express the condition itself in C? And how do we evaluate its truth or falsity? As a general rule, we express a condition using C's 'relational' operators. The relational operators allow us to compare two values to see whether they are equal to each other, unequal, or whether one is greater than the other. Here's how they look and how they are evaluated in C.

this expression	is true if
x == y	x is equal to y
x != y	x is not equal to y
x < y	x is less than y
x > y	x is greater than y
x <= y	x is less than or equal to y
x >= y	x is greater than or equal to y

The *if-else* Statement

The **if** statement by itself will execute a single statement, or a group of statements, when the expression following **if** evaluates to true. It does nothing when the expression evaluates to false. Can we execute one group of statements if the expression evaluates to true and another group of statements if the expression evaluates to false? Of course! Example of if-else

If his basic salary is less than Rs. 1500, then HRA = 10% of basic salary and DA = 90% of basic salary. If his salary is either equal to or above Rs. 1500, then HRA = Rs. 500 and DA = 98% of basic salary. If the employee's salary is input through the keyboard write a program to find his gross salary.

```
/* Calculation of gross salary */
main( )
{
float bs, gs, da, hra ;
printf ( "Enter basic salary " ) ;
scanf ( "%f", &bs ) ;
if ( bs < 1500 )
{
hra = bs * 10 / 100 ;
da = bs * 90 / 100 ;
}
else
{
hra = 500 ;
da = bs * 98 / 100 ;
}
gs = bs + hra + da ;
printf ( "gross salary = Rs. %f", gs ) ;

}
```

Forms of *if*

The **if** statement can take any of the following forms:

```
(a) if ( condition )
        do this ;
(b) if ( condition )
        {
        do this ;
        and this ;
        }
(c) if ( condition )
        do this ;
        else
        do this ;
(d) if ( condition )
        {
        do this ;


        and this ;
        }
        else
        {
        do this ;
        and this ;
        }
(e) if ( condition )
        do this ;
        else
        {
        if ( condition )
        do this ;
        else
        {
        do this ;
```

```
        and this ;
        }
        }
(f) if ( condition )
        {
        if ( condition )
        do this ;
        else
        {
        do this ;
        and this ;
        }
        }
        else
        do this ;
```

Use of Logical Operators

C allows usage of three logical operators, namely, &&, || and !. These are to be read as 'AND' 'OR' and 'NOT' respectively.

There are several things to note about these logical operators. Most obviously, two of them are composed of double symbols: || and **&&**.

The first two operators, **&&** and ||, allow two or more conditions to be combined in an **if** statement. Let us see how they are used in a program. Consider the following example.

Example 2.4: The marks obtained by a student in 5 different subjects are input through the keyboard. The student gets a division as per the following rules:

Percentage above or equal to 60 - First division
Percentage between 50 and 59 - Second division
Percentage between 40 and 49 - Third division
Percentage less than 40 - Fail

Write a program to calculate the division obtained by the student.

There are two ways in which we can write a program for this example. These methods are given below.

```
/* Method – I */
main( )
{
int m1, m2, m3, m4, m5, per ;
printf ( "Enter marks in five subjects " ) ;
scanf ( "%d %d %d %d %d", &m1, &m2, &m3, &m4, &m5 ) ;
per = ( m1 + m2 + m3 + m4 + m5 ) / 5 ;
```

```
if ( per >= 60 )
printf ( "First division ") ;
else
{
if ( per >= 50 )
printf ( "Second division" ) ;
else
{
if ( per >= 40 )
printf ( "Third division" ) ;
else
printf ( "Fail" ) ;
}
}
}
```

This is a straight forward program. Observe that the program uses nested **if-else**s. This leads to three disadvantages:

a) As the number of conditions go on increasing the level of indentation also goes on increasing. As a result the whole program creeps to the right.
b) Care needs to be exercised to match the corresponding **if**s and **else**s.
c)Care needs to be exercised to match the corresponding pair of braces.

