

## UNIT- I

**Introduction to Computers:** Characteristics of computers, evolution of computers, generation of computers, classification of computers, applications of computers.

**Input and Output Devices:** Keyboard, pointing devices, speech recognition, digital camera, scanners, optical scanners. Classification of output devices, hard copy output devices- printers, plotters, computer output microfilm (COM), soft copy output devices- monitors, audio output, projectors, and terminals.

## COMPUTER

1. A comp is an electronic device which processes raw data according to the programmed instruction to produce the O/P in useful form.
2. Comp is an electronic devices which is capable of solving any problems (simple or complex) by (a) accepting input in the from of data , (b) performing prescribed operation in this data in a specified sequence and finally (c) supplying result (or information) after these operation, in the form of an output.

## **Characteristics of computers**

1. Automatic: - Computers are automatic machines because once started on job, they carry on, until job is finished.
2. Speed: - It can perform in a few seconds, may be milliseconds ( $10^{-3}$ ), microseconds ( $10^{-6}$ ), nanoseconds ( $10^{-9}$ ), picoseconds ( $10^{-12}$ ) and a powerful computer perform several billion ( $10^9$ ) operation in a second.
3. Accuracy: - Large calculations in a few seconds accurately without any interruption, for this reason computer are used in banks, aircrafts, and remote senescing for accurate results.
4. Reliability: - Computers are reliable, unlike humans, computer simply do not get bored or tired.
5. Memory/storage capabilities: - It has large amount of memory which is capable to store large amount of data for time being.
6. Perfectionist: - A computer is diligent it never loose concentration. It can work for hours without committing any mistake and getting irritated. Performed millionth calculation with the same accuracy and speed.
7. Flexibility: - It can switch from one application to another means one moments play a song can be sketch to print out any letter / report or may be another work.
8. Artificial intelligence: - A computer has no I.Q. all intelligence is incorporated in the computer as programs. So it cannot take decision of its own.
9. Numbness: - computer has no emotions and feeling because they are machines. It can work for hours in extreme weather condition.
10. Diligence
11. Experience less
12. User friendly

## **Limitation of a computer**

Computer have the major limitation is that it is not intelligent enough to take its own decisions and it can be easily crashed which would result in data or information.

1. Computer cannot take over all activities simply because they are less flexible than human.
2. Computers do not have the potential to try out various alternative to solve the unexpected.
3. It does not have the capability to learn from experience.
4. It has to be given every details instruction and every steps of its operation has to be described.
5. They are always a threat to personal privacy.
6. They are manufactured using hazardous chemicals hence harming the health of people working and also contributing in pollutions.
7. Discarded computers are real junk and consume lot of space.
8. They are failure prone. A failure in a nuclear power station or airplane etc. can endanger many lives and resources.

9. Working too much time in computer gives the user back pain, nerve injuries etc.
10. By automating tasks- unemployment is increasing at a very high speed.

### **The evolution of computer / generations.**

Other than this, refer to Sinha book i.e.in details. These are not from P.K.Sinha book.

#### **First generation 1942-1954**

1. Computer in this generation use of vacuum tubes or valves as their basic electronic component.
2. They were faster than earlier mechanical devices.
3. These computers were very enlarging in size and very costly.

##### **Disadvantages**

1. They consumed too much power and generated too much heat, when used for even short duration of time.
2. They were very unreliable and broke down frequently.
3. They require regular maintenance .their components had assembled manually.
4. Big air condition was required.

Example:

- I. First comp was ENIAC (Electronic numerical integrator and calculator) it was the first electronic comp using vacuum tubes.
- II. EDSAC (Electronic delay storage automatic calculator) it was the first stored program comp.
- III. EDVAC (Electronic discrete variable automatic comp) it was successor of EDSAC
- IV. IAS machine (Princeton's institute of advance studies) it was a new version of the EDVAC, built by von Neumann.

#### **Second generation 1954-1964**

1. Transistors used instead of vacuum tubes.
2. Comparatively smaller in size and generated less heat.
3. Better than the earlier comp.
4. Transistors were made from pieces of silicon, so they were more compact than vacuum tubes.

##### **Disadvantage**

1. Limited storage capacity
2. Consumed more power
3. Relatively slow in performance.
4. Required regular maintenance and their components are very expensive.
5. Commercial production was difficult and costly.

Example:

- I. PDP -1 developed by DEC was the first minicomputer.
- II. NCR 304 (National cash register) was first all- transistorized comp.
- III. IBM 1401,

#### **Third generation 1964-1978**

1. Based on IC is (Integrated chips) technology.
2. Mainframe computers were developed in this generation.
3. Smaller in size and were cost effective with increased memory capacity.
4. IC's were more compact than transistors.
5. Very less heat generated
6. Required very less power
7. Reduce computational times from microseconds to nanoseconds
8. More reliable
9. Maintenance cost is low because h/w failure is rare, easily portable and totally general purpose.

##### **Disadvantage**

## BCA I Fundamental of Computers

1. They still had less storage capacity,
2. Relatively slower performance
3. Air conditioning is required in many cases.
4. Highly sophisticated technology required for the manufacture of IC chips.

Example:

- I. IBM 360, developed by IBM in 1964 was the first product line designed as a family.
- II. PDP-11 developed by DEC in 1970 was the first highly successful minicomputer.
- III. CRAY-1, developed by CRAY in 1974 was the first supercomputer.

### Fourth generation 1978-1995

1. Used micro technology
2. Use of large scale integrated (LSI) in place of ICs.
3. VLSI is the latest technology of comp introduced
4. Development of the popular PCS, also called as microcomputer.
5. Having a high memory and a fast processing speed.
6. Today's PCS are more powerful than mainframe computer,
7. Smallest in size because of high component density.
8. Very reliable. Heat generated is negligible.
9. No air conditioning was required.
10. Hardware failure is negligible.
11. Minimal maintenance is required.
12. Easily portable. Totally general purpose.

### Disadvantage

1. Highly sophisticated technology is required for the manufacture of LSI chips.
2. No intelligence on their own.

Example:

- I. IBM pc, developed in 1981 was the first industry standard PC, having Intel 8088 microprocessor.
- II. CRAY-2 developed in 1985, was the 4<sup>th</sup> generation supercomputer.
- III. Pentium processor based comp, developed in 1995.

### Fifth generation 1995- present

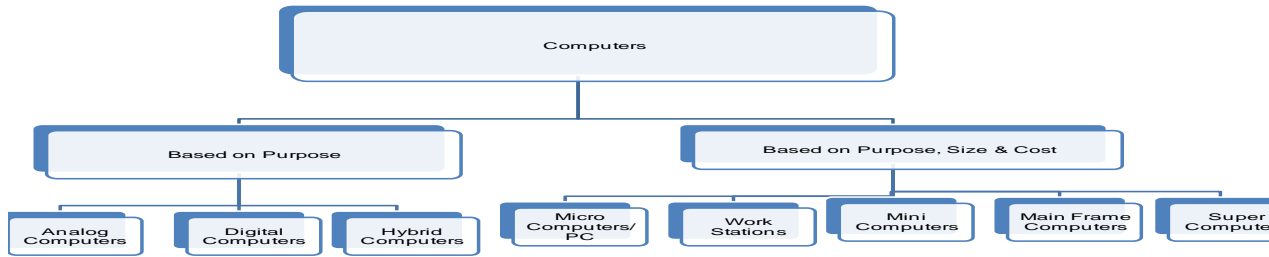
1. The AI was introduced. The comp of this generation has the capability to think on their own.
2. Use ULSI (Ultra Large Scale Integration) chips in place of VLSI chips.
3. One ULSI chip contains millions of components on a single IC.
4. Use intelligent software.
5. The programmers or users would not require giving each and every instruction to the comp for solving a problem.
6. Comp can accept spoken word instructions (voice recognition) and reproduce human reasoning.
7. Fifth generation computers have the ability to translate a foreign language.

Example:

- I. Yet to develop, but ROBOTS have few features of 5<sup>th</sup> generation comp.
- II. Use an expert system, which can perform all the tasks.

## Types of computers

Manufacturers make many shapes and sizes of comp systems, but the comp can be classified on the basis of purpose, performance, size and cost.



**A. Based on purpose**

1. **Analog computers:** - Analog computer represents numbers by a physical quantity; that is they assign numbers values by physically measuring some actual property. E.g. An angle, length of an object, Amount of voltage passing through a point. Analog computer derives all their data from of measurement. The accuracy of the data used is an analog computer is directly related to the precision of its measurement.
2. **Digital computer:** - Digital computers represent data as numbers or separate units. Digital computers work upon 0 and 1, which is discontinuous data. They translate the data into digital and all operations are carried out on these digital at enormously fast rates. Digital computers are quicker than analog and are more accurate.

**Main characteristics/Features of a digital computer.**

- I. **Versatility:** - A computer is a general purpose machine which can be programmed to perform varied tasks. A computer work under the control of a program, and program can be viewed as a sequence of instruction, and can be asked to execute appropriate programs.
- II. **Basic operations:-** computer understand limited set of simple instruction-
- III. Add, subtract, multiply and divide number.
- IV. Compare values
- V. Copy values from one part of the memory to the other.
- VI. **Speed:** - A computer can execute instructions at a very fast speed. the fastest computers today can execute nearly one billion instruction per second (10 – 1000000000)  
The speed of a computer is expressed in time. The time taken to execute an instruction may be measured in units of nanosecond (billion of a second) or micro second (million).
- VII. **Accuracy and Reliability:** - can execute instruction very accurately and reliability.
- VIII. **Automation:** - A computer need not be given instruction one at a time. It works under the control of a program. The computer executes the instruction in the program in the desired sequence.
- IX. **Storage:** - We can store large number of programs and data on a computer one the program for a job has been stored, it can be recalled and the computer can be asked to execute it.

**Different between Analog and Digital Computers**

	<b>Analog</b>	<b>Digital</b>
1.	Represent continuous measurement of physical quantities e.g. Rotation, voltage, temperature etc.	Represent number by discrete coded patterns.
2.	Accuracy is quite limited	Unlimited accuracy
3.	Represent physical or mathematical quantities.	Represent number, letters, and other symbols.
4.	Data storage scattered in various non-inter changeable devices.	Data storage concentrated in space, inter changeable and unlimited in duration.
5.	Distinct elements used for each operation.	Identical elements used in sequence.

## BCA I Fundamental of Computers

6.	Sets up analogy of problem	Breaks down problem into arithmetic operations.
7.	Serves as model and mirrors relation of actual system.	Digital comp compounds arithmetic data, unrelated to system it represents.
8.	Operation usually carried out in real time of physical system.	Time of operations usually does not correspond to real time.
9.	Relatively few devices used and easier programming.	Many devices needed and difficult programming.
10.	Basic operation performed by relatively few single-purpose devices such as (integrators, multipliers, magnitude-comparators etc.	Operation performed by relatively many interchange enable arithmetic devices such as address, registers, accumulators etc.
11.	Best suited to represent measurable quantities and simulate response of physical systems by mathematical analogies.	Best suited to handle discrete random processes statistical data and numerical problems of business and scientific nature.

**3. Hybrid computer:** - Hybrid computer are those computer which perform some work based on analog principal and some work based on digital computers. They have the speed of an analog computers and accuracy of a digital computer. These types of computer have analog- digital convertor.

E.g. Hybrid computer are used in communication system control the air traffic and the radar of national defense.

### B. Based on performance, size and cost

1. **Micro computers:** - Micro computers are the smallest computer system. Their size range from calculator size to desktop size. It is designed for single user. Micro computers are very cheap, can operate either as independent computers in stand- alone mode or an intelligent terminal in network mode. E.g. Apple, AT NT, Compaq, IBM, Commodore.

