UNIT - I

Fundamentals of Computer

1.1 Introduction

- The word "computer" comes from the word "*compute*", which means to calculate. Hence, a computer is normally considered to be a calculating device, which can perform arithmetic operations at rapid speed.
- In fact, the original objective for inventing the computer was to create a fast- c a l c u l a t i n g machine. However, more than 80% of the work done by computers today is of a non-mathematical or non-numerical nature. Hence, to define a computer merely as a calculating device is to ignoreover 80% of its functions.
- The computer we see today is quite different from the one designed in the beginning. The number of applications for computers has increased. One must appreciate the impact of computers on our dayto-day life.
- Reservation of tickets, payment of telephone and electricity bills, deposits, and withdrawals of money from banks, business data processing, medical diagnosis, weather forecasting, etc., are some of the areas where the computer has created a revolution.

1.2 Meaning of Computer

A computer is an electronic device that executes the instructions in a program. A computer has four functions:

Function	Description
Input	Accepts data
Processing	Processes data
Output	Produces output
Storage	Stores results

Four functions of a computer

- Generally, computer is simply considered as a calculator, which works automatically and fast, but for a person who knows much about it, computer is a machine capable of solving problems and manipulating data. It accepts data, processes it by doing some mathematical and logical operations and gives the desired output.
- Hence, one can define computer as a device that transforms data. Data can be anything like marks obtained by an individual in various subjects. It can also be name, age, sex, weight, height, etc., of all the students in a class or income, savings, investments, etc., of a country.

1.3 History /Generations of Computer

Historically, the word computer has been derived from the Latin word 'computers,' which means to calculate. Therefore, the term computer can logically be applied to any calculating device. **The Abacus,** the first "automatic" computer was invented in china as a first attempt at automating the counting process. Abacus is a machine which allows the user to remember his current state of calculations while performing more complex mathematical operation.

Gottfried Leibniz Wilhelm, Blaise Pascal, Charles Babbage are the fore fathers of modern computers.

Blaise Pascal invented one of the first mechanical calculators: The Pascaline

Gottfried Leibniz Wilhelm invented the binary system which is the foundation of virtually all modern compute architectures. It is used internally by modern computers. Made up of 0s and 1s, it is used for card readers, electric circuits, and vacuum tubes.

- Charles Babbage is credited with invention of the first mechanical computer, called the Difference Engine, which eventually led to more complex and advanced designs. He originated the concept of a programmable computer.

Computer evolution as per the generations has been tabulated below:

Generation	Years	Switching device	Storage device	Software	Applications
First	1949-55	Vacuum tubes	Acoustic delay lines and later magnetic drum. I K byte memory	Machine and assembly languages. Simple	Mostly scientific, later simple business systems
Second	1956-65	Transistors	Magnetic core main memory, tapes and disk peripheral memory 100 Kbyte main memory	High level language. Fortran , Cobol, Algol batch operating system	Extensive business applications, engineering design optimisation
third	1966-75	Integrated circuits (IC)	High speed magnetic cores. Large disks (100 MB). IM byte main memory	Fortran IV, Cobol 68, PL/1, time shared operating system	Data base management systems, online systems
Fourth (first decade)	1975-84	Large scale integrated circuits, microprocessors	Semi conductor memory. Winchester disk. 10 M byte main	Fortran 77, Pascal, Cobol 74	Personal computers, Integrated CAD/CAM. Real time control. Graphics oriented systems

Fourth generation (second decade)	1985-91	Very large scale IC. Over 3 million transistors per chip	memory 1000 M Semiconductor memory. 1 GB main memory. 100 GB disk	C, C++ Java, Prolog	Simulation, visualisation, parallel computing multimedia
Fifth generation	1991- present	Parallel computing and superconductors	Attachable hard drives, USB drives used to add memory	Use of artificial intelligence	Voice recognition and response to natural language

1.4 Features of Computer

The main features of computer are as described below:

- **Speed:** A computer can do billions of actions per second.
- **Reliability:** Failures are usually due to human error, one way or another.
- **Storage:** A computer can store huge amounts of data and retrieve it whenever required.
- **Accuracy:** A computer is very accurate in its operations and calculations.
- **Diligence:** A computer is free from monotony, tiredness and lack of concentration and can perform the tenmillionth calculation with same accuracy and speed as the first one.
- **Versatility:** A computer is capable of performing variety of tasks at the same time.
- **No IQ:** A computer is unable take its own decisions. It has to be told or instructed on what to do and in what sequence.
- **No feeling:** Computers are devoid of emotions. They are machines and cannot make judgements on their own. Their judgements are based on the instructions given in the forms of program that are written by the programmers.

1.5 Classification of Computer

There are varieties of computers available today. Although they belong to the fifth generation, they can be divided into different categories depending upon the size, efficiency, memory and number of users. Broadly they are divided into the following four categories:

- Microcomputer
- Minicomputer
- Mainframes
- Supercomputer

1.5.1 Microcomputer

- Microcomputer is at the lowest possible end of the computer range in terms of speed and storage capacity. Its CPU is a microprocessor.
- The first microcomputers were built of 8-bit microprocessor chips. The most common application of personal computers (PC) is in this category.
- The PC supports a number of input and output devices. An improvement of 8-bit chip is 16-bit and 32-bit chips.
- Examples of microcomputer are IBM PC, PC-AT.

1.5.2 Minicomputer

- This is designed to support more than one user at a time. It possesses large storage capacity and operates at a higher speed.
- The minicomputer is used in multi-user system, in which various users can work at the same time.
- This type of computer is generally used for processing large volume of data in an organization. They are also used as servers in Local Area Networks (LAN).

1.5.3 Mainframes

- These types of computers are generally 32-bit microprocessors. They operate at very high speed, have very large storage capacity and can handle the work load of many users.
- They are generally used in centralized databases. They are also used as controlling nodes in Wide Area Networks (WAN).
- Example of mainframes are DEC, ICL and IBM 3000 series.

1.5.3 Supercomputer

- These are the fastest and most expensive machines. They have high processing speed compared to other computers and also have multiprocessing technique.
- One of the ways in which supercomputers are built is by interconnecting hundreds of microprocessors.
- Supercomputers are mainly being used for weather forecasting, biomedical research, remote sensing, aircraft design and other areas of science and technology.
- Examples of supercomputers are CRAY YMP, CRAY2, CRAY XMP and PARAM from India.
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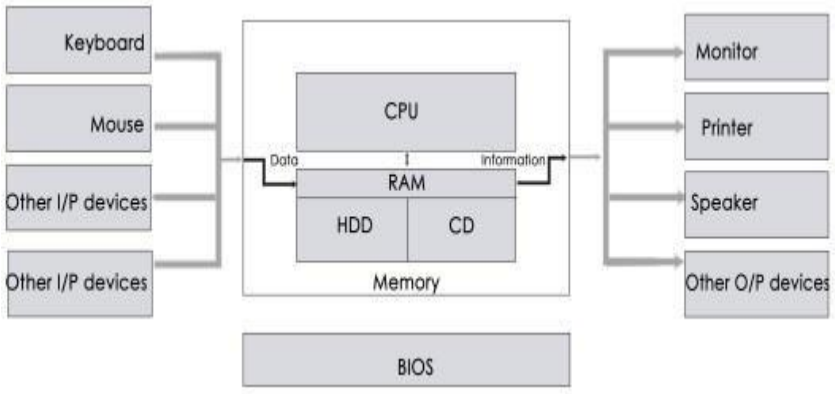
1.6 *Concept* of Hardware and Software

Hardware

The term hardware refers to mechanical device that makes up computer. Computer hardware consists of interconnected electronic devices that we can use to control computer's operation, input and output. Examples of hardware are CPU, keyboard, mouse, hard disk, etc.

Hardware Components

Computer hardware is a collection of several components working together. Some parts are essential and others are added advantages. Computer hardware is made up of CPU and peripherals as shown in image below.



Software

A set of instructions that drives computer to do stipulated tasks is called a program. Software instructions are programmed in a computer language, translated into machine language, and executed by computer. Software can be cate. gorized into two types −

- System software
- Application software

System Software

System software operates directly on hardware devices of computer. It provides a platform to run an application. It provides and supports user functionality. Examples of system software include operating systems such as Windows, Linux, Unix, etc.

Application Software

An application software is designed for benefit of users to perform one or more tasks. Examples of application software include Microsoft Word, Excel, PowerPoint, Oracle, etc.

1.7 Input Devices

The computer needs an input in some form to proceed with the next steps. Input and output devices are collectively called I/O devices. Input devices (and also output devices) are the hardware interfaces between the human user and computer system, but (as always) hardware is ‘driven’ by software, so when we talk about an I/O device, remember there is an associated ‘device driver.’

Keyboard

- Keyboard is the most common data entry device having more than 100 keys on it. Almost all general-purpose computers are supplied with a keyboard.
- When you press a key, a number (code) is sent to the computer to tell it which key you have pressed. Keyboards are often used in conjunction with a screen on which the data entered are displayed.
- The keys on a keyboard are usually arranged in the same order as those on a typewriter. This layout of keys is called **QWERTY** because Q-W-E-R-T-Y is the order in which the letters occur on the top row of keyboard.

Keyboards are widely used because they provide flexible method of data entry and can be used in most applications. However, they do have limitations like entry using keyboard is a slow form of data entry process and is prone to error.

Pointing Devices

These are also called Cursor Control Devices. Cursor Control Devices are used to place the cursor (a highlighted screen location indicating where the next action will occur), select menu items, and control the computer by 'clicking buttons' on the screen. If these are built into the computer they are called Integrated Pointing Devices. A few such devices available are:

- Mouse: A standard device of GUI (Graphical User Interface). New versions are optic and have no moving parts.
- An LED (Light Emitted Diode) records a reflected light which senses motion over a flat surface.
- Trackballs: Like an 'upside-down mouse': it has the advantage of being stationary.
- Joysticks: A hand-held stick that pivots about one end indicating 360 degree directions.
- Track point or pointing stick: A miniature joystick that responds to the touch of a singlefinger.
- Track pads: A touch sensitive surface that translates finger motion into cursormotion.

Pen Input Devices

These are based on screens that sense the location of a special pen that is connected to the terminal. Following are some of the devices:

- Light pens either detect the monitor's light or emit light that can be picked up by a specially designed monitor.
- Styluses are pens with electronic point heads which activate pixels on the monitor, usually a LCD display.
- Handwriting recognition software translates alphanumeric to digitized equivalents: normally these needs to be 'trained' to recognize an individual's carefully printed letters, numbers, and symbols. These have been rather primitive, but significant advances have been made recently. They are the primary input device of hand-held PDAs (Personal Digital Assistants) and PIMs (Personal Information Managers) state –of-the- art readers reportedly are very accurate.
- Digitizing tablets are similar to light pens or styluses except one draws on a tablet rather than the screen.

- Touch screen recognizes human touch and allows selection of menu items displayed on a monitor bytouching them.

Video Input Devices

Following are the various video input devices:

Digital cameras

- Digital cameras have optics like regular photographic cameras: however, they record the single images electronically (rather than on photographic film) in digital form. These images are stored in camera's RAM (Random Access Memory), which like that in a computer is volatile.
- The images can be displayed immediately or stored on a secondary storage medium, e.g. a diskette, and processed later using image processing software.

Digital video cameras

- These are digital cameras which can store sequences of digital images on magnetic tape and play them back as 'movies.' They are similar to camcorders, but camcorders store their images as analogue data.
- Digital video cameras are essential features of video conferencing where remote computers can actually control a remote camera and remote users can share applications and collaborate on 'whiteboards.'

Analogue image converters

- Photographs taken with regular cameras and videos recorded with camcorders store their images as analogue data.
- There are special kinds of hardware that can take these images (scanning photographs or converting camcorder tapes) and convert them to digital images which, like any other digital image, can be processed by computers.

Audio Input Devices

Following are the various audio input devices:

Digitized audio signals

- Audio (analogue) signals can be converted to digital signals by analogue to digital converters, processed by a computer and converted back with digital to analog converters. This allows computer manipulation of music (See MIDI, below), speech or any recordable sounds.
- Synthetic audio signals can be created by the computer.
- Musical Instrument Digital Interface (MIDI) devices allow the input and output to any musical instrument capable of electrical I/O. The music, once digitised in the computer's memory can be processed by musical software giving incredible opportunities for creativity and innovation.

Voice input and speech recognition

- Microphones convert spoken words (analog signals) to digital signals that can be processed by a computer. (Words are ‘digitized’)
- Digitized words are compared to ‘voice templates’ stored in memory.
- Customizable devices can be ‘trained’ to recognize an individual’s speech
- Current systems are still rather primitive and have limited vocabularies: however, rapid developments are being reported.
- If a word is recognized, it is processed: if not, then the user has to give a recognizable input.

Graphic Capture Devices

Image scanners are popular examples of graphic capture devices. When a page of text already exists, like the page that you are reading now, it can be directly put into a computer using a scanner. Scanner can be used to input not only the texts, but also the photographs, drawings and so on. Image Scanners (Gray-scale or color) digitize the pictures (which are analog data). The resulting bitmapped images (Each pixel has a collection of bits that define its color) can be easily modified by graphics programs. The resolution of bitmapped images is measured in dpi, i.e., dots per inch.

Code Numbers Barcode readers

- The bar code is a pattern of thick and thin bars divided by thick and thin spaces. Only the relative separations and thickness of the bars are important.
- Barcodes can be printed in different sizes and colors. The barcode is read either by passing a light-pen over it or by passing the bar code over a flatbed scanner.
- Barcodes are suitable for data input when all that is necessary is to identify an item, and the data input simply comprises a code.
- The reading of the barcode records a transaction, and information is fed back to a computer database. Barcode systems are easy to operate and have very low error rates.
- Occasionally, a scanner can read a barcode number incorrectly. A check digit is included in the barcode number to reduce such incidents.

Magnetic ink character recognition (MICR)

- This input device is widely used by banks to process the tremendous volume of checks being received by them.
- This can be seen at the bottom of a check leaf, where some code numbers are written using a special ink that contains magnet sable particles of iron oxide.

Magnetic stripe code

- It is a short length of magnetic tape which may be stuck on the surface of a tag, card or document. On plastic cards such as credit cards, the stripe is usually sealed in.
- Stripes store data in the form of magnetic spots which represent the 1’s and 0’s of the ASCII code.

Smart cards

- These have a memory store in the form of a very thin integrated circuit sealed into them.
- These can be used to store data about a customer, which can be updated as transactions are made using the card.

Optical Input Devices

Following are the optical input devices:

Optical Character Readers (OCR)

- This device is similar in concept to MICR. Characters in a special font are printed on a document, and the reader scans the document for reflected light patterns, and then translates those patterns into a pattern of electrical signals, which are passed to the computer store.

Optical Mark Readers (OMR)

- These are similar to OCR except that the reader recognizes marks in appropriately positioned boxes rather than characters.
- These are found in areas where responses are one out of a small number of alternatives and the volume of data to be processed is large. One can notice the usage OMR in bank examinations.

1.8 Central Processing Unit

The data given as an input to the computer is then processed at the Central Processing Unit (CPU). It can be thought

of as a collection of processing and storage units within an Arithmetic Logic Unit (ALU) and Control Unit (CU) that are linked internally and externally by busses which carry binary signals between. Higher the bandwidth or processing speed of CPU the faster the machine is.

Arithmetic Logic Unit (ALU)

The Arithmetic Logic Unit (ALU), as the name indicates, performs all the arithmetic and logic operation. ALU consists of:

- Accumulator: It is the main data register where all the intermediate results of a calculation are kept (accumulated) until the final result is determined (which is then stored in memory).
- Data registers are supplemental storage registers that support the operations of the accumulator.
- Computational circuits (e.g. a binary adder) perform mathematical operations.
- Operational circuits that perform logic operations: Here, all math operations are performed in binary numbers and all logic operations are performed using binary operations. Math operations include addition, subtraction, multiplication and division. Logical operations allow programs to contain repetition and selection, the two essential control structures of programming. Logical operations performed by ALU include comparing two quantities: keeping a counter and deciding the further route.

Control Unit (CU)

This unit controls the internal functioning of a computer and input/output units. The role of control unit in CPU is that of a 'manager' or 'a traffic cop.' In other words, it controls and co-ordinates all hardware operations. The components of CU (greatly oversimplified for illustrative purposes) are:

- Decoders interpret program instructions (object code written in machine language).
- Timer (or clock) sequences all CPU activities.
- Logical gates and circuits distribute signals which activate various components of the CPU.
- Program counter/register keeps track of the next instruction to be executed
- Registers is a group of (usually) bistable devices that are used to store information like instructions, address and so on, within a computer system for high-speed access.

Primary CU

Functions of primary CU are:

- Read and interpret machine language instructions
- Control the transmission of data between ALU, registers, cashes, primary memory, and auxiliary memory
- Control the sequence of execution of program instruction (i.e. govern branching, jumping around within a program) which allows repetition and selection
- Direct ALU as to what math or logic operations to perform.

Primary Memory

- Primary memory, also called main memory or internal memory, provides temporary storage of programs in execution and the data being processed.
- It is known as Immediate Access Storage (IAS) as this is the portion of CPU which can be accesseddirectly.
- From the hardware point of view, the primary memory is formed by a large number of basic units referred to as 'memory cells.' Each memory cell is a device or an electronic circuit that has two or more stable states, which represents the binary numbers 0 (Zero) or 1 (One).
- The computer can retrieve any item of data or any instruction stored in primary memory at lightning speed. The modern computer does this in a few nano seconds.
- Primary memory can be further grouped into Random Access Memory (RAM) and Read Only Memory (ROM). **Cache** memory (small, fast RAM) is designed to hold frequently used data. Summary of the features of each as given below:

Random Access Memory (RAM)

- This memory allows writing as well as reading of data, unlike ROM on which data cannot be written.
- It is a volatile storage because the contents of RAM are lost when the power (computer) is turned off. If you want to store the data for later use, you have to transfer all the contents to a secondary storage device.