All these three problems can be eliminated by usage of 'Logical operators'. The following program illustrates this.

```
/* Method – II */
main( )
{
int m1, m2, m3, m4, m5, per ;
printf ( "Enter marks in five subjects " ) ;
scanf ( "%d %d %d %d %d", &m1, &m2, &m3, &m4, &m5 ) ;
per = ( m1 + m2 + m3 + m4 + m5 ) / 5 ;
if ( per >= 60 )
printf ( "First division" ) ;
if ( ( per >= 50 ) && ( per < 60 ) )
printf ( "Second division" ) ;
if ( ( per >= 40 ) && ( per < 50 ) )
printf ( "Third division" ) ;
if ( per < 40 )
printf ( "Fail" ) ;
}
```

As can be seen from the second **if** statement, the **&&** operator is used to combine two conditions. 'Second division' gets printed if both the conditions evaluate to true. If one of the conditions evaluate to false then the whole thing is treated as false.

Two distinct advantages can be cited in favour of this program:

a) The matching (or do I say mismatching) of the **if**s with their corresponding **else**s gets avoided, since there are no **else**s in this program.
b) In spite of using several conditions, the program doesn't creep to the right. In the previous program the statements went on creeping to the right. This effect becomes more pronounced as the number of conditions go on increasing. This would make the task of matching the **if**s with their corresponding **else**s and matching of opening and closing braces that much more difficult.

Loops

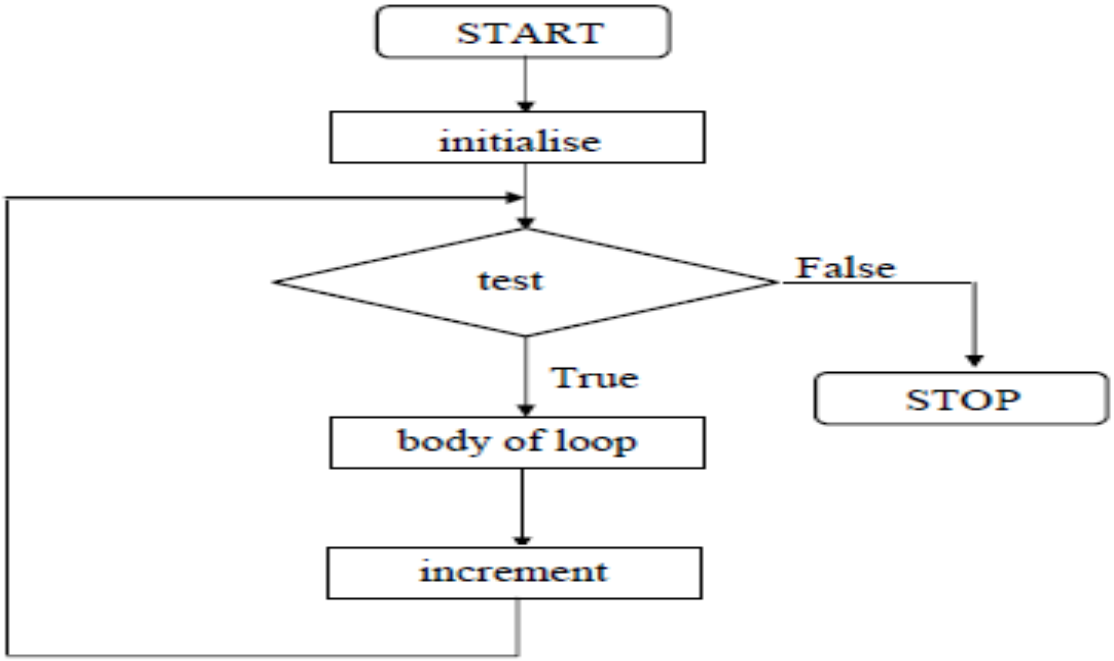
The versatility of the computer lies in its ability to perform a set of instructions repeatedly. This involves repeating some portion of the program either a specified number of times or until a particular condition is being satisfied. This repetitive operation is done through a loop control instruction.

There are three methods by way of which we can repeat a part of a program. They are:

a) **Using a for statement.**

b) **Using a while statement.**
c) **Using do-while statement.**

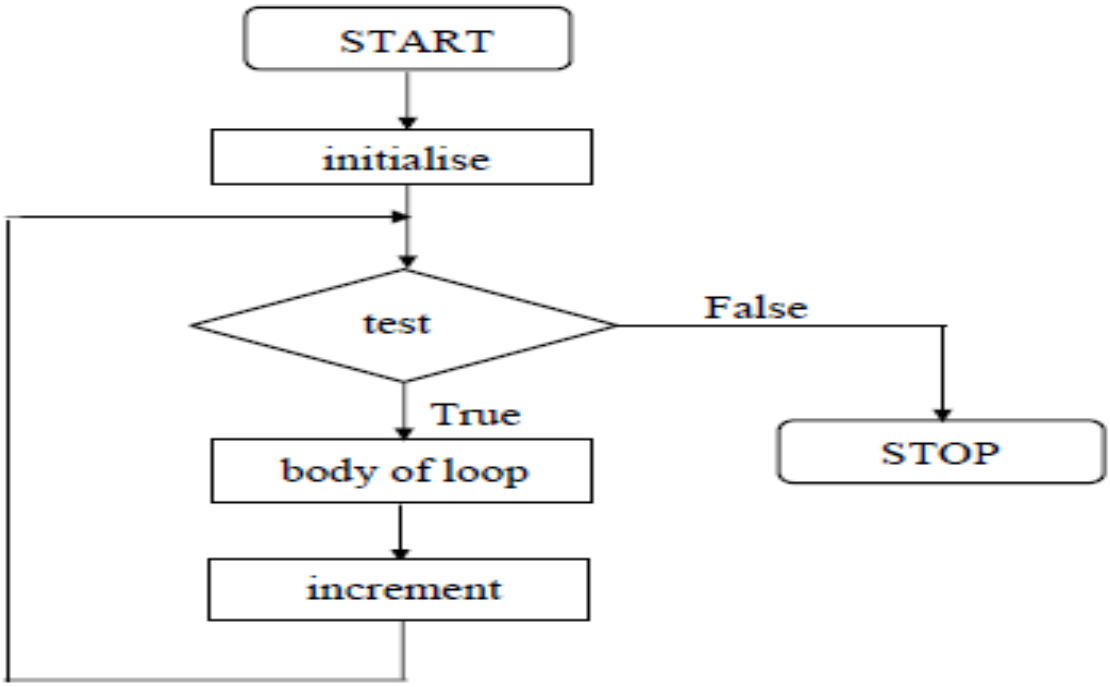
While Loop Flowchart



While Loop C Example

```
main()
 {
    Int I;
    I=1
    While (i<=10)
     {
       Printf("%d",i);
       I++;
     }
 }
```

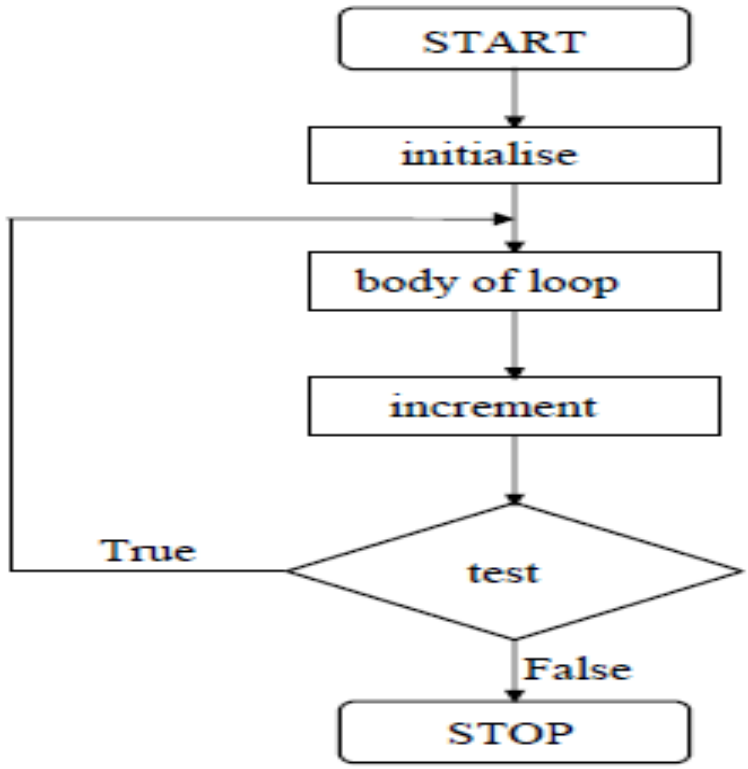
For Loop Flowchart



For Loop C Example

```
main()
 {
    Int I;
    For  (i=1;<=10;i++)
     {
       Printf("%d",i);
      }
 }
```