A microcomputer is a complete computer on a smaller scale and generally a synonym is personal computer or PC, a computer designed for an individual. A microcomputer contains a microprocessor (a central processing unit on a microchip), memory in the form of read-only memory and random access memory, I/O ports and a bus or system of interconnecting wires.

2. **Work stations:-** These are also specialized, single-user computers with many of the features of a P.C. but with the processing power of a minicomputer (10 times more than P.C.) the standard operating system is UNIX .they have a system x-window to display the status of multiple process during their execution. These powerful machines are popular among scientists, engineers and animators. They also used for executing numeric and graphic intensive application like CAD.

Workstations are purpose built for high performance and heavy workloads. They are also designed so you can tailor the system. Workstations lie between personal computers and minicomputers. A workstation class PC may have some of the following features:

- Support for ECC memory (Error-Correcting Code Memory)
- Larger number of memory sockets which use registered (buffered) modules
- Multiple processor sockets, powerful CPUs
- Multiple displays
- Run reliable operating system with advanced features
- High performance, reliable graphics card

3. **Mini computers:** - Minicomputers are multiuser systems. The processing pace and other capabilities exceed those of microcomputer and more peripheral devices can be attached to them. They have more sophisticated O.S. than microcomputer and can be programmed in a wider variety of programming language. They are usually more powerful and more useful as compared to micro computers some minis are designed for a single user. The most powerful minicomputers can serve the Input of Output needs of hundred of users at a time. E.g. PDP 11/45 and VAX-11.

## BCA I Fundamental of Computers

- They have less memory & storage capacity than mainframe computers.
- The end users can directly operate it.
- They are not very sensitive to the external environment and Hence are more generalized.
- They are used for data processing

4. **Mainframe computer:** - Main frame computers are those computers have faster processing speed and greater storage area. They are also multiuser. They have large primary memory, which usually exceed several millions characters, have very powerful processors. These are used in large organizations where many people need to access the same data. the speed measured in megaflops (millions of floating-point arithmetic operations per seconds) e.g.(A) DEL's VAX-8350,-8650 (B) IBM 4300 series (small to medium size models) (C) IBM enterprise system 19000 series.

- They are big computer systems sensitive to temperature, humidity, dust etc.
- Qualified & trained operators are required to operate them.
- They have wide range of peripherals attached.
- They have large storage capacity.
- They can use wide variety of software's.
- They are not user friendly.
- They can be used for more mathematical calculations.
- They are installed in large commercial places or government organizations.

5. **Super computer:** - Super computer are very powerful, high – performance machine used mostly for scientific computations these computer system known for its high computational speed, fast and large memory system and the extensive use of parallel processing. Super computers are based on expert system/ AI. e.g. First super computer was CRAY-1, other series of CRAY X-mP 24/48, ETA (ETC-ETA 10 ETA 20), C-DAC's PARAH, IBM 3090, Fujitsu (VP series), Hitachi (HITAC 5-300) etc.

- They are huge computers installed in space centre, Nuclear power stations etc.
- They are used for performing complex mathematical Calculations.
- Only scientists and mathematicians can operate them.
- They are having huge memories & tremendous Processing speed.
- They are used for weather forecasting, animation graphics etc.

### Difference between Mainframe and minicomputer

	Mainframe	Mini Computer
1.	It is a multiprocessor computer.	It is multiuser computer.
2.	Very fast in speed	Slow as compare to mainframe computer.
3.	Large in size.	Small in size as compare to mainframe computer.
4.	Very expensive	Less expensive.
5.	Use in large organization.	Small organization.
6.	Eg. DEC's VAX-8350,8650,HP 9,000 model 870/s 400, IBM 43000 series (small to medium size)etc.	Eg. Wipro s- 68030v and s- 68033v built around Motorola 68030 CPU, IBM as/400/B60, DEC's VAX 8842 etc.

### Difference between computer and calculator

	Computer	calculator

## BCA I Fundamental of Computers

1.	Computer can perform very large number of calculations.	Calculator can perform limited number of calculations.
2.	Use number as well as character.	Use only numbers.
3.	Store data permanently	Cannot store data permanently.
4.	It can be used for many works other than calculation	We can use calculator only for numeric calculations. Like add, sub, multiplication, division.
5.	Large in size.	Very compact in size.
6.	Cost high	Cost very low or affordable.

### Various applications of Computers in today's arena

#### Business

The computer's characteristic as high speed of calculation, diligence, accuracy, reliability, or versatility has made it an integrated part in all business organizations.

Computer is used in business organization for:

- Payroll Calculations
- Budgeting
- Sales Analysis
- Financial forecasting
- Managing employees database
- Maintenance of stocks, etc.

#### Banking

Today Banking is almost totally dependent on computer.

Banks provide following facilities:

- Banks on-line accounting facility, which includes current balances, deposits, overdrafts, interest charges, shares and trustee records.
- ATM machines are making it even easier for customers to deal with banks.

#### Insurance

Insurance companies are keeping all records up-to-date with the help of computers. The Insurance Companies, Finance houses and Stock broking firms are widely using computers for their concerns.

Insurance Companies are maintaining a database of all clients with information showing:

- how to continue with policies
- starting date of the policies
- next due installment of a policy
- maturity date
- interests due
- survival benefits
- bonus

#### Education

The computer has provided a lot of facilities in the Education System.

- The uses of computer provide a tool in the Education system known as CBE (Computer Based Education).
- CBE involves Control, Delivery and Evaluation of learning.
- The computer education is very familiar and rapidly increasing the graph of computer students.
- There are number of methods in which educational institutions can use computer to educate the students.
- It is used for prepare a database about student performance and analyses are carried out.

#### Marketing

## BCA I Fundamental of Computers

In Marketing uses of computer are following:

- **Advertising:** With computers, advertising professionals create art and graphics, write and revise copy, and print and disseminate ads with the goal of selling more products.
- **At Home Shopping:** Home shopping has been made possible through use of computerized catalogues that provide access to product information and permit direct entry of orders to be filled by the customers.

### Health Care

Computers have become important part in all Medical Systems.

The computers are being used in hospitals to keep the record of patients and medicines. It is also used in scanning and diagnosing different diseases. ECG, EEG, Ultrasounds and CT Scans, etc., are also done by computerized machines.

Some of major fields of health care in which computers are used:

- **Diagnostic System:** Computers are used to collect data and identify cause of illness.
- **Lab-diagnostic System:** All tests can be done and reports are prepared by computer.
- **Patient Monitoring System:** These are used to check patient's signs for abnormality such as in Cardiac Arrest, ECG, etc.
- **Pharma Information System:** Computer checks Drug-Labels, Expiry dates, harmful drug side effects, etc.
- Nowadays, computers are also used in performing surgery.

### Engineering Design

Computers are widely used in engineering purposes.

One of major areas is CAD (Computer aided design). CAD provides creation, edition, and modification of image. Some fields are:

- **Structural Engineering:** Requires stress and strain analysis required for design of Ships, Buildings, Budgets, Airplanes, etc.
- **Industrial Engineering:** Computers deal with design, implementation and improvement of integrated systems of people, materials and equipments.
- **Architectural Engineering:** Computers help in planning towns, designing buildings, determining a range of buildings on a site using both 2D and 3D drawings.

### Military

Computers are largely used in defense. Modern tanks, missiles, weapons, etc., employ computerized control systems. Some military areas where a computer has been used are:

- Missile Control
- Military Communication
- Military operation and planning
- Smart Weapons

### Communication

Communication means to convey a message, an idea, a picture or speech that is received and understood clearly and correctly by the person for whom it is meant. Some main areas in this category are:

- E-mail
- Chatting
- Usenet
- FTP
- Telnet
- Video-conferencing

### Government Applications

Computers play an important role in government applications. Some major fields in this category are:

- Budgets
- Sales tax department
- Income tax department



- Male/Female ratio
- Computerization of voters lists
- Computerization of Driving Licensing system
- Computerization of PAN card
- Weather Forecasting.

## Input and Output Devices

Before a computer can process your data, you need some method to input the data into the machine. The device you use will depend on what form this data takes (be it text, sound, artwork, etc.).

Similarly, after the computer has processed your data, you often need to produce output of the results. This output could be a display on the computer screen, hardcopy on printed pages, or even the audio playback of music you composed on the computer.

The terms “input” and “output” are used both as verbs to describe the process of entering or displaying the data, and as nouns referring to the data itself entered into or displayed by the computer.

## Input Devices

### 1. Keyboard

Most keyboards attach to the PC via a PS/2 connector or USB port (newer). Older Macintosh computers used an ABD connector, but for several years now all Mac keyboards have connected using USB.

It is a text base input device that allows the user to input alphabets, numbers and other characters. It consists of a set of keys mounted on a board.

#### Alphanumeric Keypad

It consists of keys for English alphabets, 0 to 9 numbers, and special characters like + - / \* ( ) etc.

#### Function Keys

There are twelve function keys labeled F1, F2, F3... F12. The functions assigned to these keys differ from one software package to another. These keys are also user programmable keys.

#### Special-function Keys

These keys have special functions assigned to them and can be used only for those specific purposes. Functions of some of the important keys are defined below.

#### Enter

It is similar to the ‘return’ key of the typewriter and is used to execute a command or program.

#### Spacebar

It is used to enter a space at the current cursor location.

#### Backspace

This key is used to move the cursor one position to the left and also delete the character in that position.

#### Delete

It is used to delete the character at the cursor position.

#### Insert

Insert key is used to toggle between insert and overwrite mode during data entry.

#### Shift

This key is used to type capital letters when pressed along with an alphabet key. Also used to type the special characters located on the upper-side of a key that has two characters defined on the same key.

#### Caps Lock

Cap Lock is used to toggle between the capital lock features. When ‘on’, it locks the alphanumeric keypad for capital letters input only.

#### Tab

Tab is used to move the cursor to the next tab position defined in the document. Also, it is used to insert indentation into a document.

#### Ctrl

Control key is used in conjunction with other keys to provide additional functionality on the keyboard.

### **Alt**

Also like the control key, Alt key is always used in combination with other keys to perform specific tasks.

### **Esc**

This key is usually used to negate a command. Also used to cancel or abort executing programs.

### **Numeric Keypad**

Numeric keypad is located on the right side of the keyboard and consists of keys having numbers (0 to 9) and mathematical operators (+ - \* /) defined on them. This keypad is provided to support quick entry for numeric data.

### **Cursor Movement Keys**

These are arrow keys and are used to move the cursor in the direction indicated by the arrow (up, down, left, right).

## **Pointing Devices**

The graphical user interfaces (GUIs) in use today require some kind of device for positioning the on-screen cursor. Typical pointing devices are: mouse, trackball, touch pad, track point, graphics tablet, joystick, and touch screen.

Pointing devices, such as a mouse, connected to the PC via a serial ports (old), PS/2 mouse port (newer), or USB port (newest). Older Macs used ADB to connect their mice, but all recent Macs use USB (usually to a USB port right on the USB keyboard).

### **2. Joysticks**

Joysticks and other game controllers can also be connected to a computer as pointing devices. They are generally used for playing games, and not for controlling the on-screen cursor in productivity software

### **3. Mouse**

PC Keyboard (you have one in front of you that you can see for a closer look)

The mouse pointing device sits on your work surface and is moved with your hand. In older mice, a ball in the bottom of the mouse rolls on the surface as you move the mouse, and internal rollers sense the ball movement and transmit the information to the computer via the cord of the mouse.