There are several types of RAM, the most popular of which include:

② Dynamic RAM (DRAM), although its name sounds sophisticated, is the oldest and simplest (and the slowest) type of RAM used today. The word 'dynamic' comes from the fact that it must be electronically 'refreshed' constantly in order to maintain the stored data.

② Static RAM (SRAM), unlike DRAM, does not need to be refreshed: its storage is fixed (as long as power is supplied to the computer). This newer, more dependable, type of RAM is faster but more expensive than DRAM. SRAM is often used for cache memory.

② Enhanced Data Output DRAM (EDO RAM) is a type of RAM that improves the memory access time on faster microprocessors such as the Intel Pentium. EDO RAM was initially optimized for the 66 MHz Pentium.

② Synchronous DRAM (SDRAM) is a new form of RAM that can be synchronized to the clock speed of the computer, a powerful feature that optimizes data access by the system buses.

 Ram bus DRAM (RDRAM) is Intel's designated successor to SDRAM having an effective speed of 800 MHz and a peak data transfer rate of 1.6 GBps. However, it has yet to prove itself, and there are several rivals,

e.g. DDR SDRAM, that are slower but have 64b bus widths thus providing comparable transfer rates.

Read Only Memory (ROM)

- Another type of microcomputer memory is read only memory. Data is 'burnt' into the ROM chip at the time of manufacturing.
- Unlike RAM, the data on the ROM is non-volatile, i.e. data is not lost when the computer is switched off.

Following are the popular ROMs:

② Programmable ROM (PROM) can be programmed to record information using a facility known as a PROM- programmer. Once the chip has been programmed, the recorded information cannot be changed.

② Erasable PROM (EPROM) is erased by shining ultraviolet light on the exposed chip. To write to or erase from EPROM, one must use a PROM burner.

② Electronically Erasable PROM (EEPROM) is more convenient than EPROM, because it can be erased electronically and can be written to in bytes.

② Flash Memory, a special type of EEPROM, can be erased and rewritten in multi-byte blocks

rather than in single bytes characteristic of EEPROM. Flash memory is most often used to hold

control code such as the Basic Input/output System (BIOS) in a personal computer: these are often called 'flash BIOS'.

Cache Memory (small, fast RAM)

- It is designed to hold frequently used data. In general, **Cache** (high speed RAM that is configured to hold the most frequently used data) is used to improve system performance.
- Memory cache or CPU cache is a dedicated bank of high-speed RAM chips used to cache data from primary memory.
- When data is read from primary memory, a block larger than immediately necessary is stored in the cache under the assumption that the next data needed by a program will be located near the data being read: when that data is needed, it will then be waiting in the high speed cache.
- Memory Cache may be either built into the CPU (level 1, or L1, cache, e.g. Pentiums and PowerPCs) or contained in separate chips (level 2, or L2, cache,).
- After the data received through the input devices is processed in the central processing unit, the data in the form of result is dispatched through the output devices.

1.9 Output Devices

Output devices are the means by which computer systems communicate with people. Output devices accept data from the processor and convert them into the required output format. The convenience of use of these devices and the quality of their results has a significant impact on the effectiveness of a computer system. In other words, output devices translate the data in the processor into a format that is suitable for people to use. Most 'real world' data is analogue, i.e. it consists of continuous signals like sounds, pictures, voltage and so forth.

However, computers can only process digital data (discrete signals): therefore, input usually involves analogue to digital conversion (A/D hardware) and output reverses the process using D/A converters. Output can be sub-classified as either direct (to/from I/O devices) or indirect (to/from secondary storage). Output can also be divided into another two kinds: hard copy output (paper, microfilm, etc.) provides a permanent record while soft copy output (visual, audio, tactile, or action) is transient. Action output facilitates control of electromechanical devices, e.g. robotics. For the sake of convenience, let us follow the given classification to discuss the output devices.

Visual Output Devices (Soft copy)

- Cathode Ray Tube Displays (CRTs)

② These are the most commonly seen output device. The computer screen is made of CRTs. They are aslalled **monitors or visual display terminals (VDTs)**.

② Monitors look identical to a television screen. They produce fast and virtually costless output ofinformation.

② CRTs use faster scan technology to portray images as bitmapped graphics on a phosphorescent electrons are fired at the screen and light up tiny dots of phosphor, which then glow for a short period of time. Each point is called a picture element or pixel.

② Since the phosphors glow momentarily, the electronic gun keeps on firing the electron beam at

regularintervals. This refreshing mechanism is measured in Hertz (Hz) or cycles per second. A low refresh rate leads to screen flicker.

② Monochrome monitors use one color images (usually black) on a one colour background (usually white),

e.g. old mainframe monitors. These are now virtually obsolete in PCs.

② On the other hand, colour monitors use a triad of red, green, and blue phosphor dots which are stimulated in varying degrees to produce a wide range of colors.

② Composite video monitors (like TVs) have one electron gun. However, composite video has lower resolutions than RGB monitors. RGB monitors use three electron beams which give a higher resolution display. Virtually, all modern monitors are RGB.

② The quality of the screen display or its resolution depends on the number of pixels on the screen. Resolution indicates the ability to show details: the more pixels per inch, the higher the resolution.

- Bitmapped CRTs allows individual pixels to be addressed thereby producing greater screen control: this is the origin of WYSIWYG (What You See Is What You Get) applications that can incorporate high resolution graphics (e.g. all modern PC monitors).
- On the other hand, old fashioned character-addressable CRTs only address or manipulate groups of pixels (that form alphanumeric) and are inherently non-WYSIWYG and have crude graphics (e.g. mainframe and minicomputer monitors).
- Vector Graphics screens create images by the electron gun tracing between specified points on the screen rather than scanning every row: they are limited to special types of graphics monitors.
- Flat Panel Display, first introduced in watches and clocks in 1970s, is a technology now applied to display terminals. They eliminate flicker and radiation and minimize size problems of CRTs. Further, they are popular for their low energy consumption. However, the quality of the images is relatively poor. Hence, they are commonly used in portable devices because of compactness and low energy requirements.
- Liquid Crystal Display (LCD) is the most popular type, which has a thin layer of liquid crystal molecules divided into small squares forming pixels that are held by two glass sheets. When power is applied to a square it turns opaque. LCDs used to come in limited size, brightness and clarity, but current technology has significantly improved.
- Gas-plasma displays give the best image (though low contrast), but they cannot be battery operated.
- Project Display is a small sized screen of the displays discussed above. Project displays provides an enlarged image and could be projected on a large screen. These systems can be connected directly to the processor and the output will be displayed on the large screens.

Audio Output Devices (Soft copy)

- The audio output device converts the digital signals and gives the output in an audible format. **Speech synthesizers** transform digital computer signals into voice output. The voice maybe choppy and unnatural, but it is easily understood. Audio output units have a varied application.
- Speech synthesizers use different methods of output. In the **word analysis method**, entire

digitized words from the computer's vocabulary are combined under computer control, into digitized sentences and then converted to analogue output. This requires a huge amount of memory.

- In the **constructive synthesis method**, the basic elements of speech, called 'phonemes' (only 40 in the English language) are used to construct speech output governed by timing, pitch and inflection controls. This has minimal memory requirements.

Hardcopy Devices (print and film)

Printers and Plotters Printers

These are used to print the output data on paper. Such output is referred to as printout or hard copy. Printers can be

classified as follows, based on various characteristics:

- Image Formation (measured in dpi):

② Full character alphanumeric (no graphics) have a separate symbol on a ball, daisy wheels, thimble, band, belt or chain mechanism.

② Dot-matrix alphanumeric and graphics are formed by patterns of dots from a single print head.

② Raster scan images (alphanumeric/graphics), e.g. laser printers, are like copiers.

- Image Transfer

② Impact printers transfer images by, the print head striking a ribbon like a typewriter.

② Non-impact printers transfer images by heat (electro-thermal and thermal-transfer printers), electrostatic charge (laser printers), or by 'drawing' with ink jets.

Number of characters printed at one time, measured in ppm (pages per minute):

② Serial (bi-directional) printers print one alphanumeric or graphics pixel at a time.

② Chain printers transfer one line of alphanumeric or pixels at a time.

② Page printers (laser printers) utilize a combination of raster scan and xerographic technologies to produce one whole page at a time.

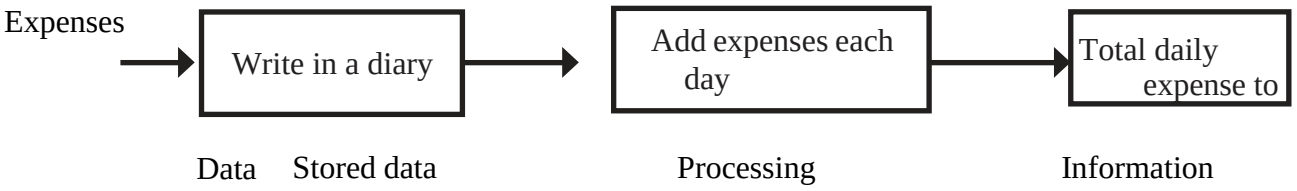
Plotters

Though a few printers listed above are capable of producing graphics, there are a few special plotters exclusively to print a good quality drawing and graphs. There are two types of plotters:

- Flatbed plotters have a drawing instrument (pen, ink-jet, electrostatic head, or heater element) that moves both horizontally and vertically, under the control of input voltages, over a flat piece of stationary paper.
- Drum plotters have a drawing pen that move vertically, while the paper on a drum rotates under it.

1.10 Data and Information

- The word information was derived from Latin verb '*informer*', which means 'to instruct'. It also means giving shape to an idea or fact. Data is the plural of the Latin word '*datum*' which means 'to give'.
- Data is defined as the raw input, which, when processed or arranged, gives meaningful output. It is the group or chunks which signifies quantitative and qualitative traits pertaining to variables. Data is raw material for data processing. Data relates to fact, event and transactions.
- Information is defined as the processed outcome of data. It is derived from data. Information is a concept that can be used in many domains. Thus, information is the data that has been processed in such a way that it will be meaningful to the person who receives it.
- Data can be anything like bio-data of various applicants for recruiting personnel, or the marks obtained by various students in various subjects, or the details (name, age, sex, etc.) of various passengers for airline or railway reservations, or numbers of different types of inputs for solving scientific research problems and so on.



Data and information

1.10.1 Types of Data

The types of data include:

- **Numeric:** For example, a report having numbers generated from surveys, like census count, the numerical

  results generated in a scientific experiments.
- **Text:** For example, a paragraph in this book is textual data.
- **Picture or image:** For example, a photograph (black and white or coloured). Other types of pictures are a map, a fingerprint, a line, an image transmitted by a satellite or an X-ray. Their main characteristics are that they are two dimensional and static.
- **Audio or sound:** For example, speeches, songs, telephone conversations, street noise, etc. Their main property is that they are continuous (i.e., vary with time) and cause pressure waves in the air which enter our ears and we hear the sound .
- **Video or moving pictures:** When a number of images (each one slightly different from the other) are shown one after another at a rate of about 30–60 pictures per seconds, due to persistence of vision, we have an illusion of movement. An example is silent movies or animations used in computer games. Video is usually combined with audio to give a better effect.

1.10.2 Information System

- The system concept and systems thinking can be used for understanding of Information System (IS) better and for designing and developing effective and efficient IS to suit the requirements of different organizations.
- A system is defined as a collection of interrelated parts forming a synergistic whole that jointly serves the desired purpose. The parts which form the whole system, also called components or elements of the system, can be things, people or both.
- A system receives inputs from sources outside the system and processes these inputs within the system. The product or results of these processes within the systems are then given out of the system as output of the system.
- A part of the output of a system may be a feedback to it as input. This is called feedback. The purpose of feedback is to determine how a system is performing and guide action on improvement of system performance.
- These actions intended to improve system performance are called control action

1.11 Problem Solving

A computer works on programs. Depending on the nature of the problem, a computer program can be very complex.

It is necessary to write each and every instruction in proper sequence (logic) to ensure that the program instructions are appropriate and comprehensive for the problem. It is for this reason that programs must be planned before they are written.

1.11.1 Algorithm

- Algorithm refers to sequencing of instructions in a manner that the execution of the instructions in the specified sequence will produce the desired result.
- Algorithm represents logic of the processing to be performed. An algorithm has the following attributes:

② Each instruction should be precise and unambiguous.

② Each instruction should be executable in a finite time.

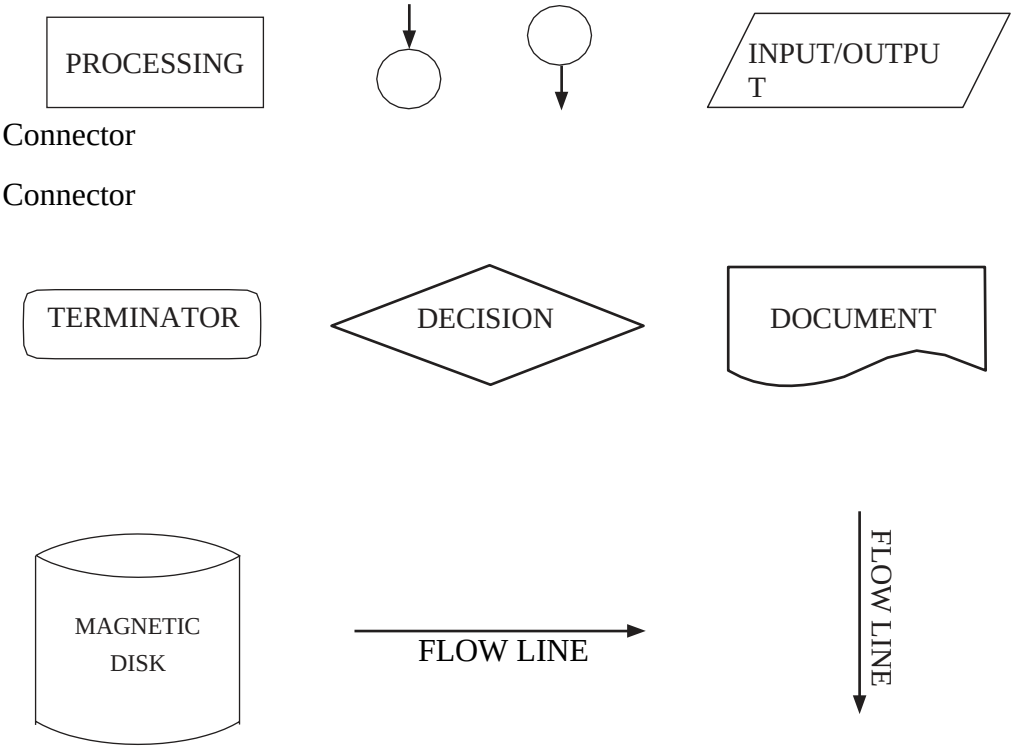
② If one or more instructions are sequenced in a repetitive way, it should have termination stage i.e., the process should not be repeated infinitely.

② The execution of the instructions should ultimately produce the desired result.

- An algorithm can be expressed in several ways e.g., writing the steps in sequenced or logical manner, writing in the form of programming language itself, expressing in the flow chart, etc.

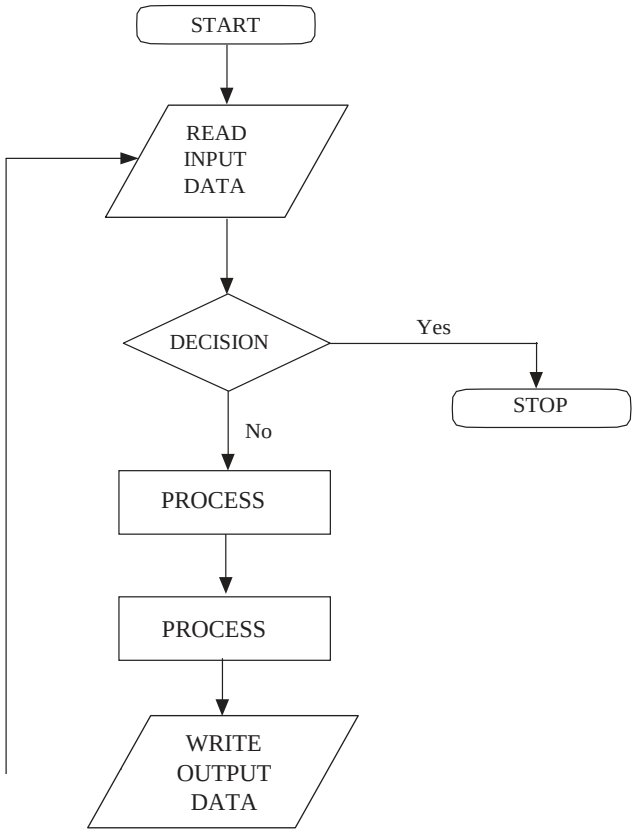
1.11.2 Flow Chart

- A flow chart is a pictorial representation of algorithm using boxes of different shapes and sizes. A particular shape denotes a particular type of instruction. The boxes are connected by solid lines.
- Arrow marks are given to indicate direction of the flow of operation and sequences in which the program instructions will be executed.
- The algorithm or logic of the program is first drawn in a flow chart which is then converted into a programming language to develop a computer program. Any error in the logic of the procedure can be detected more easily as the flow of operations is in the pictorial form. Once the logic is clearly drawn and checked, it is quite convenient to write the statements of the programming language sequentially.
- A program can be written without taking help of flow chart, but the chances for mistakes may increase and it is difficult to follow the logic and make any modification at any subsequent stage either by the programmer himself or by another programmer in his absence.
- The communication of the programming logic through flow chart is done by using symbols carrying standardized meaning.