Do-while Loop Flowchart



Do-while Loop C Example

```
main()
 {
    Int I;
   I=1;
  Do
  {
     Printf("%d",i);
      I++;
   }while(i<=10);
 }
```

➔EXAMPLES

Flowchart for prime number

Flowchart for check a number is prime or not as following:

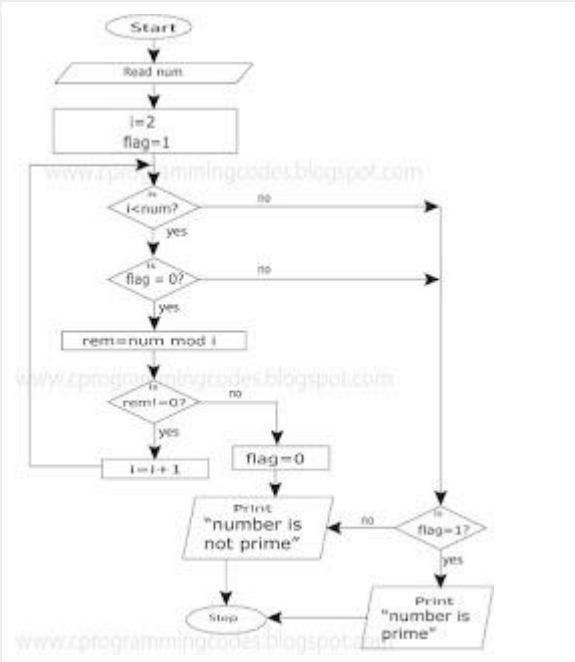


Figure: Flowchart for check given number is prime number or not

Factorial C program,Algorithm,Flowchart

/*c program to find out factorial value of a number*/

```
#include<stdio.h>
#include<conio.h>
int main()
{
 int n,i,fact=1;
 printf("Enter any number : ");
 scanf("%d", &n);
 for(i=1; i<=n; i++)
    fact = fact * i;
 printf("Factorial value of %d = %d",n,fact);
 return 0;
}
```

Algorithm for calculate factorial value of a number:

[algorithm to calculate the factorial of a number]
step 1. Start
step 2. Read the number n
step 3. [Initialize]
    i=1, fact=1
step 4. Repeat step 4 through 6 until i=n
step 5. fact=fact*i
step 6. i=i+1
step 7. Print fact
step 8. Stop
[process finish of calculate the factorial value of a number]

Flowchart for calculate factorial value of a number:

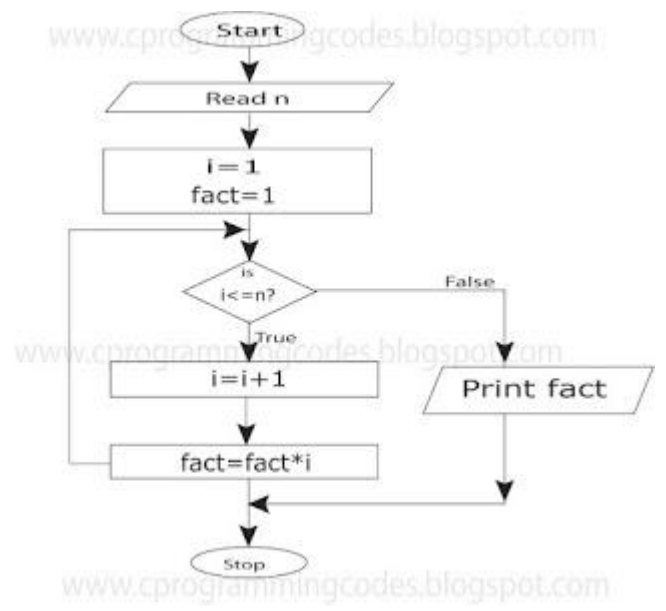


Figure: Flowchart for calculate factorial value of a number C program

Flowchart for finding Armstrong number

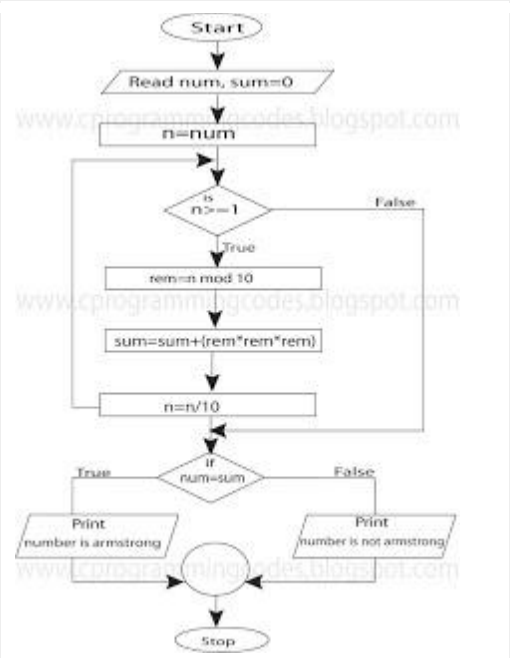


Figure: Flowchart for finding number is Armstrong or not C program

Algorithm

An algorithm is a finite set of steps defining the solution of a particular problem. An algorithm can be expressed in human readable language like as English. Algorithm is language depended, well structured and detailed.

Rules for constructing an Algorithm

When you are going to create an algorithms, keep following point in mind as:

Input: There should be zero or more values which are to be supplied.

Output: At least one result is to be produced.

Definiteness: Each step must be clear and unambiguous.

Finiteness: If we trace the steps of an algorithm, then for all cases, the algorithm must terminate after a finite number of steps.

Effectiveness: Each step must be sufficiently basic that a person using only paper and pencil can in principle carry it out. In addition, not only each step is definite, it must also be feasible.

Comment Session: Comment is additional info of program for easily modification. In algorithm comment would be appear between two square bracket []. For example: [this is a comment of an algorithm]

The demonstration of for loop algorithm through calculate factorial number C program/algorithm:

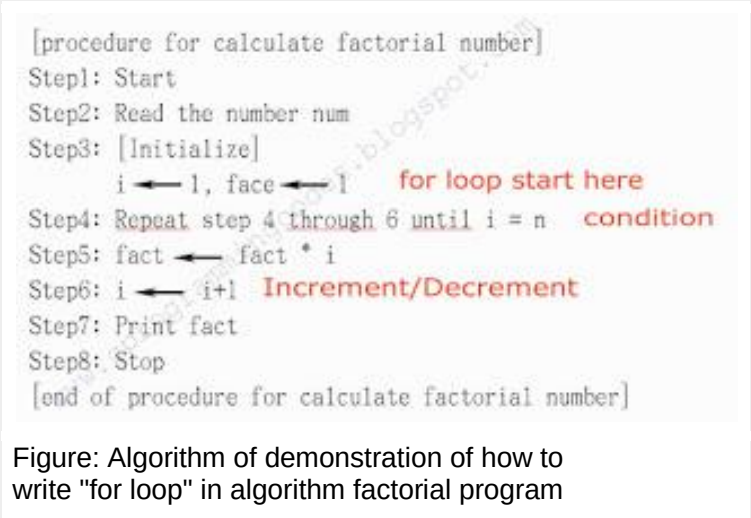


Figure: Algorithm of demonstration of how to write "for loop" in algorithm factorial program

Write algorithm to calculate the sum and average of two numbers.

Step1 : Start

Step2 : Read two numbers n,m

Step3 : Calculate sum=n+m

Step4 : Calculate avg=sum/2

Step5 : Print sum,avg

Step5 : Stop

[End of procedure for calculate sum and average of two numbers]

Write an algorithm to convert a decimal number into binary.

Step1: Start

Step2: Read number num

Step3: Set x=1

Step4: B(x)= num MOD 2

Step5: num=num/2

Step6: If num is equal to 0 then goto step8

Step7 : x=x+1

Step8: goto step3

Step9: Print B(x)

Step10: x=x-1

Step11: If x is greater than 0 then goto step8

step12: Stop

[end of procedure for convert decimal to binary number]

Sum of square program, Algorithm and Flowchart

.

```
#include<stdio.h>
int main()
{
 int num,sum=0,i;
 printf("Enter any number : ");
 scanf("%d", &num);
 for(i=1; i<=num; i++)
    sum = sum + (i*i);
 printf("Sum of square of %d = %d",num,sum);
 return 0;
}
```

Algorithm for accept a number from user and calculate sum of square:

Step 1. Start

Step 2. Read number num

Step 3. [Initialize]

sum=0, i=1

Step 4. Repeat step 4 through 6 until i<=num

Step 5. sum=sum+(i*i)