The newer optical mouse does not use a rolling ball, but instead uses a light and a small optical sensor to detect the motion of the mouse by tracking a tiny image of the desk surface. Optical mice avoid the problem of a dirty mouse ball, which causes regular mice to roll unsmoothly if the mouse ball and internal rollers are not cleaned frequently.

A cordless or wireless mouse communicates with the computer via radio waves (often using *BlueTooth* hardware and protocol) so that a cord is not needed (but such mice need internal batteries).

A mouse also includes one or more buttons (and possibly a scroll wheel) to allow users to interact with the GUI. The traditional PC mouse has two buttons, while the traditional Macintosh mouse has one button. On either type of computer you can also use mice with three or more buttons and a small scroll wheel (which can also usually be clicked like a button).

The mouse is a small device used to point to a particular place on the screen and select in order to perform one or more actions. It can be used to select menu commands, size windows, start programs etc.

The most conventional kind of mouse has two buttons on top: the left one being used most frequently.

### **Mouse Actions**

**Left Click:** Used to select an item.

**Double Click:** Used to start a program or open a file.

**Right Click:** Usually used to display a set of commands.

**Drag and Drop:** It allows you to select and move an item from one location to another. To achieve this place the cursor over an item on the screen, click the left mouse button and while holding the button down move the cursor to where you want to place the item, and then release it.



Two-button mouse with scroll wheel



Wireless Macintosh mouse

#### 4. Touch pad

Most laptop computers today have a touch pad pointing device. You move the on-screen cursor by sliding your finger along the surface of the touch pad. The buttons are located below the pad, but most touch pads allow you to perform “mouse clicks” by tapping on the pad itself.

Touch pads have the advantage over mice that they take up much less room to use. They have the advantage over trackballs (which were used on early laptops) that there are no moving parts to get dirty and result in jumpy cursor control.

#### 5. Track point

Some sub-notebook computers (such as the IBM ThinkPad), which lack room for even a touch pad, incorporate a track point, a small rubber projection embedded between the keys of the keyboard. The track point acts like a little joystick that can be used to control the position of the on-screen cursor.



Track point

#### 6. Trackball

The trackball is sort of like an upside-down mouse, with the ball located on top. You use your fingers to roll the trackball, and internal rollers (similar to what’s inside a mouse) sense the motion which is transmitted to the computer. Trackballs have the advantage over mice in that the body of the trackball remains stationary on your desk, so you don’t need as much room to use the trackball. Early laptop computers often used trackballs (before superior touch pads came along).

Trackballs have traditionally had the same problem as mice: dirty rollers can make their cursor control jumpy and unsmooth. But there are modern optical trackballs that don’t have this problem because their designs eliminate the rollers.

#### 7. Touch screen

Some computers, especially small hand-held PDAs, have touch sensitive display screens. The user can make choices and press button images on the screen. You often use a stylus, which you hold like a pen, to “write” on the surface of a small touch screen.

#### 8. Digital camera

A digital camera can store many more pictures than an ordinary camera. Pictures taken using a digital camera are stored inside its memory and can be transferred to a computer by connecting the camera to it. A digital camera takes pictures by converting the light passing through the lens at the front into a digital image.

## 9. The Speech Input Device

The “Microphones - Speech Recognition” is a speech Input device. To operate it we require using a microphone to talk to the computer. Also we need to add a sound card to the computer. The Sound card digitizes audio input into 0/1s .A speech recognition program can process the input and convert it into machine-recognized commands or input.

## 10. Graphics tablet

A graphics tablet consists of an electronic writing area and a special “pen” that works with it. Graphics tablets allow artists to create graphical images with motions and actions similar to using more traditional drawing tools. The pen of the graphics tablet is pressure sensitive, so pressing harder or softer can result in brush strokes of different width (in an appropriate graphics program).



Graphics tablet.

## 11. Scanners

A scanner is a device that images a printed page or graphic by digitizing it, producing an image made of tiny pixels of different brightness and color values which are represented numerically and sent to the computer. Scanners scan graphics, but they can also scan pages of text which are then run through OCR (Optical Character Recognition) software that identifies the individual letter shapes and creates a text file of the page's contents.

In fact, one needs a number of software:

- Driver Software – Used to control the scanner hardware.
- Photo Editing Software – Used to edit scanned photos before being stored, printed or used in projects or websites.
- Optical Character Recognition Software (OCR) – When a printed document is scanned, normally this is stored as an image and thus the OCR is used to convert this picture to word processing format for editing.

## 12. Microphone

A microphone can be attached to a computer to record sound (usually through a sound card input or circuitry built into the motherboard). The sound is digitized—turned into numbers that represent the original analog sound waves—and stored in the computer to later processing and playback.

## 13. MIDI Devices

MIDI (Musical Instrument Digital Interface) is a system designed to transmit information between electronic musical instruments. A MIDI musical keyboard can be attached to a computer and allow a performer to play music that is captured by the computer system as a sequence of notes with the associated timing (instead of recording digitized sound waves).

**1 page 9 from PDF files “Form32011.pdf”**

## Output Devices

### 1. COMPUTER MONITORS/DISPLAYS

The computer monitor, like a television, displays computer output for a user to view. The monitor has various names: screen or video display unit. When purchasing a computer monitor, the following features are important:

1. Colour
2. Size
3. Resolution
4. Refresh Rate
5. Technology

### **Colour**

Monitors can be monochrome, grey scale or coloured. Monochrome monitors display images in two colours one for the background and the other for the foreground. The colours can be white, green, or amber foreground on black background. Greyscale monitors are a special type of monitor that displays information in different shades of grey. Colour monitors can display anywhere from sixteen colours on the case of CGA and over sixteen million in the case of SVGA

monitors. The more colours, the better the quality of the pictures displayed. The number of colours available depends on the video card used and how much memory is devoted to the display. It takes 8 bits to describe 1 pixel when using 16 million colours. Video cards now come with extra memory chips on them to alleviate the problem of insufficient memory.

### **Size**

Monitors come in various sizes: 14", 15", 17", 20" and even larger monitors can be had at higher prices. A 15" monitor can display 800 pixels horizontally and 600 pixels vertically. A pixel, short for picture element, refers to the dots that make up the pictures displayed on the screen. The more pixels per inch, the better the quality of the picture. One measure of this is the dot pitch, the distance between dots. A 20" monitor can display 1280 x 1024 pixels.

### **Resolution**

One way of measuring the quality of a monitor is by its resolution. The resolution of a screen is a measure of how accurately data can be represented on it. Screens are usually Low Resolution, Medium Resolution or High Resolution.

### **Resolution types include:**

1. CGA – Colour Graphics Adapter which has a resolution of 320 x 200.
2. EGA – Extended Graphics Adapter which has a resolution of 640 x 350
3. VGA – Video Graphics Adapter which has a resolution of 640 x 480
4. SVGA – Super VGA which has resolutions of 800 x 600, 1024 x 768 or 1280 x 1024.

### **Refresh Rate**

The refresh rate of a monitor is how often, the images on the screen are redrawn. If the rate is low, the picture will appear to flicker. Flickering on the screen can affect the eye. 60 times per second is tolerable at low resolutions for some people. 75 times per second is better and is necessary for high resolution.

### **Technology**

The two most popular technology used for computer displays are:

1. Cathode Ray Tube (CRT)
2. Liquid Crystal Display (LCD)

### **CRT Technology**

CRT technology uses electron guns that must be at distances of over one foot from the screen. The inside surface of the screen is coated with dots of phosphors which glow when a stream of electrons

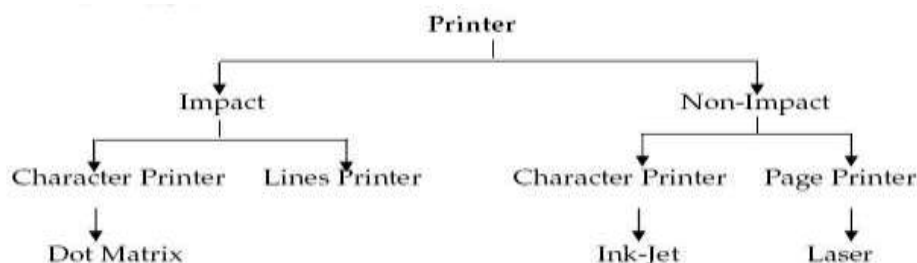
from the electron gun strike them. These dots are in groups of three red, green and blue. Three electron guns are used to set the dots glowing and the human eyes blend the dots that are glowing to create all the colors. CRT technology is used with computer systems that are not frequently moved from one place to another. CRT monitors are heavy and use more electrical power than flat panel displays, but they are preferred by some graphic artists for their accurate color rendition, and preferred by some gamers for faster response to rapidly changing graphics. Computers that used this technology include: desktop computers, minicomputers, mainframes, and supercomputers.

### Flat Panel Display

The technology used for CRT display tends to be bulky in size and hence, difficult to move around. Therefore in order to create small portable computers, flat panel display technology is used. Flat panel screens include:

1. **Liquid Crystal Display (LCD):** the most popular current technology for flat-screen display is liquid crystal display (LCD) used for pocket calculators and digital watches. LCD consists of liquid crystal material between two glass plates. Characters are etched on to the inner sheet but cannot be seen. The user can see them on the outer sheet only when a current is passed through them. Flat panel displays are much lighter and less bulky than CRT monitors, and they consume much less power. The display size of a flat panel is expressed in inches, and the resolution is the number of pixels horizontally and vertically on the display. LCD screens have a transparent thin film transistor (TFT) controlling each pixel, so response, contrast, and viewing angle are much improved.
  2. **Electroluminescent Display (ELD):** images of yellow and orange dots.
  3. **Plasma Display:** neon gas that glows orange. Used in mainframe terminal screens and some touch-sensitive screen.
2. **Terminal:** A terminal is an integration of a VDU with a keyboard. There are two types of terminals, namely INTELLIGENT TERMINALS (having a CPU) AND DUMB TERMINALS (no CPU)
- Intelligent terminals can do some local processing of data and then communicate with a main computer just to relay the results
  - In a dumb terminal, all processing must be done through the main computing system

### 3. Printer



A **printer** is an electromechanical device which converts the text and graphical documents from electronic form to the physical form. They are the external peripheral devices which are connected with the computers or laptops through a cable or wirelessly to receive input data and print them on the papers.

Quality of printers is identified by its features like color quality, speed of printing, resolution etc. Print resolution is measured in terms of number of dots per inch (dpi). Print speed is measured in terms of number of characters printed in a unit of time and is represented as characters-per-second (cps), lines-per-minute (lpm), or pages-per-minute (ppm).

Based on the technology used, they can be classified as Impact or Non-impact printers.

**Impact printers** use the typewriting printing mechanism wherein a hammer strikes the paper through a ribbon in order to produce output. Dot-matrix and Character printers fall under this category.

**Non-impact printers** do not touch the paper while printing. They use chemical, heat or electrical signals to touch the symbols on paper. Inkjet, DeskJet, Laser, Thermal printers fall under this category of printers. They are faster and quieter than impact printers because they have fewer moving parts. Nonimpact printers form characters and images without direct physical contact between the printing mechanism and the paper.