Flow chart symbols

- With the help of the standard symbols, a flow chart is portrayed by charting a main flow line of logic from top to bottom with branches from left to right and incorporating consistent level of details for easy understanding.
- A pictorial view of a simple flow chart with a process loop is show below.



A sample flow chart with a process loop on recognition of a condition or end of a job

1.11.3 Pseudo code

- Pseudo code refers to an imitation of actual computer instruction. This is written in the ordinary natural language in a structure form similar to computer instructions.
- For this reason pseudocode is also known as 'Program Design Language' (PDL). The basic logic structure of pseudocode is:

② Sequence

② Selection (IF… THEN or IF… THEN…ELSE)

② Iteration (REPEAT…UNTILor DO…WHILE)

Advantages of pseudo code

- As the structure of pseudo code is nearer to programming instruction, it is much easier to convert it into a programming language.
- It is easier to carry out any modification.
- Compared to flowchart, it takes lesser time and efforts to write pseudocode.

Limitations of pseudo code

- no graphic representation
- no standard rules to write
- for complex problem, one may find it difficult to write the logic structure

1.12 Concept of Data Storage

Data storage is the collective methods and technologies that capture and retain digital information on electromagnetic, optical or silicon-based storage media. Storage is a key component of digital devices, as consumers and businesses have come to rely on it to preserve information ranging from personal photos to business-critical information.

Storage is frequently used to describe the devices and data connected to the computer through input/output (I/O) operations, including hard disks, flash devices, tape systems and other media types

How data storage works

The term *storage* may refer both to a user's data generally and, more specifically, to the integrated hardware and software systems used to capture, manage and prioritize the data. This includes information in applications, databases, data warehouses, archiving, backup appliances and cloud storage.

Digital information is written to target storage media through the use of software commands. The smallest unit of measure in a computer memory is a bit, described with a binary value of 0 or 1, according to the level of electrical voltage contained in a single capacitor. Eight bits make up one byte.

Other capacity measurements to know are:

- kilobyte (KB) equal to 1,024 bytes
- megabyte (MB) equal to 1,024 KB
- gigabyte (GB) equal to 1,024 MB
- terabyte (TB) equal to 1,024 GB
- petabyte (PB) equal to 1,024 TB
- exabyte (EB) equal to 1,024 PB

1.12 Number System

Every computer stores numbers, letters, and other special characters in coded form. Number system is an organized way of representing numbers.

NUMBER SYSTEMS

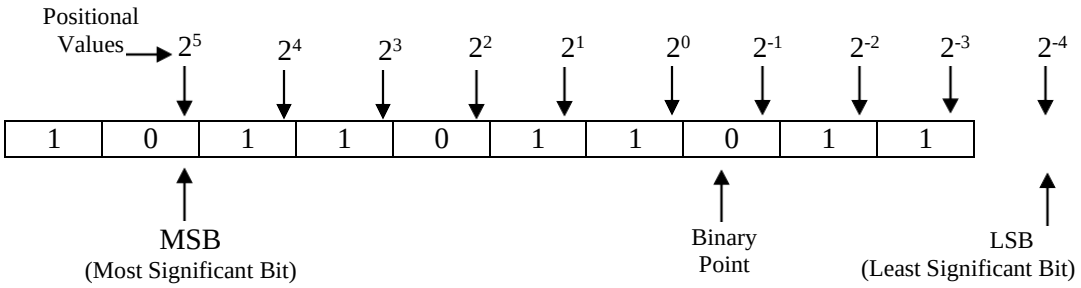
Number systems are very important to understand because the design and organization of a computer depends on the number systems.

The know ledge od number systems is essential for understanding of computers. The useful number systems discussed are:

1. Binary Number Systems.
2. Octal Number System.
3. Decimal Number System.
4. Hexadecimal Number System.

1. Binary Number system

The Binary Number System, as the name suggests, consists of two digits namely, 0 and 1. These binary digits are called BITS. Thus, the word BIT stands for either of the binary digits, namely 0 or 1. Tish system uses two digits only, it has the base or radix 2. It may be noted that the base digit namely 2, is not the fundamental or basic digit of the system. Thus, all the numbers in binary system are written with the help of these two digits namely, 0 and 1. The positional value of place value of each digit in a binary number is twice the positional value of the digit on its right. This number system is identical to decimal number system with the base replaced by 2. The binary numbers are usually written with the base indicated as a subscript on the least significant digit (LSD). For example,



Here, the places to the left of the binary point are positive powers of 2 and places to the right are negative powers of 2.

The commonly used terms in coding of data in computer terminology are:

Bit (Binary digit). A binary digit is logical 0 or 1.

Nibble. A group of four bits (binary digits) is called a Nibble. It is useful in coding the numeric data to hexadecimal form.

Byte. A group of 8 bits make a byte. A byte is the smallest unit which can represent a data item or a character.

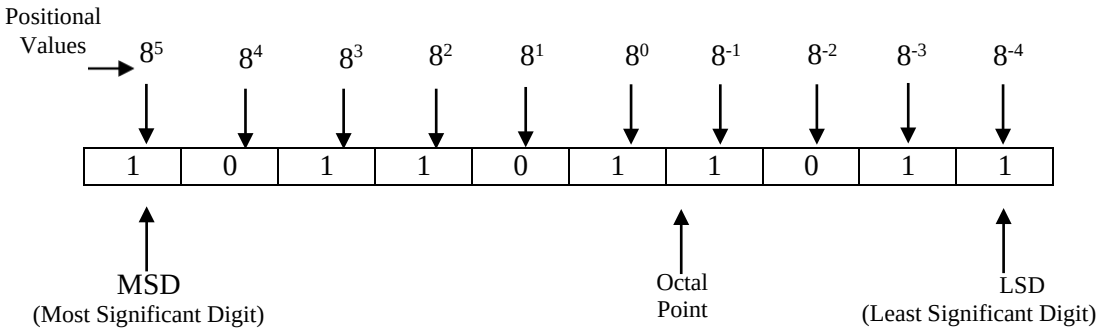
Computer Word. A computer word, like a byte, is a group of fixed number of bits which varies from computer to computer but is fixed for each computer. The number of bits in a computer word is known as the word size or word length. Why is Binary Number System used by Computers?

2. Octal Number System

This number system has base or radix 8. The basic digits of this system are 0, 1, 2, 3, 4, 5, 6 and 7. It may be noted that the base 8 is not the basic digit of the system. It is commonly used as a shorthand way of expressing binary quantities. Also the numbers represented in octal number system can be used directly for input and output operations.

The octal number system is also a positional value system, wherein each octal digit has its own value or weight expressed as a power of 8. For example,

$(157246.3174)_8$



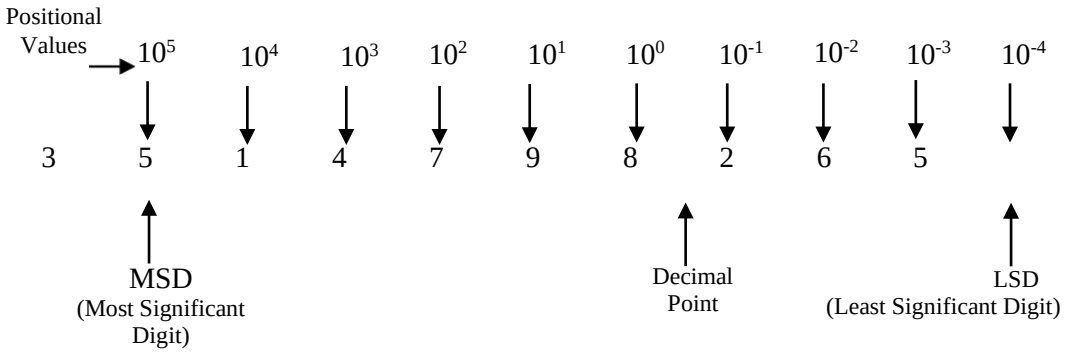
Here, the places to the left of the octal point are positive powers of 8 and places to the right are negative powers of 8.

3. Decimal Number System

The decimal number system consists of 10 digits namely 0 to 9. A number written using these digits is called a decimal number. For example, the numbers 12876, -1024, 58.74, + 768 are decimal numbers. Apart from these digits, the decimal point and $\pm$ signs may also be used in writing decimal numbers. The base or radix of the number system is the number of digits used in it. Since the decimal number system consists of 10 digits, the base of this system is 10.

(i) The face value of the digit, that is, the digit itself.
(ii) The base of the system.

The position of the digit in the number



Hexadecimal Number System

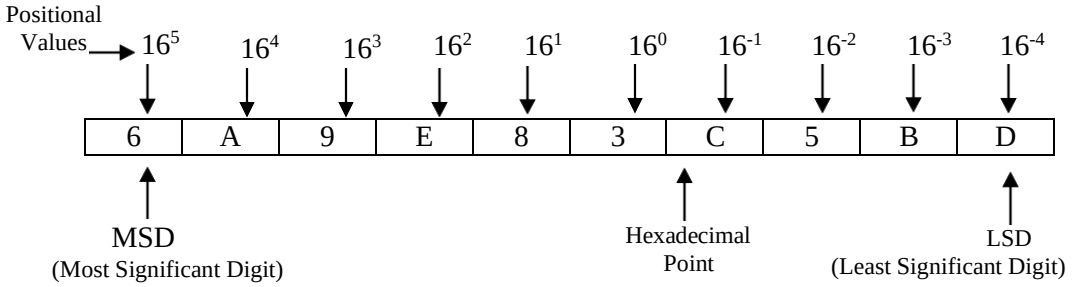
The Hexadecimal Number System, popularly known as Hex System, has sixteen symbols and therefore has the base or radix as 16 or H. It is very well suited for big computers. The hexadecimal number system represents an information in the concise form. The sixteen symbols used in this system are:

0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F

The equivalence between hex-numbers (hexadecimal numbers) and decimal numbers is given below:

Decimal	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Hexadecimal	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F

Hexadecimal number system is also a positional value system, wherein each hexadecimal digit/letter has its own value or weight expressed as a power of 16. For example,



Hexadecimal number shown with positional values

(ii) $(101011)_2$ $= 1 \times 2^5 + 0 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$
$= 32 + 0 + 8 + 0 + 2 + 1$
$= (43)_{10}$
$= 43.$

Example 2 Convert the following binary fractions to their decimal equivalents:

(i) $(0.111)_2$ (ii) $(0.1010111)_2$ (iii) $(0.1011)_2$.

Solution

(i) $(0.111)_2$ $= 1 \times 2^{-1} + 1 \times 2^{-2} + 1 \times 2^{-3}$
$= 1/2 + 1/4 + 1/8$
$= 0.5 + 0.25 + 0.125$
$= (0.875)_{10}$
$= 0.875$

Example 3 Find the decimal equivalent of the following binary numbers:

(ii) $(1110.101)_2$ $= 1 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0 + 1 \times 2^{-1}$
$+ 0 \times 2^{-2} + 0 \times 2^{-3} + 1 \times 2^{-4}$
$= 8 + 4 + 2 + 0 + 1/2 + 0 + 0 + 1/16$
$= 14 + 0.5 + 0.0625$
$= 14.5625.$

(iii) 5280.

(iii) Start dividing 5280 by 2 and

Continue the procedure till the quotient becomes 0.

2	5280	
2	2640 – 0	($=R_1$)
2	1320 – 0	($=R_2$)
2	660 – 0	($=R_3$)
2	330 – 0	($=R_4$)
2	165 – 0	($=R_5$)
2	82 – 1	($=R_6$)
2	41 – 0	($=R_7$)
2	20 – 1	($=R_8$)
2	10 – 0	($=R_9$)
2	5 – 0	($=R_{10}$)
2	2 – 0	($=R_{11}$)
2	1 – 0	($=R_{12}$)
	0 – 1	($=R_{13}$)

Solution

(i) Start dividing 759 by 8 and continue the procedure till quotient is 0. The procedure is shown below:

8	759	
8	94 - 7	LSD
8	11 - 6	
8	1 - 3	
	0 - 1	MSD

ASCII

ASCII (American Standard Code for Information Interchange) is the most common format for text files in computers and on the Internet. In an ASCII file, each alphabetic, numeric, or special character is represented with a 7-bit binary number (a string of seven 0s or 1s). 128 possible characters are defined.

UNIX and DOS-based operating systems use ASCII for text files. Windows NT and 2000 uses a newer code, Unicode. IBM's S/390 systems use a proprietary 8-bit code called EBCDIC. Conversion programs allow different operating systems to change a file from one code to another.

ASCII was developed by the American National Standards Institute (ANSI).

UNIT - II

2.1 Introduction to Operating System

Operating system is an essential component of a computer system and its primary objective is to make computer system convenient to use and utilize computer hardware in an efficient manner. An OS is a large collection of software, which manages resources of the computer system, such as memory, processor, file system and input/output devices. It keeps track of the status of each resource and decides who will have a control over computer resources, for how long and when.

Functions of operating system

- Allocating system resources: The operating system directs the traffic inside the computer, deciding what resources will be used and for how long.
- Time: Time in the CPU is divided into time slices which are measured in milliseconds. Each task that CPU does is assigned a certain number of time slices. When time expires, another task gets a turn and the first task must wait until it has another turn. Since time slices are so small, you usually can't tell that any sharing is going on. Tasks can be assigned priorities so that high priority (foreground) tasks get more time slices than low priority (background) tasks.
- Memory: Memory must be managed also by the operating system. All those rotating turns of CPU use leave data waiting around in buffers. Care must be taken not to lose data. One way to help out the traffic jam is to use virtual memory. This includes disk space as part of main memory. While it is slower to put data on a hard disk, it increases the amount of data that can be held in memory at one time. When the memory chips get full, some of the data is paged out to the hard disk. This is called swapping. Windows uses a swap file for this purpose.
- Input and output: Flow control is also part of the operating system's responsibilities. The operating system must manage all requests to read data from disks or tape and all writes to these and to printers. To speed up the output to printers, most operating systems now allow for print spooling, where the data to be printed is first put in a file. This frees up the processor for other work in between the times when data is going to the printer. A printer can handle limited at a time. Without print spooling, one has to wait for a print job to finish before doing anything else. With it, one can request several print jobs and go on working. The print spool will hold all the orders and process them in turn.
- Monitoring system activities: Following are the activities monitored by the OS:

② System performance: A user or administrator can check to see whether the computer or network is geitngoverloaded. Changes could be made to the way tasks are allocated. System performance would include response time and CPU utilization.

② System security: Some system security is part of the operating system, though additional software can addmore security functions. For multiple users who are not all allowed access to everything, there must be a logon or login procedure where the user supplies a user name or ID and a password. An administrator must set up the permissions list of who can have access to what programs and data.

- File and disk management: Keeping track of what files are where is a major job. An operating system comes with basic file management commands, where, a user needs to be able to create

directories for storing files. A user needs to copy, move, delete, and rename files. This is the category of operating system functions that the user actually sees the most. A more technical task is that of disk management. Under some operating systems, hard disk can be divided up or partitioned into several virtual disks. The operating system treats each virtual disk as a physically separate disk. Managing several physical and/or virtual disks can get pretty complex, especially if some of the disks are set up with different operating systems.

2.2 Types of operating system

- Batch operating system: It requires grouping of similar jobs consisting programs, data and system commands. The suitability of this type of processing is in programs with large computation time with no need of user interaction or involvement. Some examples of such programs include payroll, forecasting, statistical analysis, and large scientific number crunching programs. Users are not required to wait while the job is being processed. They can submit their programs to system and collect the results later.
- Multiprogramming operating system: Multiprogramming operating systems, compared to batch operating systems, are fairly sophisticated. They have a significant potential for improving system throughput and resource utilization with very minor differences. Different forms of multiprogramming operating system are multitasking, multiprocessor and multi-user operating systems.
- Network operating system: A network operating system is a collection of software and associated protocols that allow a set of autonomous computers, which are interconnected by a computer network, to be used together in a convenient and cost-effective manner. In a network operating system, the users are aware of existence of multiple computers and can log into remote machines and copy files from one machine to the other.
- Distributed operating system: A distributed operating system is one that looks like an ordinary centralized operating system but runs on multiple independent CPUs. The key concept here is transparency. In other words, the use of multiple processors should be invisible to the user. Another way of expressing the same idea is to say that user views the system as virtual unit processor but not as a collection of distinct machines. In a true distributed system, users are not aware of where their programs are being run or where their files are residing; they are all handled automatically and efficiently by the operating system.

Utility Software

Utility software is a kind of system software designed to help analyse, configure, optimise and maintain the computer. A single piece of utility software is usually called a utility. Utility software usually focuses on how the computer infrastructure, including the computer hardware, operating system, and application software and data storage operates. Due to this focus, utilities are often rather technical and targeted at people with an advanced level of computer knowledge.

2.3 Application Software

Application software is written to enable the computer to solve a specific data processing task. A number of powerful application software packages, which does not require significant programming knowledge, have been developed. These are easy to use and learn, as compared to the programming languages. Although such packages can perform many general and special functions, there are

applications where these are not found to be adequate. In such cases, application program is written to meet the exact requirements. A user application program may be written using one of these packages or a programming language.

The most important categories of software packages available are:

- Data Base Management Software
- Spreadsheet Software
- Word Processing, Desktop Publishing (DTP), Presentation Software and Graphics Software

② Data Communication Software

② Statistical and Operational Research Software.

We will have a brief overview of some of the application soft wares.

Word Processing

- Word processing is the most used computer application, which has largely replaced the typewriter. It facilitates revision and correction of documents before they are printed.
- An existing document can be used as a template, or pattern, for a new one. So the user doesn't have to recreate standard documents from scratch each time. This is a major time-saver and helps keep things consistent.
- Microsoft Word, WordPerfect, Lotus WordPro, and Open Office Writer are some examples of word processing programs.