Step 6. i=i+1

Step 7. print the sum of square

Step 8. stop

Flowchart for sum of square C program as following:

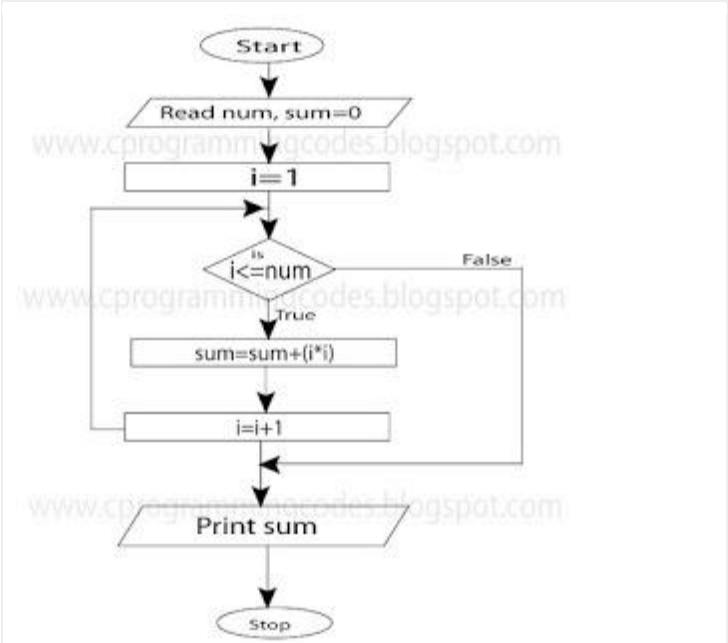


Figure: Flowchart for calculate sum of square C program

Algorithm for star pyramid

Write a C program to print the following star program. Also write down the algorithm.

```
*
**
***
****
*****
```

Algorithm for above star pyramid as follows:

```
[star pyramid procedure]
step1: Start
step2: Read number num
step3: [initialize]
       r=1
step4: Repeat step 4 through 10 until num>=r
step5: [initialize]
       c=1
step6: Repeat step 6 through 8 until c<=r
step7: print */#
step8: c=c+1
       [end of loop step6]
step9: go to next line
step10: r=r+1
        [end of loop step4]
```

step11: stop
[end of star pyramid procedure]

Algorithm for number pyramid
write a C program for following number pyramid and also write down algorithm:

1234554321
1234__4321
123____321
12______21
1________1

Algorithm for above number pyramid as:

[procedure of number pyramid]
step1: Start
step2: Read number num
step3: [initialize]
r=1
step4: Repeat step 4 to 21 until num>=1
step5: [initialize]
c=1
step6: Repeat step 6 to 8 until c<=num
step7: print value of c
step8: c=c+1
[end of step6 loop]
step9: [initialize]
sp=r
step10: Repeat step 10 to 12 until sp>1
step11: print _
step12: sp=sp-1
[end of step10 loop]
step13: [initialize]
sp=r
step14: Repeat step 14 to 16 until sp>1
step15: print _
step16: sp=sp-1
[end of step14 loop]
step17: [initialize]
c=num
step18: Repeat step 18 to 20 until c>=1
step19: print value of c
step20: c=c-1
[end of step18 loop]
step21: Go to next line
[end of step4 loop]
step22: Stop
[end procedure of number pyramid]

if else statement and flowchart
Decision Control Statements and Flowchart

The if Statement
It is used to execute an instruction or sequence/block of instruction only if a condition is fulfilled.
Difference forms of implements if-statement are:

Simple if statement
if-else statement
Nested if-else statement
else if statement

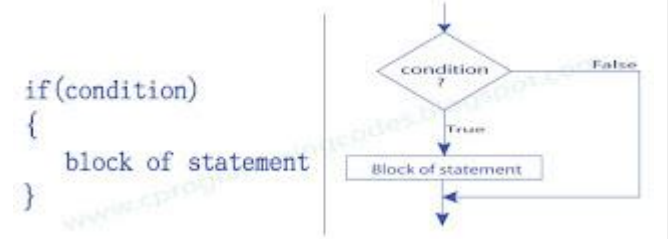


Figure: Simple if statement syntax and flowchart

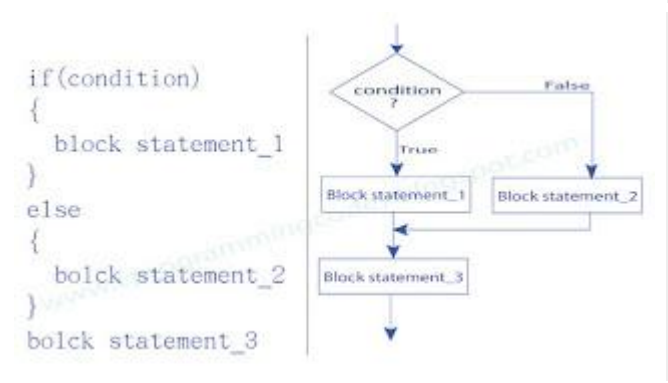


Figure: if-else statement syntax and flowchart

Nested if-else statement
In nested if...else statement, an entire if...elseconstruct is written within either the body of the if statement or the body of an else statement.
The syntax is as follows:

```
if(condition_1)
{
 if(condition_2)
 {
   block statement_1;
 }
 else
 {
   block statement_2;
 }
}
else
```

```
{
  block statement_3;
}
block statement_4;
```

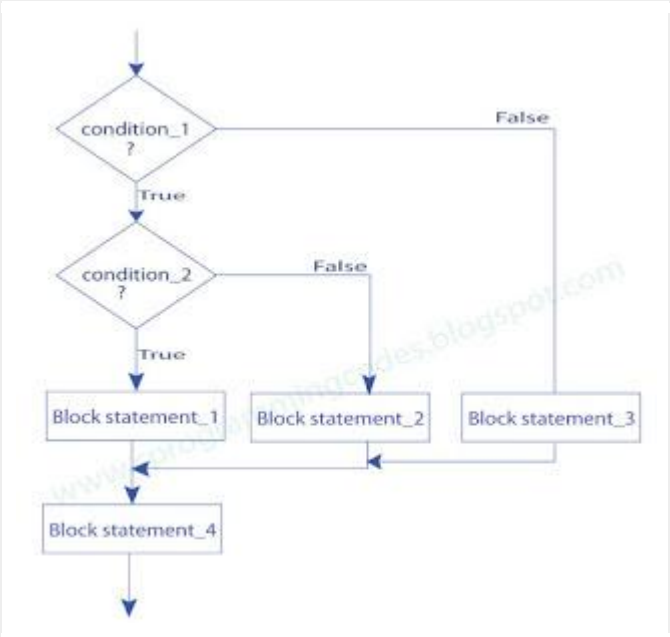


Figure: nested if-else statement flowchart

Else if statement

It is used in multi-way decision on several conditions. This works by cascading comparisons. As soon as one of the conditions is true, the statement or block of statements following them is executed and no further comparison are performed.

The else...if syntax is as follows:

```
if(condition_1)
  block statement_1;
else if(condition_2)
  block statement_2;
else if(condition_n)
  block statement_n;
else
  default statement;
```

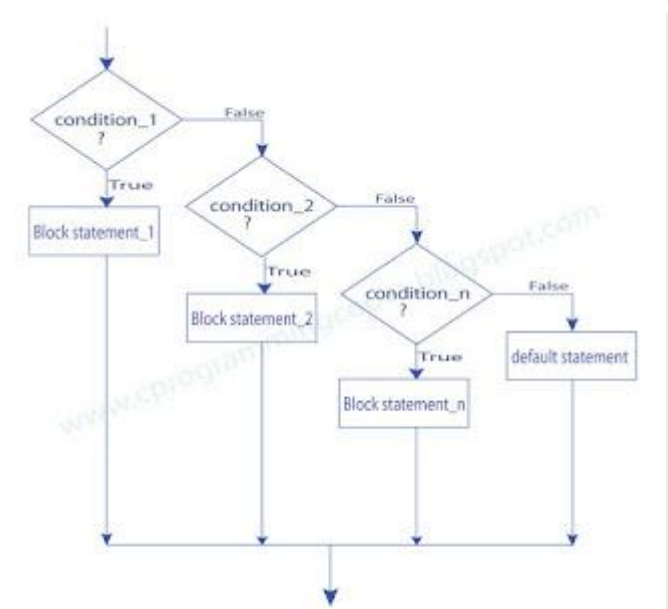


Figure: flowchart for else...if statement