**Printer Characteristics**

Printers are also classified by the following characteristics:

1. **Quality of type:** The output produced by printers is said to be either *letter quality* (as good as a typewriter), *near letter quality*, or *draft quality*. Only daisy-wheel, ink-jet, and laser printers produce letter-quality type. Some dot-matrix printers claim letter-quality print, but if you look closely, you can see the difference.
2. **Speed:** Measured in characters per second (cps) or pages per minute(ppm), the speed of printers varies widely. Daisy-wheel printers tend to be the slowest, printing about 30 cps. Line printers are fastest (up to 3,000 lines per minute). Dot-matrix printers can print up to 500 cps, and laser printers range from about 4 to 20 text pages per minute.
3. **Impact or non-impact:** Impact printers include all printers that work by striking an ink ribbon. Daisy-wheel, dot-matrix, and line printers are impact printers. Non-impact printers include laser printers and ink-jet printers. The important difference between impact and non-impact printers is that impact printers are much noisier.
4. **Graphics:** Some printers (daisy-wheel and line printers) can print only text. Other printers can print both text and graphics.
5. **Fonts :** Some printers, notably dot-matrix printers, are limited to one or a few fonts. In contrast, laser and ink-jet printers are capable of printing an almost unlimited variety of fonts. Daisy-wheel printers can also print different fonts, but you need to change the daisy wheel, making it difficult to mix fonts in the same document.

The difference between impact and non – impact printer is as follows:

Impact printer / Dot-matrix Printer	Non impact Printer / Laser Printer
1. It prints characters or images by striking print hammer or wheel against an inked ribbon.	1. It prints characters and images without striking the papers.
2. Its speed is slower.	2. Its speed is faster.
3. Its printing quality is lower.	3. Its printing quality is higher.
4. It normally uses continuous paper sheet.	4. Its normally uses individual paper sheet.
5. It generates noise during printing.	5. It does not generate noise during printing.
6. It uses inked ribbon for printing.	6. It uses toner or cartridge for painting.
7. It is less expensive.	7. It is more expensive.
8. Dot matrix is an impact printer.	8. Laser printer is a non-impact printer.

### **Benefits of Impact Printers**

The first is that since they use pressure to generate an image, they work with multipart forms that either have leaves of carbon paper or use carbon-imprinted paper.

The second is that since they print one line at a time instead of one page at a time, their paper feed mechanisms are designed to let them use continuous forms.

### **Benefits of Non-Impact Printers**

Non-impact printers have advanced to a point that they are better than impact printers at just about everything other than feeding continuous paper and working with multi-part forms. They have much higher resolutions since, instead of using metal pins, they can use drops of ink measured in toner particles measured in micrometers.

**Character Printer:** It prints only one character at a time. It has relatively slower speed. E.g. Dot matrix printers.

### **Dot Matrix Printer**

Dot-matrix technology uses a series or matrix of pins to create printed dots arranged to form characters on a piece of paper. Because the printing involves mechanical pressure, these printers can create carbon copies and carbonless copies.

Dot-matrix printers are relatively expensive and do not produce high-quality output. However, they can print to multi-page forms. There is a carbon between the pins & the paper. The words get printed on the paper when the pin strikes the carbon. There are generally 24 pins.

#### **Dot-matrix printers have 3 important characteristics:**

**Speed:** Given in **characters per second (cps)**, the speed can vary from about 50 to over 500 cps. Most dot-matrix printers offer different speeds depending on the quality of print desired.

**Print quality:** Determined by the number of pins (the mechanisms that print the dots), it can vary from **9, 18 or 24 pins**. The best dot-matrix printers (24 pins) can produce near letter-quality type, although you can still see a difference if you look closely.

**Ink:** Dot Matrix Printer use **ribbon** for ink.

In addition to these characteristics, you should also consider the noise factor. Compared to laser and ink-jet printers, dot-matrix printers are notorious for making a lot of noise.

#### **Advantages:**

1. They can print on multi-part stationary or make carbon copies
2. Low printing cost
3. They can bear environmental conditions.
4. Long life

#### **Disadvantage**

1. Noise
2. Low resolution
3. Very limiter Color performance
4. Low speed

### **Impact Printer**

#### **Line Printer**

A **high-speed printer capable of printing an entire line at one time**. A fast line printer can print as many as **3,000 lines per minute**.



The disadvantages of line printers are that they **cannot print graphics**, the **print quality is low**, and they are **very noisy**.

As the name suggests these type of printers will print one whole document line at one go. There are two basic types of line printers:

1. **Barrel Printers** – This printer has a number of disks each containing all the letters and numbers. These disks are situated one near each other on a shaft and can rotate independently from each other. Lines are written by revolving each disk in the correct position in order to form a complete line. A row of hammers will strike the ribbon and papers.
2. **Chain Printers** – All the alphabet and numbers are imprinted on a chain. In order to write on paper, a hammer will strike the right characters to print.

### **Daisy-Wheel Printer**

A daisy-wheel printer works on the same principle as a **ball-head typewriter**. The daisy wheel is a **disk made of plastic or metal** on which characters stand out in relief along the outer edge. To print a character, the printer rotates the disk until the desired letter is facing the paper. Then a **hammer strikes the disk**, forcing the character to hit an ink ribbon, leaving an impression of the character on the paper. We can change the daisy wheel to print **different fonts**.

Daisy-wheel printers **cannot print graphics**; they are also **noisy and slow**, printing from **10 to 75 characters per second**. Daisy-wheel printers have become obsolete.

### **Nonimpact Printers**

#### **Ink Jet Printers**

These printers form the image on the page by spraying tiny droplets of ink from the print head. The printer needs several colors of ink (cyan, yellow, magenta, and black) to make color images. Some photo-quality ink jet printers have more colors of ink.

Ink jet printers are inexpensive, but the cost of consumables (ink cartridges and special paper) makes them costly to operate in the long run for many purposes.

They are slower and print in a somewhat lower **resolution (300-720 dpi)** than laser printers. Some new, expensive ink-jet printers print up **1200 or 1400 dpi**. High resolution output requires the use of special coated paper, which costs more regular paper.

#### **Advantages:**

1. Low printer cost
2. Compact size
3. Low noise
4. No warm up time compare to laser printer

#### **Disadvantage**

1. The ink is often very expensive (for a typical OEM cartridge cost RM70 for 16ml, RM4375 per liter)
2. Lifetime of inkjet prints produced by inkjet printer is limited. They will eventually fade and the color balance may change.
3. Easy get “blur” if get water drop.
4. Easy to get clogging on inkjet nozzles.
5. Must print it once every few days. Make sure print head won’t dried up.

#### **Laser Printers:**

Laser printing is the most advance technology. In Laser printing, a computer sends data to the printer. Printer translates this data into printable image data. This kind of printers uses xerographic principle. A laser beam discharges photo sensitive drum. A Latent Image is created on drum; during

development process toner is attracted to the drum surface and then transferred to the paper. Its consumable called toner cartridge or laser toner.

Most laser printers are monochrome (one color only, usually black), but more expensive laser printers with multiple color toner cartridges can produce color output.

Laser printers are faster than ink jet printers. Their speed is rated in pages per minute (ppm). They are more expensive than ink jets, but they are cheaper to run in the long term if you just need good quality black & white pages.

**Advantages:**

1. Low cost per page. Compare to inkjet printer
2. Low noise
3. High speed
4. High printing quality

**Disadvantage**

1. Laser printers are more expensive, but getting more affordable these year. (Now can get RM for mono laser printer, below RM 600 for color laser printer)
2. Their sizes are generally larger.

**4. Plotter**

Plotters basically draw an image using a series of straight lines. This device is used with engineering applications. Drum plotter uses a drum, on which the paper gets wrapped. The plotter pen moves across the drum to produce plots. The other type of plotter is the flatbed plotter. The paper is placed on the bed and graphics are drawn on it. This kind of plotter is used for larger drawings.

- The plotter is a computer printer for printing vector graphics
- Plotters are used in applications such as computer - aided design such as diagrams, layouts, specification sheets and banners
- The plotter is capable of producing color drawings in a matter of minutes
- Plotters differ from printers in that they draw lines using a pen
- Plotters are considerably more expensive than printers

Computer Aided Engineering (CAE) applications like CAD (Computer Aided Design) and CAM (Computer Aided Manufacturing) are typical usage areas for plotters.

**5. Sound Output**

Computers also produce sound output, ranging from simple beeps alerting the user, to impressive game sound effects, to concert quality music. The circuitry to produce sound may be included on the motherboard, but high quality audio output from a PC usually requires a sound card in one of the expansion slots, connected to a set of good quality external speakers or headphones.

Multimedia is a term describing computer output that includes sound, text, graphics, movies, and animation. A sound card is an example of a multimedia output device (as is a monitor that can display graphics).

**Audio Output: Sound Cards and Speakers:**

The Audio output is the ability of the computer to output sound. Two components are needed: Sound card – Plays contents of digitized recordings, Speakers – Attached to sound card.

**6. Computer Output Microfilm**

Com is a system that converts stored data directly to microfilm or microfiche. It was used in 1960s still used today mostly organization who need to store payroll accounting, insurance, inventory or employee data. Computerized system that converts online or stored data directly into microfilm as images for archiving.

Computer output microfilm or "COM" is a process for copying and printing data onto microfilm from electronic media found on personal, mini, or mainframe computers.

COM consists of:

- 1) A high-speed recorder that transfers digital data onto microfilm using laser technology; and
- 2) A processor that develops the microfilm once exposed to a light source.
- 3) A COM recorder can operate “on-line” or “off-line,” meaning that it can be connected to a single computer, a local or wide-area network, a minicomputer, or a mainframe computer. In addition, the recorder can operate independently as a stand-alone device that reads digital data from formatted magnetic media, such as tape.

A COM recorder generally operates with:

- 1) A duplicator that generates copies of microfiche; and
- 2) A sorter that separates duplicate microfiche cards into bins for easy, end-point distribution. Each functional unit is connected to the next, providing a linear path from creation to end-point distribution of the microfiche.

## 7. Projectors

It is a hardware device with which an image and text is projected onto a flat screen. Image data is sent to the video card by the computer which is then translated into a video image and sent to the projector. A projector is often used in meetings or to make presentations as it allows the display to be visible to a larger audience.

### Types of projector

1. Cathode Ray Tube (CRT) projector
2. Liquid Crystal Display (LCD) projector
3. Digital Light Processing (DLP) projector

### Cathode Ray Tube (CRT) projector

1. In the early days of projectors, CRT projectors were commonly used.
2. They utilized three tubes, one for each of the primary colors.
3. Due to their large size, low light output and the frequent need to converge and align the images projected from each of the three tubes, they are no longer commonly used.
4. Long service life; CRT tubes maintain good brightness to 10,000 hours.
5. CRT projectors are both considerably larger and heavier than comparable LCD and DLP projectors.
6. CRT projectors require far more time to set up and adjust than LCD and DLP based projectors.

### Liquid Crystal Display (LCD) projector

1. LCD projectors work by utilizing polarized mirrors that pass and reflect only certain colors of light.
2. This causes each channel of red, green and blue to be separated and later re - converged via a prism after passing through an LCD panel that controls the intensity and saturation of each color.
3. An LCD projector can achieve greater brightness at a lower energy consumption
4. Smaller than CRT projectors

### Digital Light Processing (DLP) projector

- DLP projectors can be classified as one - chip or three - chip.
- One - chip DLP projectors can produce more than 16 million colors while three - chip models can produce more than 35 trillion colors.
- This allows DLP projectors to reproduce more natural and lifelike images.

1 page 20 from PDF files “Form32011.pdf”

**UNIT- II**

**Computer System:** Central processing unit (CPU), memory, instruction format, instruction set.

**Primary and Secondary Memory:** Memory hierarchy, random access memory (RAM), types of RAM, read only memory (ROM), types of ROM. Classification of secondary storage devices, magnetic tape, magnetic disk, optical disk.