② Purpose - to produce documents

② Main advantage

- easy to edit documents
- can reuse existing documents as a template.

Spread sheets

- A spreadsheet is the application of choice for most documents that organise numbers like budgets, financial statements, grade sheets, and sales records.
- Spreadsheet can perform simple or complex calculations on the numbers entered in rows and columns. Examples of spreadsheet programs are MS Excel, Lotus 1-2-3, Quattro Pro, and Open Office Calc.

② Purpose - organizing numbers

② Main advantage

- can calculate using formulas
- auto-update of related numbers when data changes
- can display data in graphs and charts

Database Management Software

- A database is a collection of data that is to be managed, rearranged, and to be added to later. With a database one can sort the data by name or city or postal code or by any individual item of information recorded.
- One can create forms to enter or update or just display the data or create reports that show just the data of interest, like members who owe dues and so on.
- Both spreadsheets and databases can be used to handle much the same information, but each is optimized to handle a different type most efficiently. The larger the number of records, the more important the differences are.
- Examples of databases are MS Access, dBase, FoxPro, Paradox, Approach, Oracle, Open Office Base.

② Purpose - managing data

② Major Advantages

-can change the way data is sorted and displayed.

Graphics Software

- Graphics programs deal with pictures, static or moving, flat or 3D. There are an amazing number of different formats for images in the world and no one program can handle them all.
- Adobe Photoshop is the most widely used graphics program for professionals. Paint Shop Pro is popular because it offers most of Photoshop's features at a lower cost and with a friendlier interface. There are many other programs, of which, some specialize in handling photographs or animations or creating logos.

② Purpose - to create and edit images

② Major Advantages

- important tool for professionals in photo or image processing

- easily creates illustrations, logos.

2.4 Basics of DOS

An acronym for Disk Operating System, in a general sense, DOS refers to just about any operating system. More commonly, it describes the operating system Microsoft developed in 1981 for IBM's line of personal computers. Though syntactically distinct, DOS shares similarities with a Unix shell. It has a command-line interface and analogs to many common Unix commands. However, DOS is a 16-bit, single-user operating system that does not support multi-tasking. It is far easier to administer than Unix, but less powerful. Compared to graphical interfaces such as Windows and Mac OS X, it's also not particularly user-friendly.

With the development of Windows, MS-DOS has faded in importance. However, you can still run some DOS commands at the command prompt in current versions of Windows, which can be useful in situations where a graphical interface is less efficient.

BASIC DOS COMMANDS :

a) Directory Commands :

DIR : To list all or specific files of any directory on a specified disk.

MD : To make directory or subdirectory on a specified disk/drive.

CD or CHDIR : Change DOS current working directory to specified directory on specified disk or to check for the current directory on the specified or default drive.

RMDIR or RD : Removes a specified sub-directory only when it is empty. This command cannot remove root directory (C:\) or current working directory.

TREE : Displays all of the directory paths found on the specified drive.

PATH : Sets a sequential search path for the executables files, if the same are not available in the current directory.

SUBST : Substitutes a string alias for the pathname and creates a virtual drive.

b) File Management Commands :

COPY : Copies one or more files from source disk/drive to the specified disk/drive.

XCOPY : Copies files and directories, including lower-level directories if they exists.

DEL : Removes specified files from specified disk/drive.

REN : Changes the name of a file(Renaming).

ATTRIB : Sets or shows file attributes (read, write, hidden, Archive).

BACKUP : Stores or back up one or more files/directories from source disk/drive to other destination disk/drive.

RESTORE : Restores files that were backed up using BACKUP command.

EDIT : Provides a full screen editor to create or edit a text file.

FORMAT : Formats a disk/drive for data storage and use.

c) General Commands :

TIME : sets or displays the system time.

DATE : Sets or displays system date.

TYPE : Displays the contents of at the specified file.

PROMPT : Customizes the DOS command prompt.

If a users requires help on any DOS commands he/she may type help and command name at the command prompt.

2.5 WINDOWS

Microsoft Windows includes a wide array of features, tools, and applications to help get the most out of Windows and your computer.

Desktop

The **desktop** is a fundamental part of the default GUI (graphical user interface) in Windows. It is a space where you can organize applications, folders, and documents, which appear as icons. Your desktop is always in the background, behind any other applications you're running.

When you power on your computer and log in to Windows, the first thing you see is your desktop background, icons, and the taskbar. From here, you can access the installed programs on your computer from the Start menu, or by double-clicking any application shortcuts you may have on your desktop.

Control Panel

The **Control Panel** is a collection of tools to help you configure and manage the resources on your computer. You can change settings for printers, video, audio, mouse, keyboard, date and time, user accounts, installed applications, network connections, power saving options, and more.

Device Manager

The **Device Manager** lists the hardware devices installed in a computer. It allows users to see what hardware is installed, view and update hardware drivers, and uninstall hardware through the Device Manager.

File Explorer

The **File Explorer**, also called Windows Explorer, provides you with a view of the files and folders on the computer. You can browse the contents of your SSD, hard drive, and attached removable disks. You can search for files and folders, and open, rename, or delete them from the File Explorer.

Internet browser

Your **Internet browser** is one of the most important applications on your computer. You can use it to find information on the Internet, view web pages, shop and buy merchandise, watch movies, play games, and more.

Taskbar

The Windows taskbar shows programs that are currently open, as well as a Quick Launch area that allows quick access to launch specific programs. The notification area is located on the right side of the taskbar, showing the date and time, and programs running in the background.

Task Manager

The **Task Manager** gives you an overview of what's running on your computer. You can see how much of your system resources is being used by each application (task), sorting by CPU, RAM, and disk I/O usage. If a program is frozen or not responding, you can right-click it in Task Manager and end the task, forcing it to quit.

Printer Setting

Printers and scanners allow your computer work to be viewed and printed beyond the dimensions of your screen. However, these devices are only useful when you can set the commands to perform the work exactly as your see necessary. Windows 7 allows you to change your printing and scanning options to get the copies that you want every single time. Read the steps listed below and learn about how to configure a printer or scanner in Windows 7.

1. Click **Start** in the lower left corner of your computer screen.
2. Select **Devices and Printers** from the popup list. A new window will open.
3. Right click on the printer or scanner that you want to configure. A drop down menu appears.
4. Select **Printer Properties** from the drop down menu. A dialog box entitled **Printer Properties** will open. This is where you can configure ports, update drivers and customize your hardware options [source: Microsoft].
5. Click the **Ports** tab from the list of tabs at the top of the box.
6. Click on the **Configure Port** button.
7. Configure the options according to your needs.
8. Click **OK** to save your configuration choices

UNIT - III

3.1 Introduction to MS- Word

A word processing program permits us to manipulate text and related objects such as pictures. The main purpose of a word processing program is to permit the user to create text documents, edit (insert, delete, and replace) text and objects, format the document to increase readability and appearance, print a copy of the document, and save the document for future use or reference.

Definitions

Understanding some of the common concepts related to text manipulation makes using the help system easier and increases your problem-solving skills when things go wrong.

Block

A block is a selected (highlighted) section of text that the program treats as a unit. You can apply most indi- vidual formatting functions, such as bold and under- line, to blocks of text, thereby making formatting and editing functions much more efficient.

Clipboard

A clipboard is a holding area or buffer for copied or cut data for later use. You can place data onto a clipboard and can then paste it into another document, another application, or another location within the original document. In Office 2010, the Office Clipboard can hold as many as 24 items at a time .

Format Formatting

Formatting is the process of editing the appearance of a document by altering the look of fonts and using inden- tations, margins, tabs, justification, and pagination; format conditions affect the document appearance. In Word, format features vary depending on whether you are formatting characters (font, size, emphasis, and spe- cial effects such as highlight or superscript/subscript), paragraphs (tabs, alignment, indentation, line spacing, and line breaks), or pages (headers, footers, margins, paper size, and orientation).

Insert

To “insert” means to add characters in the text at the point of the cursor, thereby moving all other text to the right. Insert mode is the opposite of overtype mode and is the default in most word processing programs. In Office 2010, the Insert tab is next to the Home tab on the ribbon; use it to insert pages, tables, illustra- tions, links, and so forth.

Move Move is a function in word processing programs that permits the user to relocate text or graphics to another place in the document or to another document.

Outliner ScreenTips

ScreenTips are small windows that display descriptive text when you rest the pointer on a command or icon. Office 2010 offers enhanced ScreenTips with larger windows and more text.

Scrolling

Scrolling is the process of moving around a document to view a specific portion of a page of text when the entire document does not fit on the screen. This navigation process does not change the location of the insertion point until the user clicks elsewhere in the document.

SmartArt template

A template contains predesigned formats and structure. It creates a copy of itself when you open it. When you select File, New you will see a list of templates with more available online at Office.com. Some commons ones are budgets, calendars, memos, and resumes.

Toggle

Toggling switches from one mode of operation to another mode: on or off. For example, a user might toggle from insert mode to replace/overtype mode.

Word Wrap

This feature automatically carries words over to the next line if they extend beyond the margin.

3.2 Starting Word

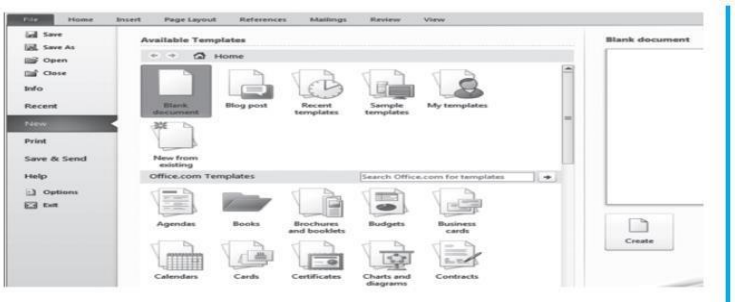
As with all Windows programs, there are many ways to start Word including the following.

- Click **Start**, **Programs**. Select **Microsoft Office**, and then choose **MS Office Word** from the available options .
- Click the **Word** icon on the Quick Launch area of the taskbar if it appears there .

Creating a New Document

After starting Word, a new blank document opens by default. At this point, you can simply type and format the text as desired. Two methods to create a new document once you open Word follow:

1. Click the **File Tab** and then **New**. A window appears. Click **Blank document** and a new document appears formatted using the normal template. Note the choices available for a new document under Templates.
2. Add the **New Document** symbol to the Quick Access toolbar. Click the **File Tab**, choose **Options**, **Quick Access Toolbar**, **New**, **Add**  , and **OK**. Alternatively, you can click the **arrow**  to the right of the Quick Access toolbar. Click **New**. Now the New Document button  shows on the Quick Access toolbar. Click the New button and the new document window appears.



For each document, Word presents a screen with the ribbon at the top, a blank window or document workplace in the center, a scroll bar on the right side, and the status bar on the bottom. A blinking vertical bar, or insertion point marker, represents the position of the cursor in the document. In Figure a cursor appears at the beginning of the document.

Opening a Previously Saved Document

When changes or additions are necessary in a document, several options are available for opening the document again after you saved it.

If the application is not open:

1. Start **Word** and click the **File Tab**. A list of Recent Documents appears on the right. Click the **desired document**.
2. Start **Word**, click the **File Tab**, and choose **Open**. The Open dialog box appears with a list of documents. Note that you can also choose Recently Changed; this choice brings up a complete list that includes the name of each document as well as its size, type, and date modified.
3. Go to the **location** of the file and double-click the **file** you want to open.

If Word is open:

1. Click the **File** Tab and **Recent**. A list of Recent Documents appears.
2. If the file is not in the list of Recent Documents, click the **Open** button in File Tab. The Open dialog box appears, allowing you to search and select the file to open.

The Ribbon in Word: Microsoft's "Fluent User Interface"

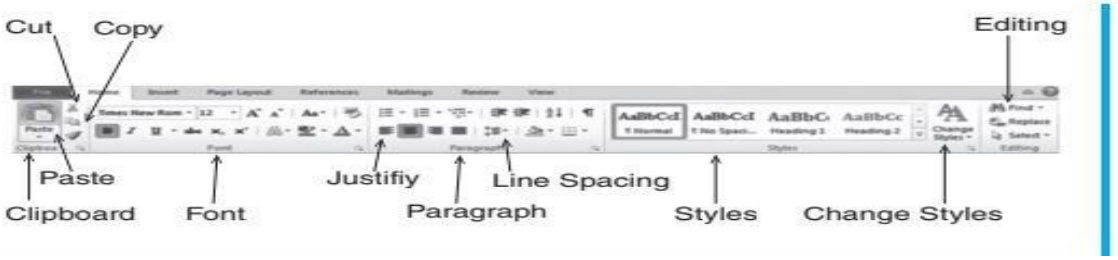
Microsoft Word's Ribbon in 2010 contains a series of task-oriented tabs and groups organized to keep like tasks together. Each tab contains a different group of commands or tasks that help you to use Word. Use the Quick Access Toolbar to add frequently used commands like New, Spell and Grammar Checker, and so forth. Following is a brief description of each tab and its groups in Word 2010. Note that the ribbon shows the groups by default. If you turned that option off and only see the tabs, click the Expand the Ribbon button on the far right of the Tabs.

Home

Figure showsthe Home tab and its groups: Clipboard, Font, Paragraph, Styles, and Editing. These groups allow you to format the document by (1) cutting, copying, or pasting items to the clipboard; (2) selecting a font style, size, and color; (3) setting indents and spacing, adding bullets or numbers to a list, and adjusting text alignment; (4) selecting a document style; and (5) using find and replace.

Insert

The Insert tab has groups such as Pages, Tables, Illustrations, Links, Header & Footer, Text, and Symbols. You can add a cover page or insert a blank page, page break, table, chart, SmartArt, or clip art using this tab.



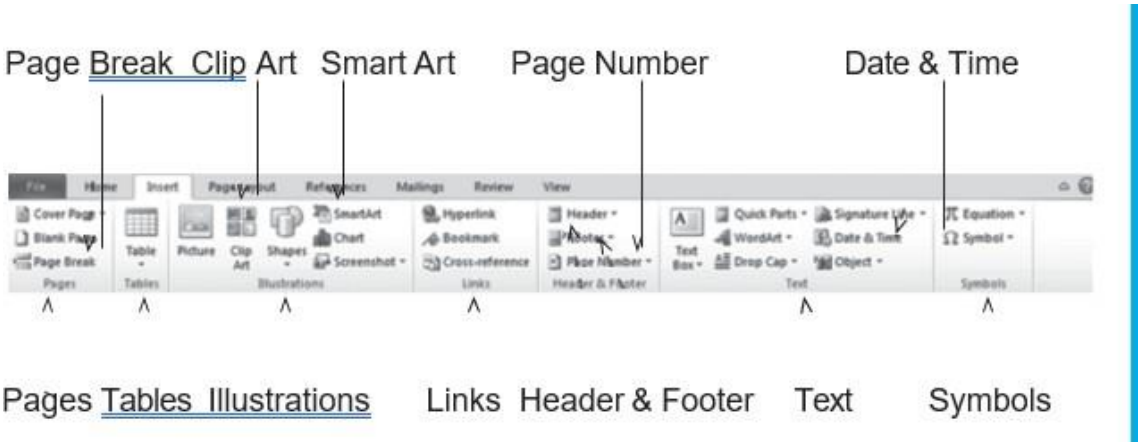


Figure above shows the menu for adding a page number in a footer. Among other things you can use this ribbon to add a hyperlink, bookmark, text box, or the date and time.

Page Layout

Figure shows the Page Layout tab and its groups: Themes, Page Setup, Page Background, Paragraph, and Arrange. These groups help you select the font style and color, margins, page orientation, paragraph indents and spacing, and allow you to add water- marks, add a page border, or change the page color or arrangement

Review

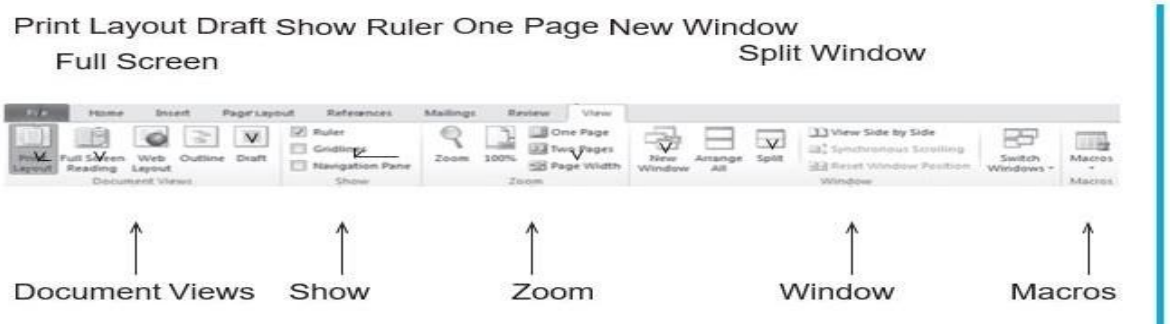
You can use the Review groups for proofing a document; for example, these groups help you check spelling and grammar, do a word count, track changes, insert comments, enable ScreenTips for showing a word in another language, or protect a document from changes by someone else.

While not part of the Review tab, you may also use a readability index to test the readability level of the document. To set this option, click **File Tab, Options**, **Proofing**, and **Show readability statistics**. Now, when you check the spelling and grammar of the document, a readability index will also appear. This consideration is very important when developing patient educational materials. However, this approach is not sufficient for measuring the health literacy level needed to understand the document. Chapter 14 further explains health literacy

View

The View tab includes commands that allow you to view the document in print layout, full screen reading, Web layout, outline, or draft form. The next group has commands to show or hide various items in Word, such as the ruler, gridlines, the message bar, the document map, and thumbnails. Zoom controls are in the Zoom group or on the status bar at the bottom of the window. Options also allow you to view one or two pages of the document. The next group focuses on the window and

provides ways to view a document or to switch between windows. The last group is Macros; a macro is an automated sequence of operations that can prove useful for repetitive tasks.



Moving Around the Document

There are several ways to move around a document.

Arrow keys	Move the insertion point one line or letter at a time.
Ctrl +arrow keys	Move one word, section, or paragraph at a time.
Home key	Moves the cursor to the beginning of the line.
End key	Moves the cursor to the end of the line.
Ctrl+Home	Moves the cursor to the beginning of the document.
Ctrl+End	Moves the cursor to the end of the document.
Page Up and	
Page Down Keys	Move the cursor quickly through the document one
screen at a time.	
Ctrl+PageUp	Moves the cursor to the previous page.
Ctrl+PageDown	Moves the cursor to the next page.

NOTE: A scroll wheel on a mouse will also let you scroll through a do cum3ent by moving the wheel back and forth

Formatting the Document

By using formatting related commands the document can be made to look professional at the same time it makes the message in the document more under- stand able. There are four components to formatting—character, paragraph, page, and document.

Character Formatting

The following terms describe the components of fonts and the options for char- acter formatting.

Font

A font defines a descriptive look or shape (font face or typeface), size, and style of a group of characters or symbols.

For example, one font is Times Roman, 12 point, Bold, Italic. Another font is Calibri, 10 point, Italic.

Th default font for Word 2010 is Calibri. The general rule is to limit the number of different fonts in one document to three. Use serif fonts (fonts with little feet) for text documents; this makes the document easier to read. Size refers to the height of the characters and is measured in 72 points per inch. Normal sizes for business documents are 10 to 12 points while Word uses 11points.Style or attributes include bold, italics, and condensed. Use these attributes for emphasis—not for the whole document.

Spacing

Proportional or fixed pitch. "Proportional" means a variable amount of space is allotted for each character

depending on the character width. "Fixed space" or "monospace" means a set space is provided for each character regardless of the character width. For example, an "I" is allowed the same amount of space as a "W." Special

Effects

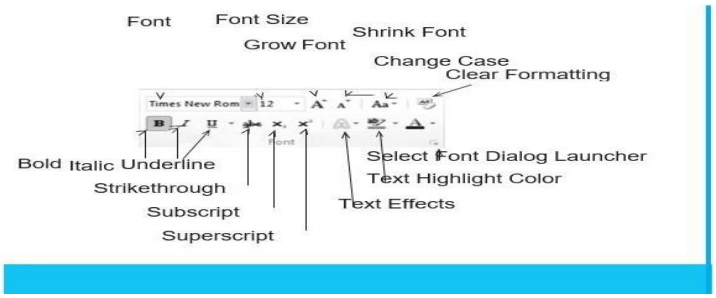
Word provides the user with the ability to apply special effects to characters. Some of these special effects are: superscript, subscript, strikethrough, highlight, color, and small caps. Use these as appropriate for the document and the message. Use color only when printing on a color printer or moving the document around electronically. A black and white printer needs to interpret the colors sometimes making them not easily readable in black and white.

Symbol Set

The characters and symbols that make up the font.

Typeface

The specific design of a character or symbol, commonly referred to as the font face. For example, Helvetica, Courier, Times Roman, Times Roman Bold, and Times Roman Italic are all different typefaces.



To format a character: font size and style

As in previous examples, you can choose the font size and style in several different ways.

1. Select the **text** to apply the font and size.
2. Click the **Home** tab. Choose a **font** and **size** from the Font group.

or

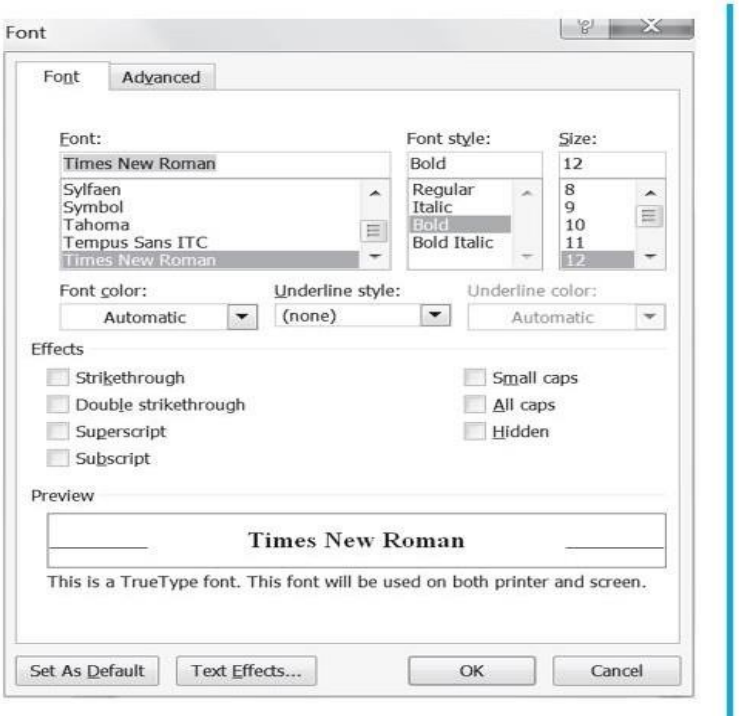
3. Click the **dialog launcher** in the Font group and the Font dialog box appears. You can

select a font, font style, size, effects, color, and character spacing in this dialog box. You can also choose a default font style and size that will be the default style for all documents. By default, the font size for business 

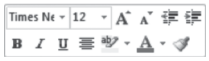
documents is 10 to 12 points, but you may also choose a larger size that can be easily read on the screen if you like. Later, you can change the font if necessary. For example, you can highlight the entire document by choosing **Select** in the **Editing** group and then **Select All** (or press **Ctrl+A**) and reduce the print size before printing by choosing another font size or print style orboth.

Or

4. Style buttons are available in the Font group for bold, italic, and underline.



To use the Style buttons for bold, italic, and underline:

1. Highlight a **word** or **section oftext**.
2.  Click the desired **Style** button that appears. You can use the **Style** button inthe **Font** group to change style attributes. Alternatively, when you high-light a word, a small
   toolbar will appear as you hold the mouse arrow over the highlighted word; you can then choose bold, italic, or another font size from among the other choices on the toolbar.
3. Clicking a **Style button** again will change the style back to its previous style.

You can turn these attributes on or off by pressing **Ctrl+B** (bold), **Ctrl+I** (italic), or **Ctrl+U** (underline). Note also that the underline button under- lines all the highlighted text. To access variations of underlining, use the Font dialog launcher and select the desired underlining.

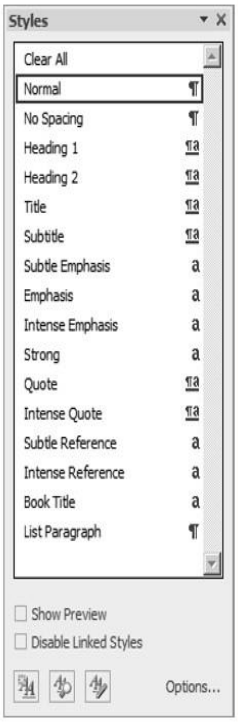
- Click the **Change Styles** arrow in the **Styles** group to select a style, color, and font for text. Even more styles and choices are available when you click the dialog launcher in the **Styles** group.

Paragraph Formatting

Just as there are options for formatting the characters, there are options for formatting paragraphs. Note that we define a paragraph by the ending paragraph mark . Paragraph formatting includes justifications, indents, lists, line spacing, borders, shading, and tabs. ¶

Alignment Justified text is aligned relative to the left and right margins. There are four options for justification: Center places th aragraph equidis- tant from both margins.

1.



2. Full is alignment of the paragraph flush against both the left and right margins.
3. Left is alignment of the paragraph flush against the left margin and stag- gered on the right.
4. Right is alignment of the paragraph flush against the right margin and stag- gered on the left.

Borders

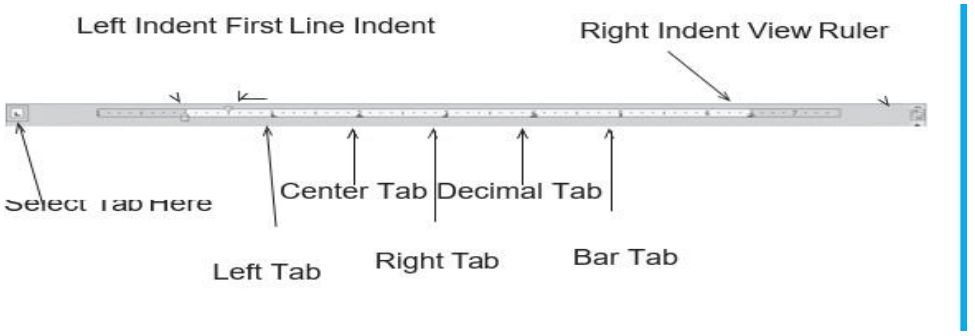
Word provides you with the option to place a border around a paragraph to highlight or make that paragraph stand out. One can choose a line style, width, and color for the border.

Indent

To "indent" text means to establish tab settings that place subsequent lines of text the same number of spaces from the margin until the next hard return. Word has four indents: first line, left, right, and hanging .The ruler displays these indent markers. Dragging the top indent marker to the right (first line inde) indents the first line of a para- graph; pressing the Tab key does the same thing. The middle marker is the left indent marker; use it to indent all lines of the paragraph except the first one. The top and middle markers will move together with the bottom marker when you select and move it. The middle marker is the hanging indent when you place it to the right of the first line indent marker. To apply a hanging indent (to the right of the first line), drag the middle marker to the right of the first line indent marker. A hanging indent will indent all lines of a paragraph except the first line.

Line Spacing

Line spacing is the space between lines or the space before or after each paragraph. By default Word assigns a line spacing of 1.15 and 10 points after a paragraph. Most style manuals require double spacing for lines of text. **Lists** Word provides for bulleted ( ), numbered ( ), and multilevel lists ( ) that can turn your text into lists of items. Automatic bulleting and numbering can be helpful—and frustrating! For example, you might want to stop the list and then start another list later in the document. Word will pick up the previous number and continue numbering from it until you adjust the settings.



Shading

Shading means to set a paragraph in a color. Use it to highlight an important paragraph or create a box look to the paragraph.

Tab

A tab is a setting that places the subsequent text on that line a certain number of spaces or inches in from the left margin. Tab settings by default are five spaces (0.5 inch) although they are not visible to you. These settings can be changed, however. Five styles of tabs are available—left ( ), right ( ), center ( ), decimal( ), and bar ( ). All deal with the alignment of the text around the tab mark. You can adjust and place tabs on the ruler using the mouse. Never use the space bar to move text around; use the tab key. There should be only one tab between items; to line up properly, adjust the tab location.

To set the indents:

1. Place the **insertion point** in the paragraph that you will indent. Alternatively, highlight multiple paragraphs if you want to indent more than one paragraph.
2. Drag the **appropriate marker** to the chosen tick mark on the ruler bar.

You may also access the indents under the Page Layout tab, Paragraph group or by clicking the dialog launcher in that group.

To set the tabs:

1. Click the **Left Tab** button on the ruler bar until the correct tab mark appears.
2. Click the ruler bar location where the tab should be. (The ruler bar must be showing to use this option.) You may also adjust and apply additional features through the **Page Layout** tab, **Paragraph** group **dialog launcher**, and then **Tabs** Tabs... at the bottom of the dialog box.

To remove a tab(s):

1. Click a **tab** on the ruler bar and drag it **off the ruler** into the document.
2. To clear all the tab settings at once, double-click a **tab** on the ruler and click

Clear all Clear All button.

To create a bulleted list:

1. Type the **text** to be bulleted.
2. Highlight the **text**.
3. Click the **bulleted list** icon in the Paragraph group of the Home tab or click the **down arrow** and select a different **type** of **bullet**.

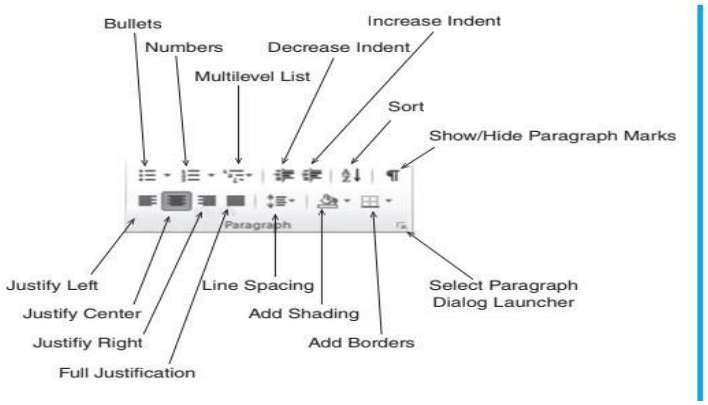
You may also click the bullet button and start typing the list. To modify the appearance of numbers and bullets, click the arrow in the button and choose an appropriate style.

To create a numbered list with text already typed:

1. Type the **text** to be numbered. Make sure the Home tab is active.
2. Highlight the **text**.
3. Click the **numbered list** icon in the Paragraph group of the Home tab or click the **down arrow** and select a **different type** of number.

To create a numbered list:

1. Select the **Home** tab.
2. Place the cursor in the **document** where you intend for the list to begin.
3. Click the **Numbering** icon in the Paragraph group .
4. Type the **list**, pressing the **Enter** key at the end of each item.
5. When you finish type the list, press the Enter key twice or click the Numbering icon to turn off the numbers.



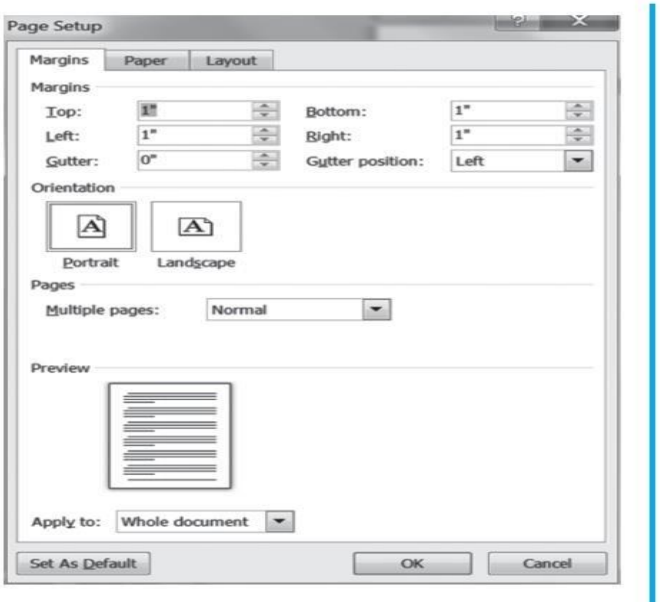
Alternatively, you can type the first number and press the **Enter** key; for the next item, Word will add the 2. If the list is ended, simply backspace to get rid of the next number or press the **Enter** key twice.

Page and Document Formatting

Page and document formatting alters the appearance of the page and the document. It includes such features as headers/footers, page break, margins, page orientation, pagination, section breaks, and columns to name a few**.** shows the Page Setup dialog box.

Footer

The footer is an information area that one places con- sistently at the bottom of each page or section of a doc- ument.
It can hold the name of the document, the page number, the date, or any information that is helpful.



Header

The header is an information area that is placed consistently at the top of each page or section of a document. It can hold the name of the document, page number, date, or other identifying information. When using section breaks, you can have several different headers.

Line Breaks

To force lines and paragraphs to move as desired use the appropriate pagination options of keep lines with next and keep lines together. Access this feature from the Paragraph dialog box.

Margins

Margins are the distance of the text from the edge of the paper. By default Word sets the margins to 1 inch at top, bottom, left, and right.

Page break

A page break is the place where Word ends the text on one page before it continues text on the next page. Insert a page break by going to the Insert tab and selecting Page Break from the Pages Group or by pressing Ctrl + Enter. The software then places the break at the cursor or insertion point location. It is a good idea to review the finished document to deter- mine where page breaks are necessary. Use this feature cautiously until you make all the necessary document revisions. You can also insert a page break from the Page Layout tab in Word; choose Page Layout and then click Breaks. A list of choices appears. You may also select column, text wrapping around objects, and section breaks here.

Page Orientation

Page orientation refers to the layout of the paper. Portrait means the paper is upright, longer than it is wide; landscape means the page is wider than it is long.

Pagination

Pagination consists of the numbers or marks that are used to indicate the sequence of the pages. It is a process of determining when a sufficient amount of text appears on one page and then starting the next page. Word processing programs automatically perform pagination if this feature is turned on. Most pro- grams permit the variation of placement and style of the page number. Add page numbers by going to the Insert tab and choosing Page Number from the Header and Footer Group. A list of options for page number placement appears.

Section Break

Section breaks permit you to create layout or format-ting changes in the document and apply them only to that section. By default a document is one section and page and document formatting applies to the total document. When applying a section break, you can format each section differently. For example, preface material may have *i, ii, iii* page numbering while the body of the document has 1, 2, 3, and soforth.

To open the Page Setup dialog box:

1. Open a **new document**.
2. Choose the **Page Layout** tab.
3. Click the **dialog launcher** at the lower-right corner  of the Page Setup group. The Page Setup dialog box appears. Use it to adjust the document's margins and decide on paper orientation (portrait or landscape), paper size, and layout. In this example margins are set 1 inch at the top and bottom of the page and on the left and right sides of the page. Vertical centering of the text is also set in this dialog box; use this feature to center a title page.