**Number Systems:** Number systems, conversion between number bases.

**Organization of a computer system.**

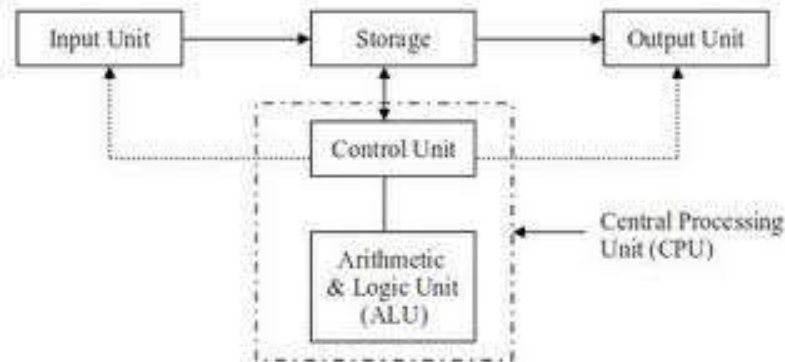
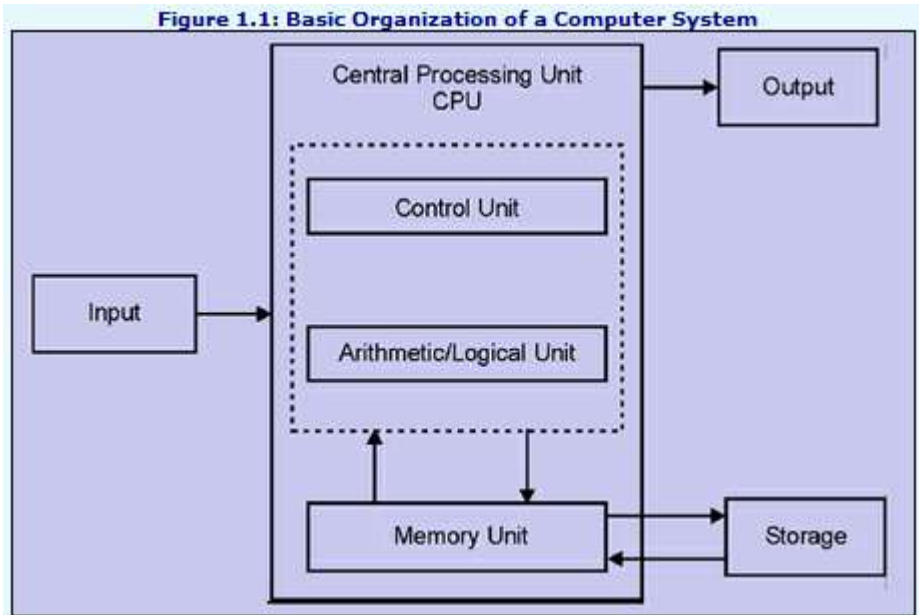


Figure 1.1: Basic Organization of a Computer System



In figure – solid lines indicate flow of instruction and dotted lines – control execution.

1. **INPUT** :- Input unit provide the way for interaction between user and computer Functions of Input units are:-
  - a. It accesses the list of instructions and data from outside world.
  - b. It converts these instructions and data in computer acceptable form.
  - c. It supplies converted instruction and data to computer (CPU) for further processing.

## BCA I Fundamental of Computers

2. **OUTPUT:** - Output units is linked the computer with the external environmental. Output interfaces are designed to match the unique physical or electrical characteristics of Output devices. Output can be in the form of a temporary display on the monitor or a print out through a printer.

### Functions of Output unit are-

- It accepts the results produced by the computer which are in coded form and hence cannot be easily understood by us.
- It converts these coded results to human acceptable (readable) form.
- It supplies the converted results to the outside world.

**CPU:** - CPU is the Brain of a computer. It is the part of computer which controls the interpretation and execution of instruction. It also controls the operation of computer and performs processing functions. Every program to be executed consists of a set of instructions stored in memory of CPU sequentially executes instructions specified in a program. CPU is responsible for activation and controlling the operation of other units of computer system.

CU and ALU are together known as CPU. It is a brain of a computer system which takes before all major calculation and comparison that take place inside the CPU.

### Functions of CPU are:-

- It coordinates entire computer system.
- Internal data movement (moving data between various parts of storage.)
- Data manipulation (Accept, sort, process then generating the required information)
- Arithmetic and Logical operations.
- It obtains instruction from program stored in main memory, interpret (to compile line by line) instruction and issues signals that causes other units of system to executes them.

### Components of CPU:-

- Control units (CU)**
- Arithmetic Logical units (ALU)**
- Registers/ Memory Unit**

**Control units:** - It acts as a central nervous system for other components of computer system manages and coordinates the entire computer system. It obtain and stored in main memory interprets the issue signals causing other units of the system to execute them.

It maintains order and directly the operation of entire system it coordinates the operations of H/W. it also coordinates the flow of data and instruction that are fed into the main via CPU.

### Function of control units are:-

- To access and store relevant data and instruction during processing
  - To control the sequence of operations.
  - Ti give commands to all parts of computer
  - To coordinates actions of all parts of computer
  - To carry out processing.
  - It also control signals between the CPU and the Input devices.
  - It determines the movements of electronic signals between the main and the ALU.
  - Instruction can be converted by a lang processor into a low level form of instruction
  - The computer can work with machine lang. Data and instruction are represented in binary form (0 and 1)
  - It fetches the instruction and data from the main unit, decodes them and sends them to the ALU. The O/P from the ALU is fetched by the control units and sent to various parts.
- ALU:** - This unit is responsible for execution of all instructions taking place. Data and information are stored in primary storage and accessed or transferred to ALU when required. Intermediate results

## BCA I Fundamental of Computers

generated in ALU are transferred to storage device and retrieved when needed. ALU perform +, -, %, \*, <, > and logic operations (AND, OR, NOT). Its functioning is based on fetch-execution cycle. Load, store, Move is the most commonly use commands. No processing is done in the primary storage units. Intermediate results generated n the ALU are temporarily transferred back to the primary storage until needed at a later time. After the completion of processing , the final results which are stored in the storage units are released to an output device.

- a. Fetching
- b. Decoding: - CPU already had done this work Executing, Storing.

When entire CPU (CU and ALU) is contained on a single tiny silicon chip, it is called a microprocessor.

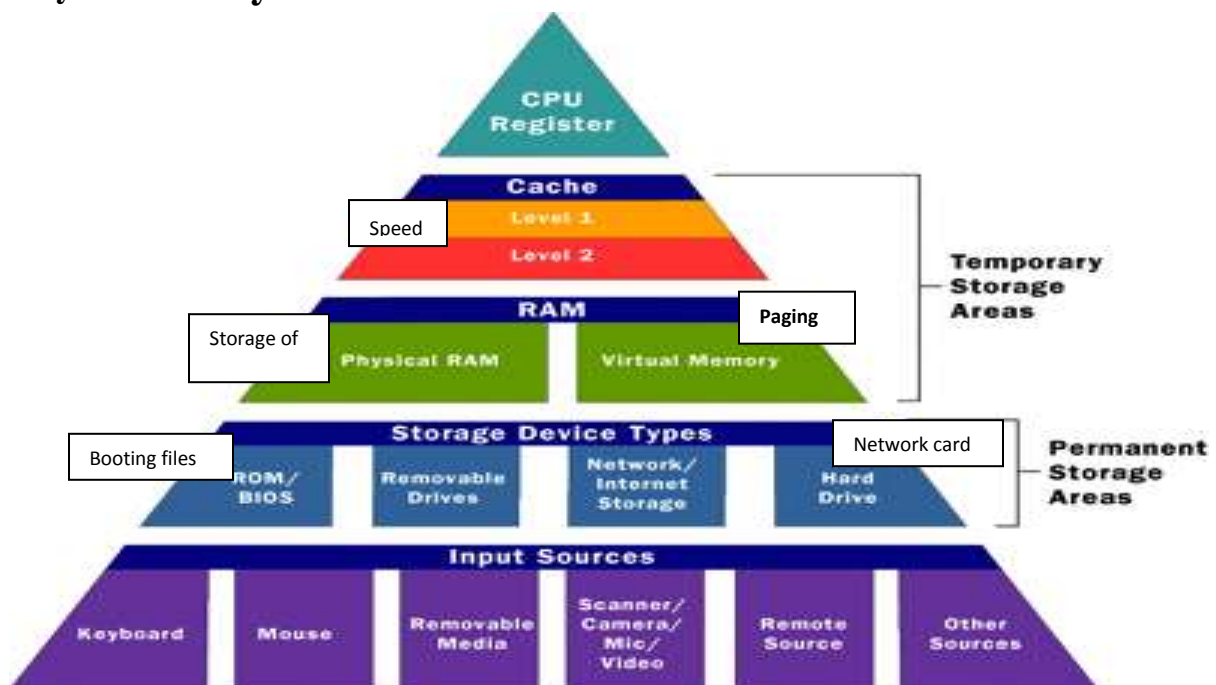
### c. Registers: Temporary Storage Areas

Registers are temporary storage areas for instructions or data. They are not a part of memory; rather they are special additional storage locations that offer the advantage of speed. Registers work under the direction of the control unit to accept, hold, and transfer instructions or data and perform arithmetic or logical comparisons at high speed. The control unit uses a data storage register the way a store owner uses a cash register-as a temporary, convenient place to store what is used in transactions.

Computers usually assign special roles to certain registers, including these registers:

- **An accumulator**, which collects the result of computations.
- **An address register**, which keeps track of where a given instruction or piece of data is stored in memory. Each storage location in memory is identified by an address, just as each house on a street has an address.
- **A storage register**, which temporarily holds data taken from or about to be sent to memory.
- A general-purpose **register**, which is used for several functions.
  - Holds address of the active memory location
  - Holds information on its way to and from memory.
  - Holds address of the next instruction to be executed.
  - Accumulates results and data to be operated upon.
  - Holds an instruction while it is being executed.
  - Communicates with I/O devices.

## Memory: - Memory Architecture



## Memory means

**Based on a Layman:** - Memory is the mental faculty of retaining and recalling past experience based on the mental processors of learning, retention, recall and recognition.

**Based on IT:** - The term *memory* identifies data storage that comes in the form of chips, and the word *storage* is used for memory that exists on tapes or disks. Memory is an electronic device.

The memory of a computer is a place where data and instruction are stored. The capacity of the computer depends upon the parts.

1. The storage capacity
2. The processing speed of the processor.

Memory usually refers to a form of solid state storage known as RAM & sometimes other form of last but temporary storage.

## Types of memory

- **Volatile memory:** it requires constant power to maintain the stored information .volatile memory is typically used only for primary storage.
- **Non-volatile memory:** it will retain the stored information even if it is not constantly supplied with electric power. It is suitable for long term storage for information & therefore used for secondary tertiary & off-line storage.
- **Dynamic memory:** dynamic memory is volatile memory which also requires that stored information is periodically refreshed or read & rewritten without modification.

## Advantage of storage device:

- It is economical as it takes up far less space than paper document.
- It is secured as by using the storage controls. We can save our data from unauthorized user.
- It is almost unlimited as there is virtually no limit to the amount of data to be stored.

## Storage devices are divided into 2 parts:-

- Primary Storage Device
- Secondary Storage Device

1. **Primary storage device:** it also called main memory. It works with the C.P.U. to hold instructions' and data in order to be processed. Primary storage is considered as volatile form of storage means, it hold data temporarily because it requires a continuous flow of electrical current. If current is interrupted, data is lost. They are two types:-

- 1) RAM
- 2) ROM

Primary storage may include several types of storage such as main storage, cache memory and special registers, all of which can be accessed randomly, that is, accessing any location in storage at any moment takes the same amount of time.