To change the margins:

1. Click **Page Layout** tab and **Margins** icon.
2. Select the **margin** necessary.
3. To change the margins of a section of the document, choose the **Page Layout** tab and click **Margins**; choose **Custom Margins** at the bottom of the box and do what is necessary and then select **this point forward** from the **Apply to** options.

To set a page break:

1. Go to the **place** in the document where you want to place the page break.
2. Press **Ctrl + Enter** or select the **Insert** tab and **Page Break** from the Pages group Use this feature cautiously; use the lines and page break feature in the paragraph dialog box to keep lines together. For example, use this feature to keep a paragraph from splitting between pages or a title from being separated from its related paragraph. Use the page break feature to separate the reference

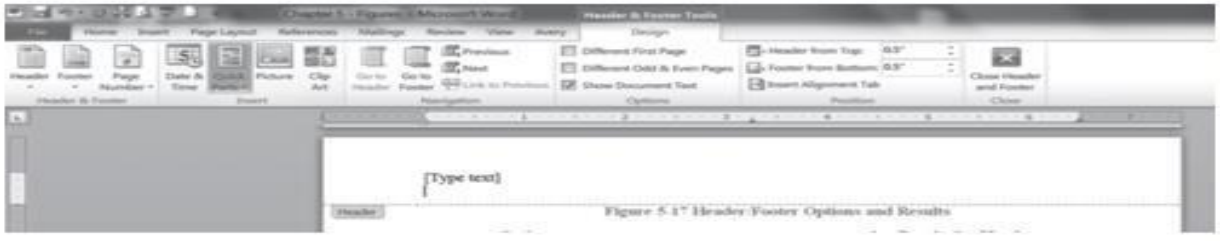
list from the body of the paper.

To add a header or footer to a document:

1. Choose the **Insert** tab and select **Header or Footer** from the Header & Footer group
2. Select either **header** or **footer**. For choices for a footer and page number.
3. Select one of the **style options**

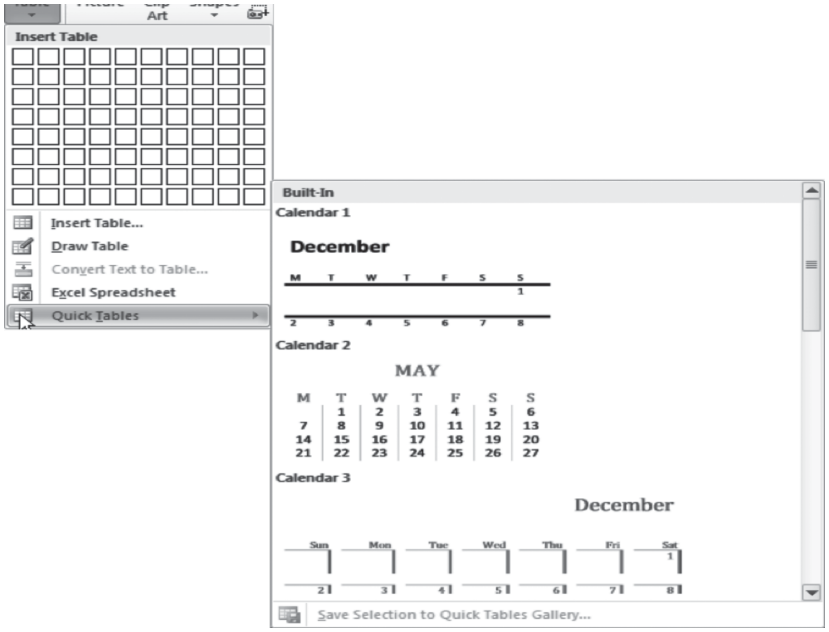
a

b



Creating a Table

Tables in word processing have many uses. For example, they help you set columns for recording minutes of a meeting or for organizing any kind of information. Tables are also essential to research reports. It is a good idea to plan the kind of table needed in terms of number of rows and columns required before selecting them. Among the choices for a new table in the Tables group is Insert Table, Draw Table, or (built-in) Quick Tables. shows the dialog boxes that appear when you select Table and Quick Tables under the Insert tab. shows the dialog box that appears when you select Insert Table (under the grid).



To create a table:

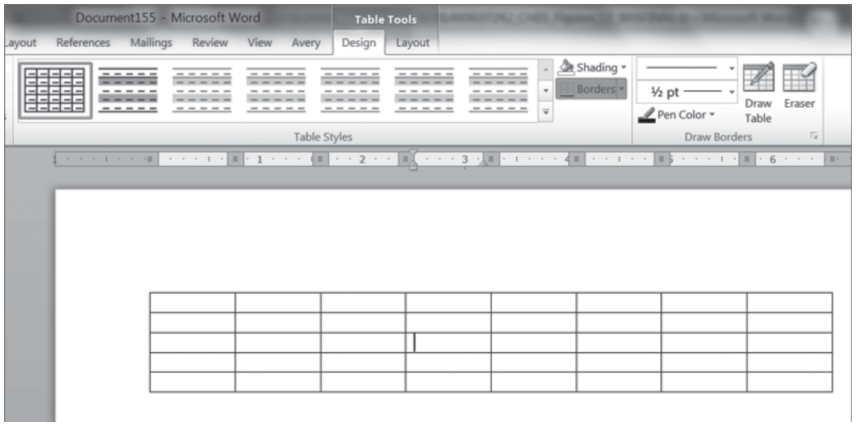
1. Place the **insertion point** where the table should appear in the document.
2. Click the **Insert** tab, the **Table** icon, and **Insert Table**.
3. Select the number of **rows** and **columns** and click **OK** or, if using the mouse, drag over the cells for the number of rows and columns desired. Remember that a row is necessary for headers. Insert additional rows or columns if necessary.

To create a table by dragging:

1. Click the **Table** icon on the Insert tab.
2. Place the mouse over the **grid** and drag to highlight the **number of rows and columns** needed. Keep dragging until you create the correct size for the table.

To insert a row:

1. Right-click in a **row**.
2. From the menu, select **Insert** and select **Insert rows** either **above** or **below** the selected row.
3. You may also insert multiple rows at one time by selecting the **number of rows** to be inserted using the quick select area in the left margin, and right-clicking the selection. Follow the directions from the shortcut menu. Insert columns the same way.



The Table Tools Tab appears once the table is in place and selected. Use the **Table** o adjust the table and enhance it. For example, you can change the width or height row or column, alter the style of the table, or delete grid lines.

To delete the table:

- Click the **four-headed arrow** on the top left of the table to select the table.
- Right-click the **table** and select **Deletetable**.

UNIT - IV

4.1 Characteristics of a Computer Network

The main objectives of a computer network are to share resources. Some of the examples of sharing of resources are given below.

- Play music (like CD) from a computer while using some other computer.
- Suppose a computer has a CD writer or a pen drive or hard disk (backup system) connected to it, but the other computer does not have it. In this case, the user can burn CDs or make backups on a computer that has one of these using data from a computer that does not have a CD writer, etc.
- A user can place a movie DVD on the computer which has a DVD player, and then view the movie on a computer that does not have a DVD player.
- Connect a printer (or like scanner, fax machine) to one computer and let the other computers of the network print (or scan, fax) to that printer (or scanner, fax machine).
- Insert a CD with pictures on one computer and let the other computers access those pictures from that computer.
- Create a file and store it in one computer, then access that file from the other computers which are connected to it.

4.2 Advantages of Networking

The following are the advantages of network:

Resource sharing

- Many of the peripheral devices used along with computers for specific purposes are costly. A huge amount is required to attach such devices with each computer. But in a network, the devices connected with one computer can be utilized by other computers.

② For example, consider the situation that a laser printer is connected to a computer (say, computer A). Another computer (say, computer B) is connected to computer A through a network. A person is typing a letter in computer B using a word processor. But to get the printout, computer B has no printer connected to it. Hence, computer B sends the print command along with the file to computer A.

② If the printer is idle (i.e., no printing is in progress) the file from computer B gets printed, otherwise it will be kept in the memory and will be printed later when the printer is free.

② One can expand this network so that more than one computer is connected to A and all the computers use that printer.

② Another example of sharing computer resources is in the internet cafes. Usually, internet connection is given through telephone lines. In internet cafes, only one computer is connected to the telephone line and other computers, through the network, share the internet services.

Centrally controlled information

- If there is a computer network, there is no need to copy same information in all the computers. The important data/information can be stored in a particular computer and they can be accessed on other computers through the network.
- Some of the information may be confidential and its sharing cannot be allowed and hence some sort of control should be enforced. For this, there is a facility to decide what information should be allowed to access, by whom and what kind of access rights can be provided. A person is made responsible to arrange and control the computers in a network in this manner.

Security of information

- The information stored in computers may be lost due to machine failure, virus infection, fire, natural calamities, attacks, etc. Imagine the situation of losing the information on the transactions in a bank.
- This kind of important information can be copied and stored in a distant computer through computernetwork

  If the information stored in one computer is lost, the copy stored in some other computer will be safe.
- The network is utilized by defense institutions, bank, software development companies, research institutions etc., for such purposes.

Media for communication

- There are different ways to utilize network as communication media. WWW, e-mail, chatting, video conferencing, etc., are some of the examples.
- As a medium, the main advantage of the network is that one can share audio, video, pictures, and so on.

4.3 Classification of Networks

Networks are classified into following types:

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

Local Area Network (LAN)

- A LAN connects network devices over a relatively short distance.
- A networked office building, school, or home usually contains a single LAN, though sometimes one building will contain a few small LANs (perhaps one per room), and occasionally a LAN will span a group of nearby buildings.
- In addition to operating in a limited space, LANs are also typically owned, controlled, and managed by a single person or organization.

- Local area network is a system of computers that share resources such as hard-drives, printers, data, CPU power, fax/modem, applications, etc.
- The components used by LANs can be divided into cabling standards, hardware and protocols. Examples of cabling standards used on LANs are:

② Cat 3, 4 and 5 cables

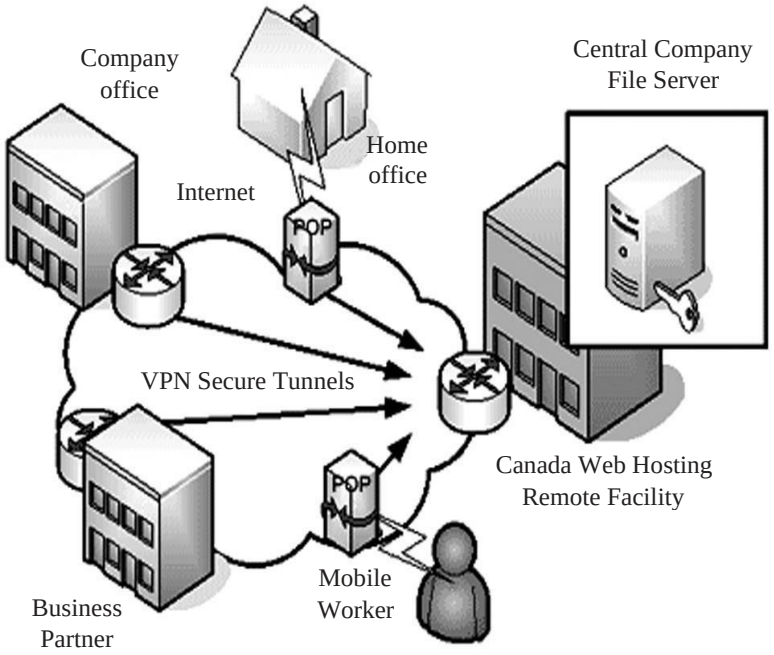
② IBM Type 1–9 cabling standards

② Ethernet cabling standards - IEEE 802.3 (10Base5), IEEE 802.3a (10Base2), IEEE 802.3i (10BaseT)

② Unshielded Twisted Pair (UTP)

② Shielded Twisted Pair (STP)

② Connectors: RJ45, RJ11, Hermaphroditic connectors, RS-232, DB-25, BNC, TEE



LAN network

Metropolitan Area Network (MAN)

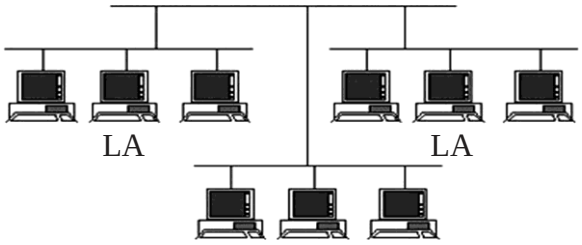
- Metropolitan Area Networks (MANs) are those which connect LANs together within a city.
- MANs are used to connect to other LANs.
- A MAN must have the requirement of using a telecommunication media such as voice channels or data channels.
- Branch offices are connected to head offices through MANs.
- Examples where MANs are used include universities and colleges, grocery chains and banks.
- The main criterion for a MAN is that the connection between LANs is through a local exchange carrier (the local phone company).
- The protocols that are used for MANs are quite different from LANs except for ATM which can be used for both under certain conditions.

- Diagram shown below represents MAN used in Local Exchange Carrier.

Wide Area Network (WAN)

- Wide Area Network (WAN) connects LANs together between cities, and is a geographically-dispersed collection of LANs.
- A network device called "Router" connects LANs to a WAN.
- The main difference between a MAN and a WAN is that the WAN uses 'Long Distance Carriers'. Otherwise the same protocols and equipment are used as a MAN.

WIDE AREA NETWORK (WAN)



LAN

4.4 Network Topology

- The network topology defines the way in which computers, printer and other devices are connected. It describes the layout of the wire and devices as well as the path used for data transmissions.
- There are seven basic topologies:

② Point to Point Topology

② Bus Topology

② Star Topology

② Ring Topology

② Tree Topology

② Mesh Topology

② Hybrid Topology

4.5 Concept of Internet

Internet is the world's largest network. It is a unique collection of networks of different kinds. It is often described as "a network of networks" since all the smaller networks are linked together into one giant network called the Internet. The use of internet began in 1969 in the U.S. Department of Defense's Advanced Research Project Agency (ARPA) to provide immediate communication within the department during war. Computers were then installed at U.S. universities with defense related projects. As scholars began to go online, the network changed from military use to scientific use. As Arpanet grew, administration of the system became distributed to a number of organizations,

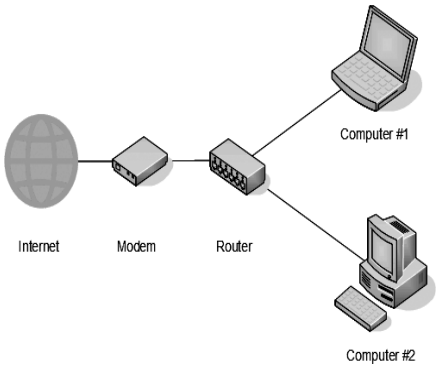
including the National Science Foundation (NSF). This shift of responsibility began the transformation of the science oriented Arpanet into the commercially minded and funded internet, which is used by millions today. The core of the internet is a network of supercomputers connected to each other by high-speed links (known as "backbones"). Each node is linked to a number of smaller networks which in turn are linked to even smaller networks and ultimately to the PC of an individual user.

Internet has four important elements:

② The network

② The people (who use it)

② The various programmes used in getting the information



② The information itself

Internet

Applications of the Internet

- Internet can be used by an organization for linking their offices and employees and thus using the internet as a virtual private network.
- It can serve as a communication channel where one can: exchanging social notes and information; gathering latest news all over the world; transferring computer files and software; cooperate communication, etc.
- It may be used as a virtual market place to advertise for products, services, employment and other personal needs.
- It may be used for publishing general information, as done by many government and non-government agencies.
- Many universities and educational and training institutes use internet for academic communications.

Communication Protocols

- Internet is a packet switching network and the data to be transmitted is converted into small packets.
- The software that carries out the function of communication efficiently and accurately is known as TCP/IP, which is actually two communication protocols put together.

② TCP/IP stands for Transmission Control Protocol over Internet Protocol.

② TCP breaks the data into little packets and ensures that the same reaches the destination computer intact.

② IP is a set of conventions, ensuring routing of the packets from one host to another with destination IP address.

Three kinds of mechanisms are involved in the routing namely;

② bridges

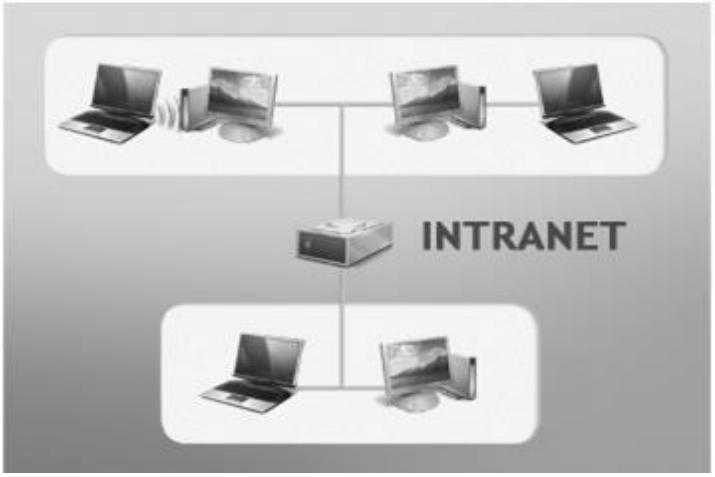
② routers

② gateways

- Access to internet depends on many factors e.g., the type of interface connection and browser installed services and connection available from the network and the type of connection selected by the user depending on his requirement to explore the internet.

4.6 Intranet

- An 'intranet' may be defined as the application of internet technologies to the internal business applications. It may also be viewed as the introduction of web technologies to the information system in an organization.
- As a result, the information relating to the organization may be shared among various levels of employees in the organization including a few closely connected with the organization. Intranets are local to the organization and TCP/IP is the protocol used.



Intranet

Purpose of Intranet

Intranet serves the following purposes:

- distribution of information within the company to the company's own people
- access to the intranet server locally or remotely through dial up access
- storing of applications related to the organization in the intranet server which can be accessed by the users
- Examples of applications are: company procedures and manuals; ordering and inventory; help desk; intranet library; newsgroups and corporate and other web enable databases.

Advantages of Intranet

- There is a need for accommodating changes in the systems and keeping parity with the current global culture.
- It is equally important to keep the employees trained in use of modern tools and exploit their talents and skills in an effective manner.
- Unless the company is able to have an edge over its competitors in this sphere, it would be difficult to attract best talents and retain employment in order to grow.
- The company should therefore build up a strong information base and system of communication and sharing of knowledge/information among its employees.
- Intranet will provide such opportunities through its underlying technologies and applications. The advantage of intranet can therefore be summed up as under:
- **Competitive advantage:** To acquire best talents and retain employees by providing opportunities to work under the internet and intranet technologies – more so as a result of reduction in work force both in ranks and numbers under the present day business environment.
- **Timelines advantage:** Information can be delivered to employees almost instantly and effectively.
- **Data advantage:** Intranet provides simple way of getting updated within any database of the company any time and from anywhere.
- **Communication advantage:** The application of technology to communication and information is a common phenomenon throughout the world and a company not providing such opportunities to its workforce will do so at its risk. Travelling staff or those having office in remote places can have access to the intranet through remote/dialup access and use the intranet infrastructure.

4.7 Clients and Servers

- This is a purely role-based classification of computer systems. With the increased popularity of computer networks, it has become possible to interconnect several computers, which can communicate and interact with each other over the network.
- In such a computing environment, there are several resources/services which can be shared among multiple users for cost-effective usage and can be best managed/offered centrally. A few examples of such resources/ services are:

② **File server:** It provides a central storage facility to store files of several users on the network

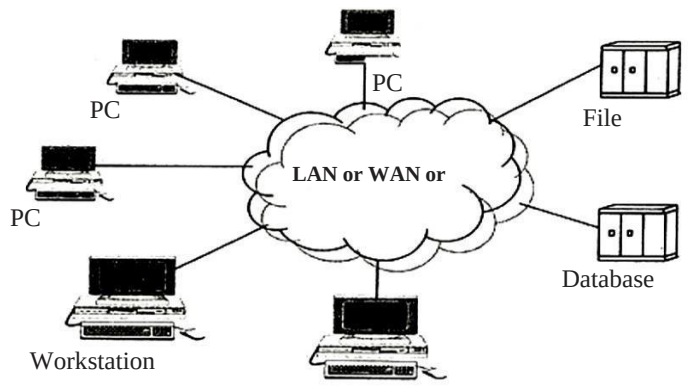
② **Database server:** It manages a centralized database and enables several users on the network to have shared access to the same database.

② **Print server:** It manages one or more printers and accepts and processes print requests from any user in the network.

② **Name server:** it translates names into network addresses, enabling different computers on the network to communicate with each other.

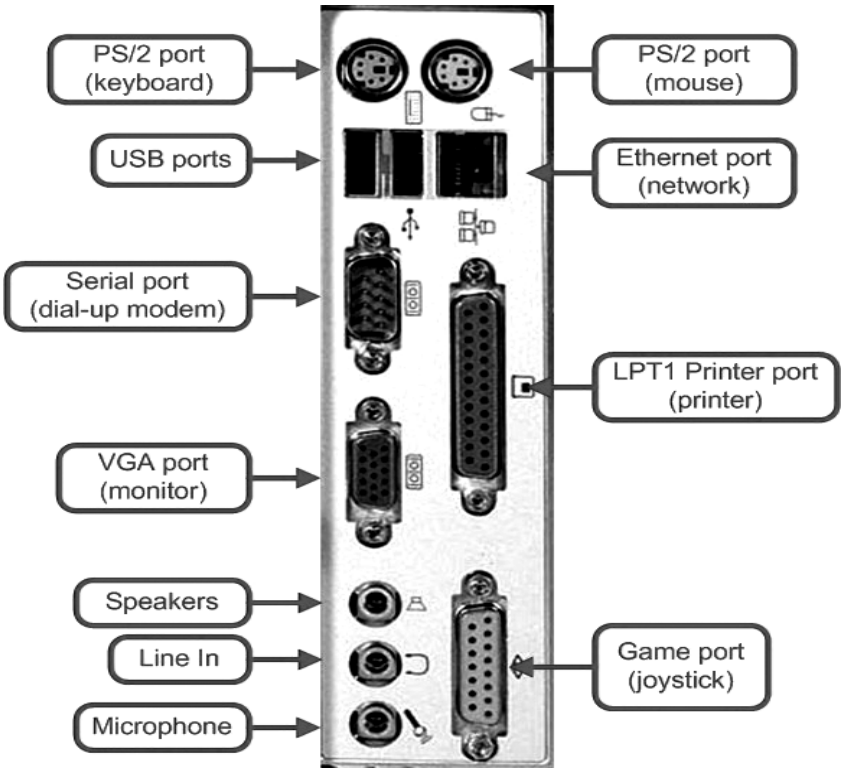
- In these cases, it is usual to have one process, which "owns" the resource or service and is in charge of managing it. This process accepts requests from other processes, which want to use the resources or service.
- The process that owns the resource and does this management is called a 'server process', and the computer on which the server process runs is called a 'server computer', because it services requests for use of the resource.
- Other processes, which send service requests to the server, are called 'client processes', and the computers on which the client processes runs are called 'client computers'.
- Note that there may be multiple client computers, which send service requests to the same server computer.

Workstation (Client)



A generic client-server computing environment

- In a client-server computing environment, it is common for one server to use the services of another server, and hence, to be both a client and a server at the same time.
- For example: let us assume that a client-server computing environment has clients, a file server, and a disk block server. Any client can send a file access request to the file server. On receiving such a request, the file server checks the access rights, etc., of the user, but does not actually read/write the file blocks itself. Instead, it sends a request to the disk block server for accessing the requested data blocks. The disk block server returns to the file server, the requested data blocks. The file server then extracts the actual data from the data blocks and returns it to the client. In this scenario, the file server is both a server and a client. It is a server for the clients, but a client for the disk block server. Hence, the concept of client and server computers is purely role-based and may change dynamically as the role of a computer changes.



Ports

- Modern computers carry many types of ports, for example, mouse, keyboards, serial, USB, parallel (printer), microphone, telephone, network etc. computer ports in common use cover a wide variety of shapes such as round (PS/2, etc), rectangular (FireWire, etc), square (Telephone plug), trapezoidal (D-Sub – the old printer port was a DB-25) etc.
- There is some standardization to physical properties and function. For instance, most computers have a keyboard port (currently a round DIN-like outlet referred to as PS/2), into which the keyboard is connected.

Uses of Ports

- Ports are used to connect various devices to the computer and hence enable communication between the device and the computer, for example, external modem is connected to serial ports, and printer is connected to parallel ports.
- Ports help in transmitting the data from the device to the computer and vice versa.
- Each port has a specific way of communicating and this depends upon the speed and size of the port, for example, serial, parallel and USB.

Types of Ports

The following are the types of ports:

- **USB (Universal Serial Bus):** a new universal connector
- **Firewire:** fast camcorder connector
- **Ethernet (Network Port):** connect to a network and high speed internet
- **Serial Ports:** for external modems and old computer mice
- **Parallel Ports:** connector for scanners and printers
- **PS/2 Ports:** keywords and mouse interface
- **VGA (Video Graphic Array):** a video port for the monitor
- **DVI:** used to interface between a PC and display items
- **Modern Port:** connect by phone to the internet
- **Power Port:** for power plug

A hardware port resembles a plug-in or connection commonly found on the back of a computer. Hardware ports allow computers to access the external devices such as computer printers, etc.

4.8 Domain Name Service

- The Domain Name System (DNS), as a whole, consists of a network of servers that map '*internet'* domain names to a local IP addresses.
- The DNS enables domain names to stay constant while the underlying network topology and IP addresses change. This provides stability at the application level while enabling network applications to find and communicate with each other using the IP no matter how the underlying physical network changes.

4.9 WWW Browsers Connections

- The 'World Wide Web' (called WWW or W3 in short) is the most popular and promising method of accessing the internet. The main reason for its popularity is the use of a concept called 'hypertext'.
- Hypertext is a new way of information storage and retrieval, which enables authors to structure information in novel ways. An effectively designed hypertext document can help users rapidly locate the desired type of information from the vast amount of information on the internet.
- Hypertext documents enable this by using a series of 'links'. A link can be shown on the screen

in multiple ways, such as a labelled button, highlighted text, or different colour text than normal text if your computer has a colour display, or author author-defined graphic symbols.

- A link is a special type of item in a hypertext document, which connects the document to another document that provides more information about the linked item.
- The latter document can be anywhere on the internet. By "connect", we mean that a user simply selects the linked item and the user almost immediately sees the other document on his computer terminal.
- The concept of hypertext can be best illustrated with the help of an example. Let us assume that the screen of your computer terminal has the following hypertext document currently displayed on it:

Pradeep K. Sinha has been involved in the research and development of distributed systems for almost a decade. At present, Dr. Sinha is working at the **Centre For Development Of Advanced Computing (C-DAC)**, Pune, India. Before joining C-DAC, Dr, Sinha worked with the **Multimedia Systems Research Laboratory(MSRL) of Panasonic** in Tokyo, Japan.

- The hypertext document has the following two links which are shown on the screen as highlighted (bold and underlined) texts:

① Centre for Development of Advanced Computing (C-DAC). Let us assume that this link connects the current document to another document, which gives detailed information about C-DAC, and is located on a computer system at C-DAC in Pune, India.

② Multimedia Systems Research Laboratory (MSRL) of Panasonic. Let us assume that this link connects the current document to another document, which gives detailed information about MSRL of Panasonic, and is located on a computer system at MSRL of Panasonic in Tokyo, Japan.

- Now, if you use your mouse to click anywhere on the link **Multimedia Systems Research Laboratory (MSRL) of Panasonic** of the displayed document, within a few seconds you will find yourself connected to the computer at MSRL of Panasonic in Tokyo, and displayed on your computer screen will be the document, which gives detailed information about MSRL of Panasonic.
- Hypertext documents on the internet are known as 'Webpages'. Web Pages are created by using a special language called 'Hypertext Markup Language' (HTML).
- HTML is a subset of the more generalized language called 'Standard Generalized Markup Language' (SGML), which is a powerful language for linking documents for easier electronic access and manipulation. HTML is becoming a de-facto industrial standard for creating Webpages.
- The WWW uses the client-server model, and an internet protocol called 'Hypertext Transport Protocol' (HTTP) for interaction between the computers on the internet.
- Any computer on the internet, which uses the HTTP protocol, is called a 'Web Server', and any computer, which can access that server, is called a 'Web Client'.
- The use of the client-server model and the HTTP allows different kinds of computers on the Internet to interact with each other. For example, a Unix workstation may be the web server and a Windows PC may be the web client, if both of them use the HTTP protocol for transmitting and receiving information.

4.10 WWW Browsers

To be used as a web client, a computer needs to be loaded with a special software tool, which is known as 'WWW browser' (or browser in short). Browsers normally provide the following navigation facilities to help users save time when they are jumping from server to server while internet surfing (the process of navigating the internet to search for useful information):

- Unlike FTP and Telnet, browsers do not require a user to remotely log in to a server computer, and then tolog

  out again when the user has finished accessing information stored on the server computer.
- Browsers allow a user to specify an URL address of a server computer to facilitate the user to directly visit the server computer's site, and to access information stored on it. URL stands for 'Uniform Resource Locator'. It is an addressing scheme used by WWW browsers to locate sites on the internet.
- Browsers allow a user to create and maintain a personal 'hotlist' of favourite URL addresses of server computers, which the user is likely to frequently visit in future. A user's hotlist is stored on his/her local web client computer. Browsers provide hotlist commands to allow the user to add, delete, update URL addresses in the hotlist, and to select an URL address of a server computer from the hotlist, when the user wants to visit that server computer.
- Many browsers have a "history" feature. These browsers maintain a history of the server that a computer visited in a surfing session. This is, they save (cache) in the local computer's memory, the URL addresses of the server computers visited during a surfing session so that if the user wants to go back to an already visited server later on (in the same surfing session), the link is still available in the local computer's memory.
- Browsers allow a user to download (copy from a server computer to the local computer's hard disk) information in various formats (i.e., as a text file, as an HTML file, or as a PostScript file). The downloaded information can be later (not necessarily in the same surfing session) used by the user. For example, downloaded information saved a PostScript file can be later printed on a PostScript-compatible printer, where even the graphics will be properly reproduced.

Data Transmission Media

The transmission media can be grouped into:

- guided media
- unguided media

Guided Media

- In guided media, the data signals are sent along a specific path, through a wire or a cable.
- Copper wire and optical fibers are the most commonly used guided media. Copper wire transmits data as electric signals.
- Copper wires offer low resistance to current signal, facilitating signals to travel longer distances. To minimize the effect of external disturbance on the copper wire, two types of wiring is used.

② Twisted pair

② Coaxial pair

Twisted-pair Wire

- Twisted-pair and coaxial cable use metallic (copper) conductors that accept and transport signals in the form of electrical current. Twisted-pair wire are of two types:

② **Unshielded Twisted Pair (UTP)** is the most common type and also used in telephone lines. A twisted pariconsists of two conductors (copper) each with its own coloured plastic insulation and twisted around each other. Twisted pair configuration reduces interference from electrical field as compared to parallel pair configuration. Unshielded twisted pair is currently the cable standard for most networks. It is relatively inexpensive, easy to install, very reliable, and easy to maintain and expand. UTP support a maximum data rate of 155 Mbps.

② **Shielded Twisted Pair (STP)** wire has a metal foil or braided mesh covering that encases each pair of insulated conductors. The metal casing prevents the penetration of electromagnetic noise and the quality of transmission improves. In all other respects it resembles UTP.

Coaxial Cable

- Coaxial cable (simply called coax) has a central core conductor of solid or standard wire (usually copper) enclosed in an insulating sheath, which is, in turn, encased in an outer conductor of metal foil, braid or a combination of the two (also usually copper).
- The outer metallic wrapping serves both as a shield against noise and as the second conductor, which completes the circuit.
- This outer conductor is also enclosed in an insulating sheath, and the whole cable is protected by a plastic cover. Coaxial cable carries signals of higher frequency ranges than twisted-pair wire. Often many coaxial cables are bundled together.
- As a result of extra insulation, coaxial cable is much better than twisted pair wiring at resisting noise. Also, it is faster than UTP (supports a maximum data rate of 200 Mbps). Optical fibre transmits data as light signals.

Unguided Media

- In unguided media, the data signals are not bounded by a fixed channel to follow. The data signals are transmitted by air.
- Radio, microwave, and satellite transmissions fall into this category.

Dial-up Line

- Dial-up line (also known as a switched line) is a service, which operates in a manner similar to a telephone call.

  That is, a user of a computer willing to communicate with a remote computer first makes a connection request by dialing up the remote computer.
- A circuit is then established between the two computers via the telephone company's switching system. The modem attached to the user computer then sends and receives data over the telephone line.

- Just as in the case of a telephone call, the charge for data transmission service in this case depends on the duration of communication (circuit establishment) and the distance between the two computers.

Integrated Services Digital Network (ISDN)

- ISDN is a telephonic system, which provides digital (not analog) telephone and data services. As it supports digital services (including digitalized voice), the ISDN telephone users enjoy noise free, CD-quality, sound.
- Moreover, with the ISDN, no modem is necessary because it supports digital transmission of all types of data (including voice). This also results in very short call set-up time between two ISDN subscribers.
- The main factor that led to the development of the ISDN was adoption of digital transmission by many public telephone systems.
- Based on the transmission and switching capabilities, the ISDNs are currently of two types:
- Narrowband ISDN
- Broadband ISDN
- **Narrowband ISDN** is based on 64kbps bit-streams that are combined into higher-capacity "trunks" using time-division multiplexing. For example, 32 64-Kbps channels can be combined into one 2- Mbps channel. The narrowband ISDN, however, cannot support the requirements of several types of data services, especially those needed for multimedia applications. For example the bandwidth required for full-definition digital video is in the 100 Mbps range.
- To handle this sort of traffic, as well as bursts of data traffic from computers, **Broadband ISDN** (often referred to as B-ISDN) was introduced. B-ISDN is based on optical fibres and asynchronous time-division multiplexing. The advantage of asynchronous time-division multiplexing over conventional time-division multiplexing is that it allows the total bandwidth available to be divided between contending activities in a much flexible way.
- ISDN has become so popular, that a term to describe the standard analog service has been coined as 'Plain Old Telephonic Service' (POTS).

Asymmetric Digital Subscriber Line (ADSN)

- ADSL is a type of DSL broadband communications technology which allows high speed access of internet.
- ADSL allows more data to be sent over existing copper telephone lines (POTS), when compared to traditional modem lines.
- A special filter, called a 'micro-filter', is installed on a subscriber's telephone line to allow both ADSL and regular voice (telephone) services to be used at the same time.
- ADSL requires a special ADSL modem and subscribers must be in close geographical locations to the provider's central office to receive ADSL service. Typically this distance is within a radius of 2 to 2.5 miles.
- ADSL supports data rates of from 1.5 to 9 Mbps when receiving data (known as the downstream

rate) and from 16 to 640 Kbps when sending data (known as the upstream rate).

The following are the advantages of having an ADSL:

- Speed: It downloads information fast, which allows quick access to information or services. It also allows making and receiving calls as normal calls without disturbance like of engaged tones, etc.
- ADSL is referred for efficient surfing as well as for downloading files for business or home users. However, there are many advantages of ADSL over other forms of broadband services. It has a modem that facilitates the transmission of massive digital information over ordinary copper wire.