## RAM

RAM can be erased and written over it by the user. RAM refers to storage formats and equipment that allow the stored data to be accessed in any order- that is, random not in sequence. Some RAM chips maintain data indefinitely without electrical power. RAM devices are not limited to memory chips, as a storage format is not limited to use as working memory. Most RAM can be both written to and read from, so often used interchangeably with "read write memory".

**RAM manufacturers:** - Corsair memory, crucial technology, GEIL, G.skill, Hynix , Infineon technologies, micron technology, mushkin, OCZ Technology, Samsung, simple technology, Kingston technology.

### RAM features

1. It can receive and use much larger programs.
2. It can hold copies of more than one program in the main memory to supports the computer by more than one user at a time.
3. It can operate faster and more efficiently.
4. It will be able to use new sophisticated S/W.
5. It can hold image for creating graphics and animation.
6. Can work with and manipulate more data,
7. Very expensive.
8. RAM comes in very small capacity as compared to secondary storage media.
9. RAM is volatile, so data on RAM should be saved on secondary storage.
10. The CPU uses it to hold the O.S., active application and many open files.
11. Major support of RAM is swiftness, when you open a S/W program or enter data into your computer, you are placing this information on RAM. CPU constantly up dates the RAM with new information.

There are two types of RAM

1. **Static RAM (SRAM) :-** (More expensive consume more power than the RAM .use 6 transistors per bit 6 times larger than the RAM) This RAM will maintain its data as long as power is provided to the memory Chips. It does not need to be re-written periodically. In fact, the only time the data on the memory is refreshed or changed is when an actual write command is executed. SRAM is very fast, but is much more expensive than the RAM. SRAM is often used as cache memory due to its speed. SRAM store bits (1's or 0's) in memory cells that are basically flip- flops- a SRAM is a type of semiconductor memory. SRAM stores its data in capacitors. It does not require constant recharging to retain their data, this type of Ram is faster than DRAM. Speed is approx 8ns to 30ns as opposed to 60 ns to 80 ns from DRAM.

### There are few types of SRAM

- a. **Asynchronous SRAM:** - An older type of SRAM used in many pc's outdated for L2 cache. It is asynchronous, meaning that it works independently of the system clocks. This means that the CPU found itself waiting for information from the L2 cache.
  - b. **Synchronous SRAM:** - Synchronous means it is synchronized with the system clocks. While this speeds it up, it makes it rather expensive at the same time.
  - c. **Pipeline burst SRAM:** - commonly used. SRAM requests are pipelined meaning larger packets of data resent to the memory at once, and acted on very quickly. This breed of SRAM can operate at bus speeds higher than 66 MHz so is often used.
2. **Dynamic RAM (DRAM) -** DRAM, unlike SRAM, must be continually re-written in order for it to maintain its data. This is done by placing the data several hundred times per second. DRAM is used for most system memory. Because it is cheap and small. The now of electrically charged points in which a computer stores quickly accessible data in the form of 0 and 1.

### There are few types of DRAM

- a. **FPM:** - Fast page mode DRAM introduced in 1987. FPM DRAM is only slightly faster than regular DRAM FPM RAM was the main type used in pc's : it was slow to work on the 66 MHz system bus. For this reason, FPM RAM was replaced by EDO DRAM . FPM RAM is not much used today due to its slow speed, but is almost universally supported.
- b. **EDO DRAM:** - Extended data out DRAM. EDO is similar to FPM; with it have the additional feature that a new access cycle can be started while keeping the data O/P of the previous cycle active. This allows a certain amount of overlap in operation (pipelining), allowing some what improved speed. EDO must be supported by the chipset. EDO comes on a SIMM. EDO cannot operate on a bus speed faster than 66 MHz so with the increasing use of higher bus speeds, EDO has taken the path of FPM.



- c. **BEDO DRAM:** - (Burst EDO) Bursting was the method devised. Each “Block” of data carried the memory address. BEDO RAM was an effort to make ED DRAM complete with SDRAM.
- d. **Synchronous DRAM (SDRAM):**- it synchronizes itself with the microprocessor clock speed allowing faster access to memory. These chips are mounted on DIMM and are classified according to the CPU speed they are designed to support.  
SDRAM was introduced in 1996, and by 2000 had replaced all other types of DRAM in modern computer because of its greater speed and much lower latency. It could operate at up to 100 MHz.
- e. **RD RAM ( RAM BUS DRAM) :-** successor to SDRAM
- f. **DDR-SDRAM (Double Data Rate):**- DDR shuffles data over the bus over both the rise and fall of the clocks cycle, effectively doubling the speed over that of standard SDRAM. DDR-DRAM is now the new standard in pc memory, with ever increasing speed support coming out, even so that it can complete quite well up against RAM BUS.  
**DDR2-SDRAM** Short for Double Data Rate Synchronous DRAM 2 is a type of DDR that supports higher speeds than its predecessor DDR SDRAM.  
**DDR3-SDRAM** Short for Double Data Rate Synchronous DRAM 3 is the newest type of DDR that supports the fastest speed of all the SDRAM memory
  - 184-pin-DIMMs, used for [DDR SDRAM](#)
  - 240-pin-DIMMs, used for [DDR2 SDRAM](#)
- g. **ESDRAM** – Enhanced SDRAM
- h. **SLDRAM** – Synchronous Link DRAM

### Ram Advantages

1. Silent – There are no moving parts. RAM operation is completely silent.
2. Power-Efficient – RAM uses much less power than Disk Drives. reduce your CO2 emissions (release) and extend battery life.
3. Fast – RAM is the fastest storage medium outside of the CPU.

### ROM

ROM stands for read only memory. It is present on mother board in the form of a chip, is also called a firm ware. It retains instruction in permanently accessible, non-volatile form. While the power computer is turned off, the instruction stored in ROM are not lost. Non-volatile chips always hold the same data. The data in them cannot be changed expect through a special process that over write the data. Putting data permanently into this kind of memory is called “Burning in the data”, and it is usually done at the manufacturing. (During normal use, the data in these chips is only read and used not changed, so the memory is called Read-only-memory.)

One important reason a computer needs ROM is that it must know what to do when the power is turned on. ROM contains a set of start-up instruction, which ensure that the rest of memory is functioning properly, checks for H/W devices and check for OS and computer disk drives.

### Features of ROM

1. ROM is non-volatile; its contents are not lost when power to the computer is turned off.
2. ROM chips contain data, instruction or information that is recorded permanently.
3. The data, instruction or information stored on ROM chips is recorded when the chips are manufactured.
4. Firm ware is ROM chips that contain permanently written data, instruction or information.
5. ROM chips are found almost every where in a computer system, from the BIOS to peripheral devices like printers and scanners. Each ROM chips contains exact instruction important to the operation of that particular part of the system.

### There are different types of ROM:-

1. **Programmable ROM (PROM):** - this is basically a blank ROM chips that can be written to, but only once. It is much like a CD-R drive that burns the data into the CD. Some companies use special machinery to write PROMs for special. In this memory user can prepare a microcode program with the

help of a facility known as PROM programmer, the user can store some special programs, once the information is recorded on PROM chips it cannot be changed.

2. **EPROM (Erasable PROM):-** this is just like PROM, except that we can erase the ROM by shining a special ultra-violet light through a sensor the ROM chip for a certain amount of time. Doing this wipes the data out allowing it to be rewritten. (Non volatile, can be programmed and reprogrammed by user, invariably byte organized) in this memory the information written can be erased using “ultra-violet rays”. After erasing the old programs, new programs can be written. The user cannot erase a particular part. The whole information present in the chips is lost when erased. The data which is of permanent nature and does not require frequent updating are stored in the EPROM chip. It is cheaper than PROM because it is reusable.
3. **Electrically EPROM (EEPROM):** - it also called flash BIOS. This ROM can be rewritten through the use of a special software program. Flash BIOS operates this way, allowing user to upgrade their BIOS. This is the earliest way of storing information in ROM. it does not require ultra violet rays to erase the information as in EPROM. it is most flexible ROM. So its information can be erased by using a high voltage current. (Versatile in nature) electrically erased and rewritten electrically.
4. **Electronically Alterable PROM (EAPROM):-** in this information can alter later. (In many sizes- up to 16 GB. Memory card). In which the contents of selected memory locations can be changed by applying suitable electric signals. EEPROM/EAPROM is more versatile. Individual cells can be reprogrammed by reversing the voltage used to create a zero. There are some timing constraints that cause the part to need more time for erasure or programming than is needed to read data from that part. Some EAPROM/EEPROM has a word or byte erase mode.

**Advantages of ROM**

1. They are non-volatile in nature.
2. ROM are easier to interface than RAM
3. ROM cannot be accidentally changed.
4. ROM are cheaper than RAM
5. ROM is easy to test.
6. These are more reliable than RAM due to their reduced complexity.
7. These are static and do not require refreshing.
8. It contents are always known and can be verified.

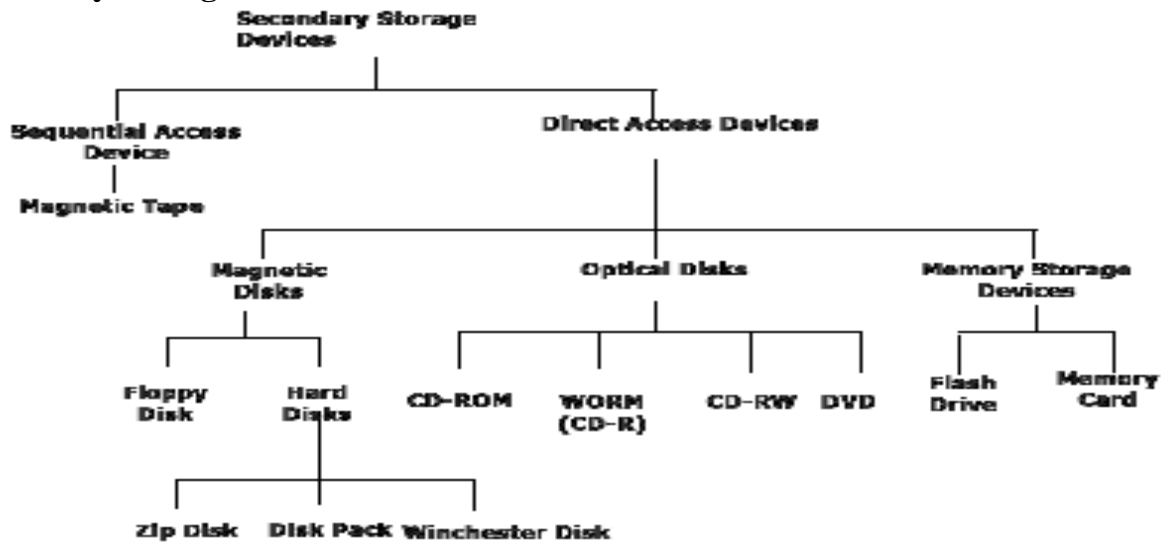
**Applications of ROM:-**

1. *Code converter:* - A ROM with N-bit MAR and M-bit MBR can realize any N-input and M output combination circuit.
2. *Character generator:* - character display in dot matrix form use ROM for decoding and activating the display.
3. *Function generator:-* tables for commonly used functions such as cosine, sine and tangent etc. may be stored in ROMs
4. *Control units design:* - ROMs are used in the design of control units of present day computer.

**Different between RAM and ROM**

		RAM	ROM
1.	Type	This is volatile by nature	This is non-volatile by nature.
2.	Price	It is more costly	It is less costly
3.	Size	RAM is small as compare to ROM	ROM is large as compare to RAM
4.	Reliability	RAM is not more reliable	More Reliable as compare to RAM.
5.	Lead Time	Lead time is not require	Lead time is requiring.
		Ram is temporary store of data	Rom is permanent store of data.
		Ram is primary storage of data	Rom is secondary storage of data
		Ram has small capacity of store data	Rom has high capacity of store data.

## Secondary Storage



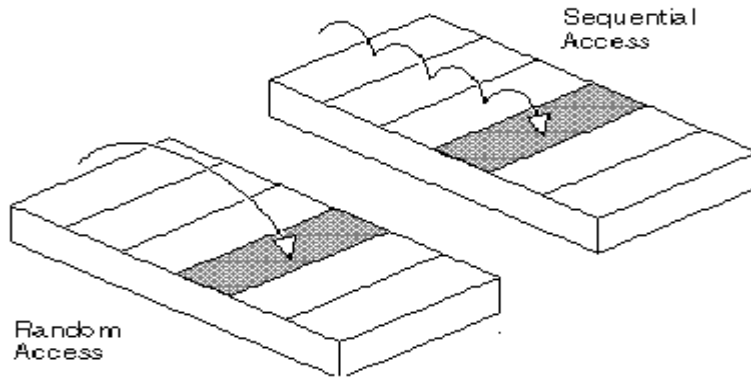
**Fig. 5.3 Secondary storage devices and their classification**

## Secondary Storage

1. **Storage** – is defined as all various media on which a computer can store programs and information.
2. **Secondary Storage** – is also called Auxiliary, backing or mass storage. It contains data, instructions and information for future use. It is permanent and non – volatile.

## The Criteria for rating Secondary Storage Devices are:

1. **Storage Capacity** – This is determined by the type of program or amount of data to be stored. It is a representative of the size of the memory. The capacity of internal memory and main memory can be expressed in terms of number of words or bytes.
2. **Access Speed** – This refers to the average time taken to locate data on a sec. storage device.
3. **Transfer Rate** – this refers to the speed and time taken for data to be transferred from a secondary device to main memory in order for the data to be executed (processed). The access time depends on the physical characteristics and access mode used for that device.
4. **Size** - this is determined by the expected amount of data to be stored.
5. **Cost** – this is directly related to the other 4 factors. E.g. “ floppy disk is cheaper than CD which is cheaper than a memory stick.”
6. Technology used to store data
7. Portability of storage device.



**Fig. 5.4 Shows methods of accessing from Sequential and Direct storage Device**

**Secondary Storage devices classified by Sequential and Random (Direct) Access Method**

1. **Sequential Access Storage** - Sequential access also known as serial access is a type of method of retrieving data from a storage device. With sequential access, the device must read or move through all information up to the point it is attempting to read or write. A tape drive is an example of a sequential access drive, where the drive must move the tape forward or backwards until it reaches its destination. (Refers to the way in which the data is retrieved i.e. sequentially)

**Magnetic Tape**- this storage medium that consists of a plastic ribbon that has been coated with material that can be magnetized to represent data. It is no longer widely used, expects for archival purposes, and was it keeps a backup of important data. A tape is divided into vertices columns called frames and horizontal rows called channels on tracks. Tapes had 7 bit tracks 6 bit BCD code format for data recording and one bit for parity.

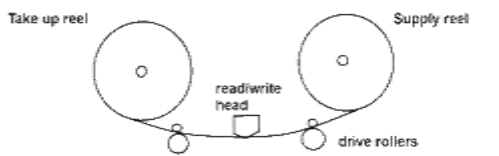


Figure 1: Tape Movement Mechanism

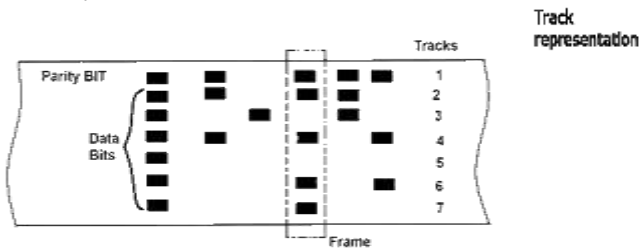


Figure 2: Data Arrangement on a Tape

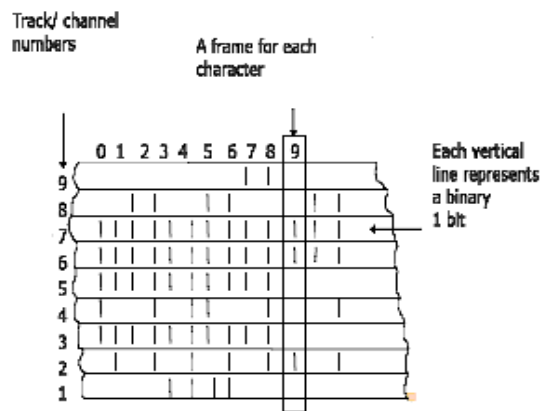


Figure 3: Shows the structure of binary 1 bit

**Fig. 5.10**

**Advantages**

1. Provides archival or backup storage
2. They are reusable, light, compact and easy to store on tracks
3. They are inexpensive
4. They can be used for large files or copying from disk files.

### Disadvantages

1. Allows only sequential data access
2. Stored data cannot be easily updated
3. They must be stored in a suitable environment, vulnerable humidity and dust.

2. **Direct Access Storage (Random)** – Means data can be located immediately without having to search consecutively through the storage medium. A direct access storage device is one in which any location in the device may be selected at random, access the information stored is direct i.e. no need of scanning a series of records and approximately equal access time is required for each location. Hard disk, optical disk are the examples of direct access storage device. (Used to retrieve the data i.e. magnetically or optically).

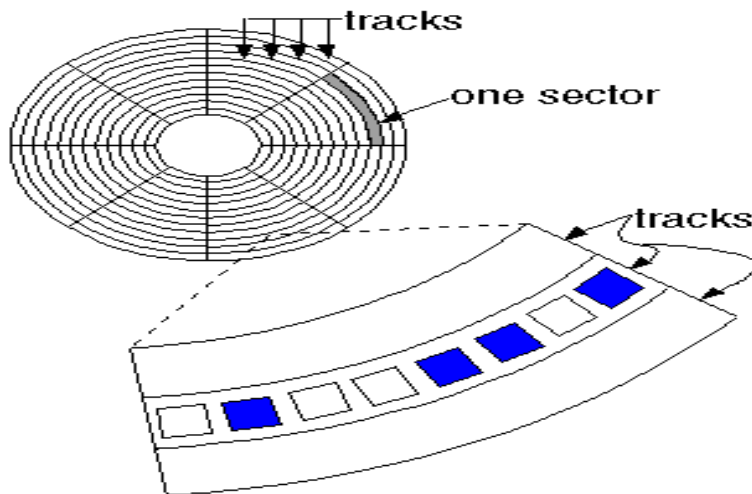
A. **Magnetic Media** –reads data from the storage medium by magnetizing the iron particles on the medium. It is also cheap.

B. **Optical Media** – uses high – powered laser beams to burn microscopic sports represented in a disk’s surface. It is expensive.

C. **Memory Storage Devices.**

**Magnetic Media** - Magnetic storage uses different patterns of magnetization in a magnetizable material to store data and is a form of non-volatile memory. A magnetic media consists of plastic or metal circular plate or platter. These platters are coated with magnetic oxide layer. Data is represented as magnetized spots on a disk. The information is accessed using one or more read/write heads. It stores data files that can be accessed later.

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The surface of a platter is organized as a number of concentric tracks. Each track is divided into sectors. The information held in one sector, a block, is the unit of transfer between the disk and primary memory. The operating system determines where the blocks for each file are placed. The time taken to access a particular block consists of:

1. Seek time-Time to move the heads to the right track.
2. The latency-Time waiting for the sector to come round to the head.
3. The block transfer time-Time to actually transfer the data.

The storage capacity of a disk is a multiple of the number of recording surfaces, number of tracks per surface, number of sector per track, and the number of bytes per sector. That is,  
Storage capacity of a disk system = Number of recording surfaces

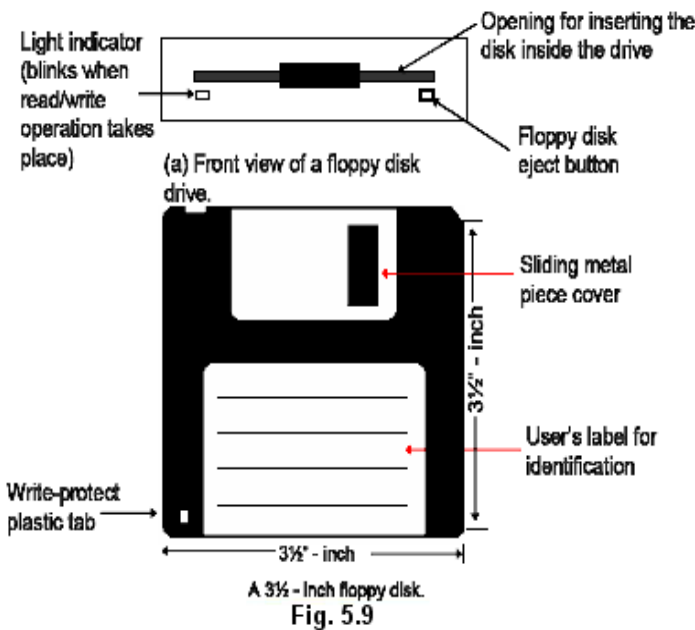
- Number of tracks per surfaces
- Number of sector per track
- Number of bytes per sector

**Floppy Disk-** It introduced by IBM in 1972. The diskette is a flexible magnetic disk on which data is recorded magnetically. The device is used to read data from a disk or record data on a disk is called a floppy device. A floppy disk is a flat, circular piece of flexible plastic coated with magnetic oxide. It is encased in a square plastic or vinyl jacket cover. A computer can have more than one floppy drive. The first floppy drive is labeled A, and if a second drive is present it is labeled B. The label C is reserved for the hard disk drive. These are slower to access than hard disks and have less storage capacity, but they are much less expensive. The disks are removable and reusable.

- Single sided single density
- Double sided double density

Floppies come in two basic sizes:

1. **5¼-inch:** This type of floppy is generally capable of storing between 100K and 1.2MB (megabytes) of data.
2. **3½-inch:** The most common sizes for PCs are 720K (double-density) and 1.44MB (high-density).



### Advantages

1. They allow to copy files from one computer to another
2. They are quite cheap
3. Widely used
4. Light/ weight portable
5. Provides random data access

### Disadvantages

1. They have a limited capacity ( graphics files often don't fit on a disk)
2. They are less care should be taken to prevent loss data
3. Vulnerable to dirt
4. Susceptible to viruses
5. Data access relatively slow
6. Data is easily damaged/corrupted

**Magnetic disk** – a magnetic disk is a thin circular plate / platter made of metal or plastic and coated on both sides with a recording material that can be magnetized such as iron oxide data are recorded on a disk in the form of tiny invisible magnetized and non magnetized spots on the coated surfaces of the disk. (8 bit EBCDIC). It can also be erased and reused indefinitely.

Storage capacity of disk system = number of recording surfaces

Number of tracks per surface

Number of sectors per track

Number of bytes per sector (usually 512 bytes)

Access time – disk access time is the interval between the time a computer makes a request for transfer of data from a disk system to primary storage and the time. This operation is completed.

1. Seek time – the time required to position the read/write head over the desired track/cylinder.
2. Latency – rotational waiting time, i.e. the time required to spin the desired sector under the head is called latency.
3. Transfer rate – it refers to the rate at which data is read from or written to disk.

**Hard Disk**- A hard disk is non- removable, enclosed magnetic disk drive that reads data from and writes data to hard disk. The disks inside the hard drive are called platters.