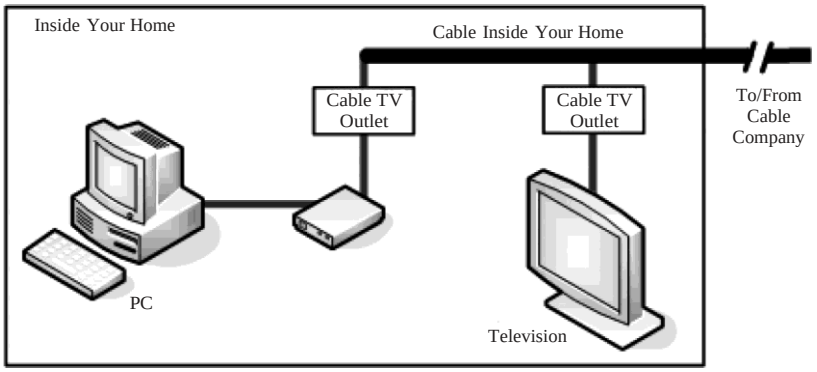
Cable

- By using cable modem, one can access a broadband internet connection which is designed to function or operate over cable TV lines.
- Cable internet connections works by using TV channel space for data transmission:

② certain channels are used for downstream transmission

② other channels for upstream transmission

- The coaxial cable used by cable TV provides greater bandwidth than telephone lines.
- A cable and internet modem can be used to achieve extremely fast access to the Web. This, combined with the fact that millions of homes are already wired for cable TV, has made cable internet service very popular.



Cable

- The process of modulation and demodulation, that is the conversion of digital data to analog form and vice versa, is carried out by a special device called a 'modem' (modulator/demodulator).
- Hence, when an analog facility is used for data communication between two digital devices (say a terminal and a computer), two modems are required, one near each digital device.
- The digital signal generated at the terminal is converted to analog form by the modulator of the modem placed near it. The analog signal is transmitted through the telephone line, which is converted to digital form by the demodulator of the modem placed near the computer. This

digital data is processed by the computer.

- The processed digital data is modulated to analog form and returned via the telephone line to the terminal, where the analog signals are demolished to digital form for display on the terminal.
- Hence, the modem is an essential piece of hardware for any application in which two digital devices (say two computers) want to communicate over an analog transmission channel (say a telephone line).
- When you want to use a modem with your computer to allow it to communicate with any other computer via the telephone line, the following factors should be considered:

② **Transmission speed:** The higher is the transmission speed of a modem, the better it is, because it can communicate faster.

② **Internal versus externa**l: Modems are of two kinds

i. internal

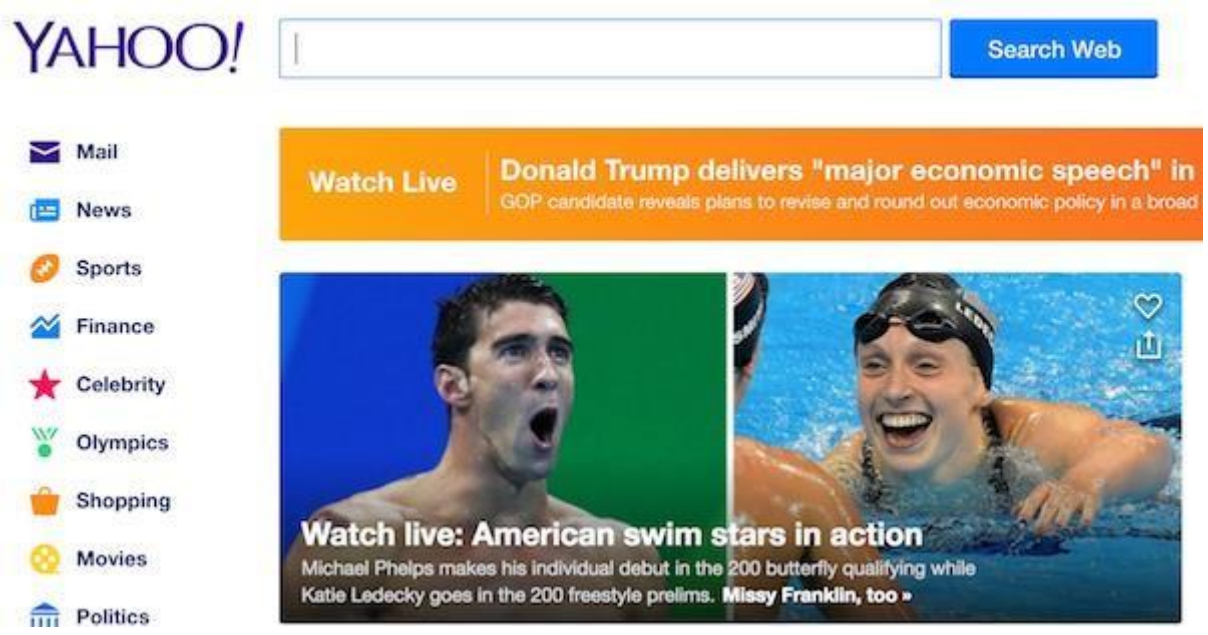
ii. external

- An internal modem is an optional add-on circuit board, which plugs into one of the computer's expansion slots. It gets its power from the computer's expansion bus. It is manufactured and supplied by the computer manufacturer itself.
- An external modem, on the other hand, is a separate box, which contains the circuitry and logic to modulate data signals. It has its own power supply, on/off switch and front panel LCDs to indicate its status. So, external modems are slightly more expensive.

- **Facsimile facility**: Some modems, known as FAX modems, are capable of emulating a FAX machine in addition add to performing the functions of a regular modem. A computer equipped with a FAX modem can send/receive text and images as a FAX to/from a remote FAX machine, or another computer equipped with a FAX modem. FAX modems can be of external or internal type.

SEARCH ENGINES


Bing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Search Web
Mail
News
Sports
Finance
Celebrity
Olympics
Shopping
Movies
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Watch Live
Donald Trump delivers "major economic speech" in
GOP candidate reveals plans to revise and round out economic policy in a broad
Watch live: American swim stars in action
Michael Phelps makes his individual debut in the 200 butterfly qualifying while
Katie Ledecky goes in the 200 freestyle prelims. Missy Franklin, too »


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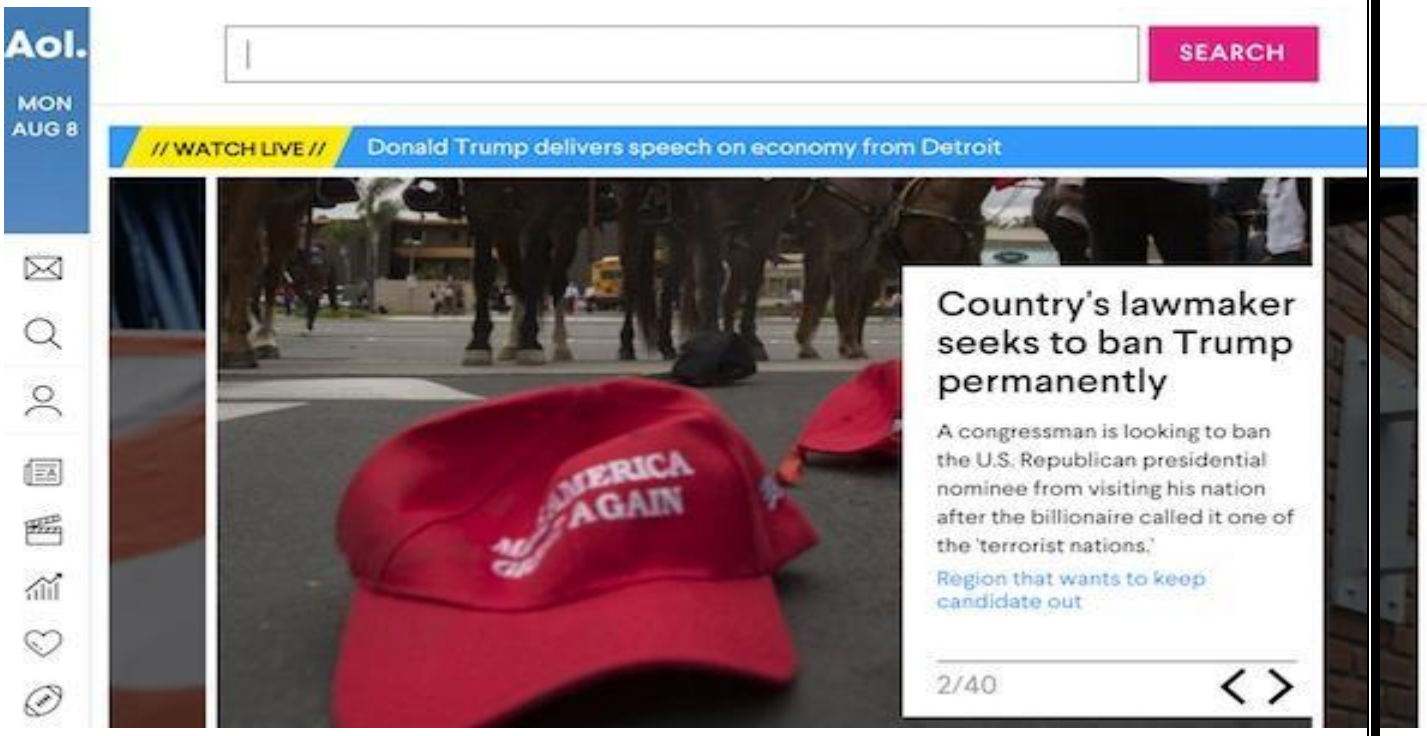
Aol.
MON
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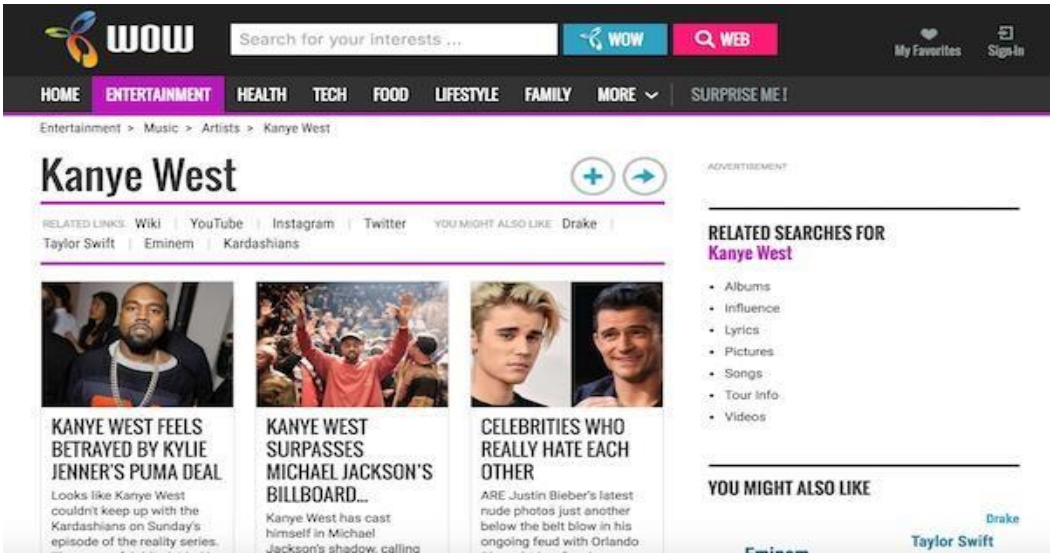
// WATCH LIVE //
Donald Trump delivers speech on economy from Detroit
Country's lawmaker seeks to ban Trump permanently
A congressman is looking to ban the U.S. Republican presidential nominee from visiting his nation after the billionaire called it one of the 'terrorist nations.'
Region that wants to keep candidate out
2/40


WOW
Search for your interests ...
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WEB
My Favorites
Sign-In
HOME
ENTERTAINMENT
HEALTH
TECH
FOOD
LIFESTYLE
FAMILY
MORE
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Kanye West
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KANYE WEST FEELS BETRAYED BY KYLIE JENNER'S PUMA DEAL
Looks like Kanye West couldn't keep up with the Kardashians on Sunday's episode of the reality series.
KANYE WEST SURPASSES MICHAEL JACKSON'S BILLBOARD...
Kanye West has cast himself in Michael Jackson's shadow, calling
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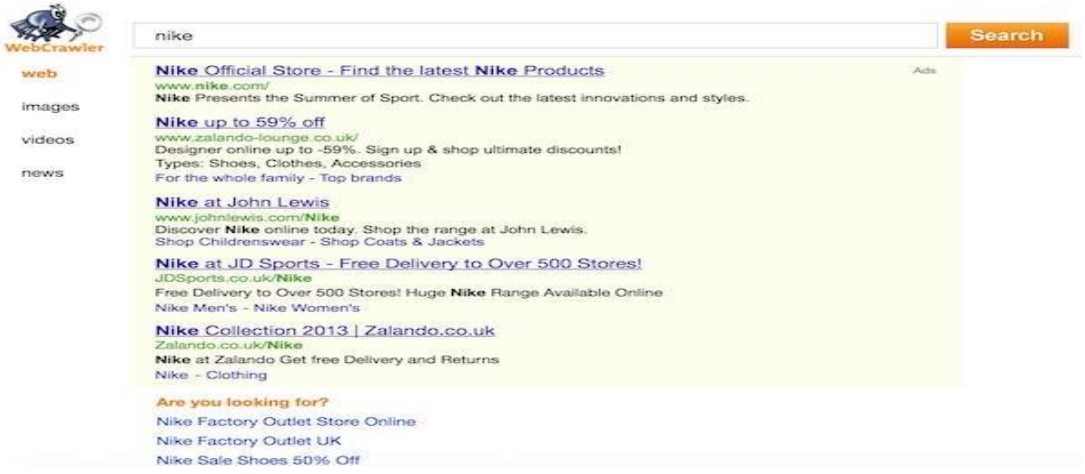
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Electronic Mail

- The electronic mail service allows an internet user to send a mail to another internet user in any part of the world in a near-real time manner. The message takes anywhere from a few seconds to several minutes to reach its destination, because it must be passed from one network to another, until it reaches its destination.
- E-mail service has many similarities with the post e-mail service, which all of us are familiar with. All internet users have an e-mail address, just like all of us have a postal address.
- Each internet user has a logical mailbox just like each one of us has a mailbox in out house. When sending a mail to another user, the sender specifies the e-mail address of the receiver just as we write the postal address of the receiver in the postal mail system.
- The e-mail service delivers an already sent mail into the receiver's mailbox. The receiver extracts the mail from the mailbox and reads it at theirs own convenient time just like in a postal mail system.
- After reading the message, the receiver can save it, delete it, pass it on to someone else, or respond by sending another message back.
- Messages in an e-mail service can contain not only text documents, but also image, audio and video data. The only restriction is that the data must be digitised, i.e., it should be converted to a computer-readable format.
- With e-mail service, the internet has proved to be a rapid and productive communication tool for millions of users. As compared to paper mail, telephone, and fax, e-mail is preferred by many because of its following advantages:

② It is faster than the postal mail.

② Unlike the telephone, the persons communicating need not be available at the same time.

② Unlike fax documents, e-mail documents can be stored in a computer and can be easily edited using editing program

Abbreviations

ADSL	-	Asymmetrical Digital Subscriber Line
ALU	-	Arithmetic Logic Unit
ARPA	-	Advanced Research Project Agency
ASCII	-	American Standard Code for Information Interchange
BCD	-	Binary Coded Decimal
BIOS	-	Basic Input Output System
B-ISDN	-	Broadband Integrated Services Digital Network
CAN	-	Control Area Network
CD-ROM	-	Compact Disk/ Read Only Memory
CIR	-	Current Instruction Register
CPU	-	Central Processing Unit
CU	-	Control Unit
DNS	-	The Domain Name System
EBCDIC	-	Extended Binary Coded Decimal Interchange Code
EDVAC	-	Electronic Discrete Variable Automatic Computer
EEPROM	-	Electrically Erasable Programmable Read Only Memory
ENIAC	-	Electronic Numerical Integrator and Computer
EPROM	-	Erasable Programmable Read Only Memory
HTML	-	Hypertext Mark-up Language
HTTP	-	Hypertext Transport Protocol
I/O	-	Input/Output
IAS	-	Institute for Advanced Studies
IP	-	Internet Protocol
IS	-	Information System
ISDN	-	Integrated Service Digital Network
LAN	-	Local Area Network
LSB	-	Least Significant Bit
MAN	-	Metropolitan Area Network
MAR	-	Memory Address Register
MDR	-	Memory Data Register
MICR	-	Magnetic Ink Character Recognition
MM	-	Main Memory
MO	-	Magnetic Optical

MSB	-	Most Significant Bit
NSF	-	National Science Foundation
OCR	-	Optical Character Reader
OMR	-	Optical Mark Reader
OOP	-	Object-Oriented Programming
PAN	-	Personal Area Network
PC	-	Personal Computers
PC	-	Program Counter
PDL	-	Program Design Language
POTS	-	Plain Old Telephonic Service
PROM	-	Programmable Read Only Memory
RAM	-	Random Access Memory
ROM	-	Read Only Memory
SAN	-	Storage Area Network
SGML	-	Standard Generalised Mark-up Language
SP	-	Stack Pointer
SSID	-	Same Service Set Identifier
STP	-	Shielded Twisted Pair
TCP	-	Transmission Control Protocol
UNIVAC	-	Universal Automatic Computer UPC - Universal Product Code
URL	-	Uniform Resource Locator
UTP	-	Unshielded Twisted Pair
VDU	-	Visual Display Unit
WAN	-	Wide Area Network
WEP	-	Wired Equivalent Privacy
WNIC	-	Wireless Interface Controller
WORM	-	Write Once Read Many
WWW	-	World Wide Web