### Advantages

1. Stores and retrieves data at high speeds
2. More storage capacity than many other storage media
3. Storage is reliable
4. Provides random data access

### Disadvantages

1. Very delicate
2. Not portable – cannot be easily moved from place to place without complications
3. Head crash can occur

### Structure of a Hard Disk

1. **Track**- is a circular ring on one side of the disk. Each track has a number.
2. **Sector**- is a pack – shaped piece of a disk. Each sector is numbered.
3. **Track Sector**- is the area of intersection of a track and a sector. Data is recorded along a track within a sector.
4. **Cluster**- a set of track sectors ranging from 2 to 32 or more depending on the formatting scheme.
5. **Cylinder**- is a set of matching tracks in a vertical plane through a disk pack.
6. **Read/ Write Head**- a device that reads data from and writes data to a magnetic disk. For writing the surface of the disk is moved past the read/write head.

7. **Access Arm**- this is a mechanical arm that moves the read/write head across the surface of the disk. It is directed by the OS to move the read/write head to a specific track or the disk.

### Variations of Hard Disk

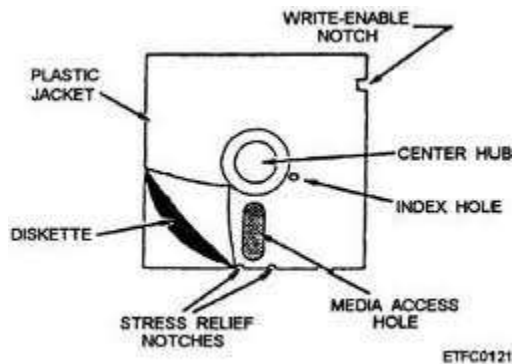
1. **Fixed Disk**- is a high speed, high capacity disk drive that is housed in their own cabinets. They are not removable or portable. They have greater capacity than the external disk and are more reliable.
2. **External Disk**- these are detachable which their own power supply and are not built into the system cabinet. They can store TB's of data.
3. **Fixed Head**- one read/ writes head per track with heads mounted on fixed arm.
4. **Moveable Head**- one read/write head per side with mounted on movable arm.

### Device Interface

1. SATA, SCSI, IDE, are all devices in the motherboard of a computer which provide an interface for devices such as internal hard disk. Drives and mass storage devices to connect to the computer.
2. **IDE** – Intelligent Drive Electronics or Integrated Drive Electronics. An IDE interface is an interface for mass storage in which the controller is integrated into the disk or CD – ROM drive.
3. **SATA** – Serial Advanced Technology Attachment. It is a computer bus primarily designed for transfer of data between a computer and mass storage devices such as hard disk drives and optical drives.
4. **SCSI** – Small Computer System Interface.

### Types of Hard Disk

- A. **Zip Disk** - single hard disk platter encased in plastic cartridge, size 3 1/2 inch, capacity 100 MB.



- A.
- B. **Disk Pack**
- C. **Winchester Disk**

### Optical Disks

**CD-ROM**- it stands for compact disk- read only memory. This optical disk's data is imprinted by the disk manufactures. The user cannot erase or change it or write on the disk. This type of disk is primarily used for making huge amount of prerecorded data. A CD-ROM can hold 650 Mb of data.



Storage disk whose data is imprinted by the disk manufacturer and cannot be altered or erased by the user. They are used primarily for multimedia data and has a storage capacity of 650 MB – 700 MB ( $\approx$  450 floppy disk)

**CD-R:** - stands for CD Reader. This device is used to read CD-ROM on a computer. It is very speedy and can read large amount of data. It uses a laser light head to read data from the disk. CD-R is a write once, read – only optical disc (the whole disk does not have to be written in the same session) and retains a high level of compatibility with standard CD readers.

**CD-RW:** – CD-Reader / writer. This device is used to do both reading data from the disk and writing data to the disk. It uses a laser light head to read and write data on the disk. It can erase a disk and rewrite the data to it. CD RW recorder can rewrite 700 MB of data to CD –RW and this disk can be written roughly 1000 times. The universal disk format 1.5 file systems allow CD-RWs to be randomly rewritten, but limits disc storage capacity to roughly 530 MB. This is an erasable, rewriteable optical disk. These allow the user to erase and alter the content many times.

### Advantages

1. Widely used
2. Stored more data in less space
3. Storage is extremely reliable
4. Very durable
5. Provides random data access
6. It is entirely unaffected by magnetic fields

### Disadvantages

1. Allows slower data access than a drive
2. It is not easy to copy on optical disk
3. Optical disk technology is expensive but prices are falling

**DVD** – also known as Digital Video Disc and even Digital Vapor Disc are identical in looks to a CD–ROM but are different in technology. DVD players use red laser CD–ROM uses infrared laser. Marks burned on a DVD are packed twice as tightly as that of a CD–ROM. Digital versatile disc or Digital video disc is an optical disc. Storage media format that can be used for data storage, DVD's resemble compact discs as their physical dimension are the same (120 mm in diameter) capacity up to 8.5 GB (DL--DUAL layer) per side but they recorded in a different format and at a much higher density.

**DVD–R** – DVD R is a DVD- recordable format. A DVD–R has a larger storage capacity than a CD-R, typically 4.7 GB (or 4.38 GB) instead of 700 MB. The capacity of the original standard was 3.95 GB (3.68GB). DVD-R can be written to only once.

### Advantages

1. They can store large amounts of data
2. They are dependable
3. Provides random data access

### Disadvantages

1. The drives are relatively expensive
2. They are not as widely used as the other storage Devices

### Instruction Set

The **instruction set**, also called **instruction set architecture (ISA)**, is a part of the computer that pertains to programming, which is basically machine language. The instruction set provides

commands to the processor, to tell it what it needs to do. The instruction set consists of multiple pieces, including addressing modes, instructions, native data types, registers, memory architecture, interrupt, and exception handling, and external I/O.

An instruction set can be built into the hardware of the processor, or it can be emulated in software, using an interpreter. The hardware design is more efficient and faster for running programs than the emulated software version.

**Examples of instruction set**

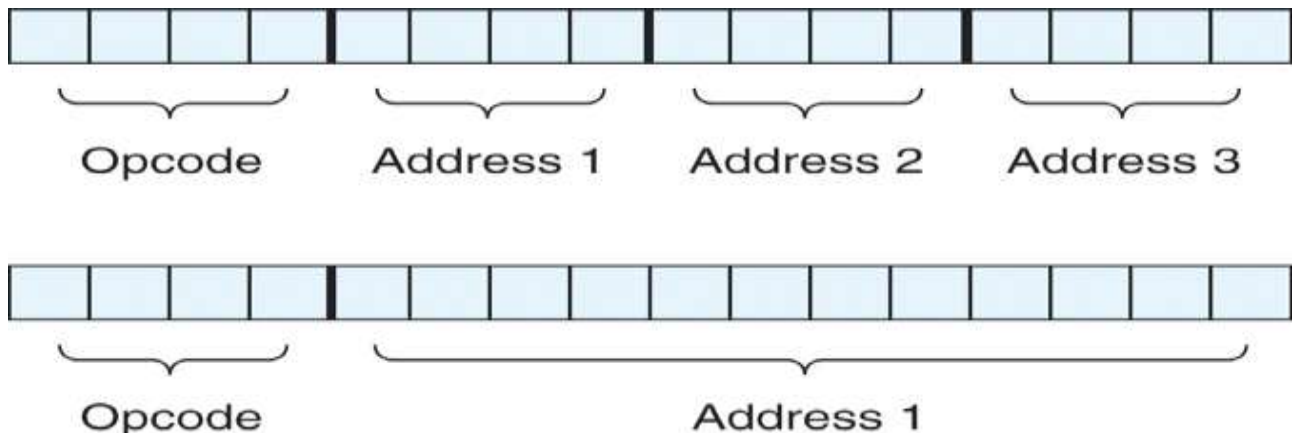
- **ADD** - Add two numbers together.
- **COMPARE** - Compare numbers.
- **IN** - Input information from a device, e.g. keyboard.
- **JUMP** - Jump to designated RAM address.
- **JUMP IF** - Conditional statement that jumps to a designated RAM address.
- **LOAD** - Load information from RAM to the CPU.
- **OUT** - Output information to device, e.g. monitor.
- **STORE** - Store information to RAM.

**Instruction Format**

A basic computer has three instruction code format-memory-reference, register-reference, and input-output instruction. Each format consists of 16bits.

An instruction is normally made up of a combination of an operation code and some way of specifying an operand, most commonly by its location or address in memory though no memory reference instructions can exist. Some operation codes deal with more than one operand; the locations of these operands may be specified using any of the many addressing schemes.

Classically, the number of address references has been used to specify something about the architecture of a particular computer. In some instruction formats and machine architectures, the number of operand references may be fixed; in others the number is variable. In the former case descriptions of formats include *one-address*, *two-address*, *three-address*, and (now rarely) *four-address*.

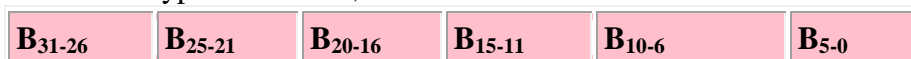


**Two Possibilities for a 16-Bit Instruction Format**

**R-type**

R-type instructions refer to register type instructions. Of the three formats, the R-type is the most complex.

This is the format of the R-type instruction, when it is encoded in machine code.



opcode	register s	register t	register d	shift amount	function
--------	------------	------------	------------	--------------	----------

### I-type instructions

I-type is short for "immediate type". The format of an I-type instruction looks like:

<b>B<sub>31-26</sub></b>	<b>B<sub>25-21</sub></b>	<b>B<sub>20-16</sub></b>	<b>B<sub>15-0</sub></b>
opcode	register s	register t	immediate

### J-type instructions

J-type is short for "jump type". The format of an J-type instruction looks like:

<b>B<sub>31-26</sub></b>	<b>B<sub>25-0</sub></b>
opcode	target

**UNIT- III**

**Computer Program:** Introduction, developing a program, algorithm, flowchart, pseudo code.

**Computer Languages:** Introduction, classification of programming languages, generations of programming languages, features of a good programming language.

**Computer Software:** Software definition, relationship between software and hardware, software categories, system software, application software.

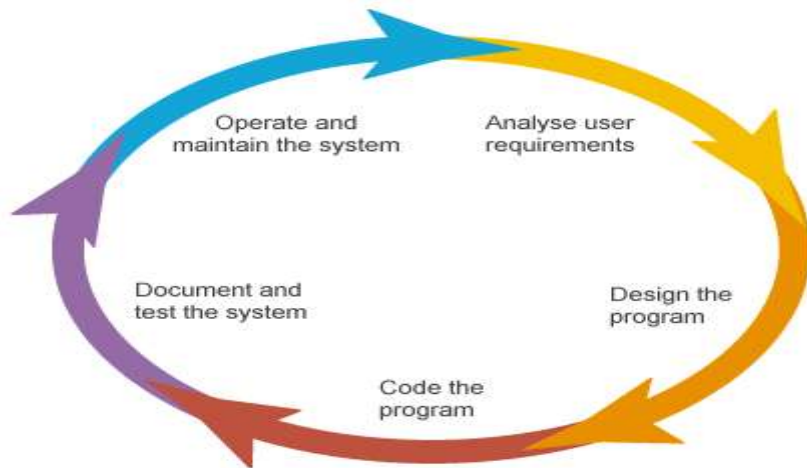
**Computer programs**

Computer programs, is describing how to do something. In its simplest form, it is a lot like writing down the steps it takes to do something- a *process*. Programming will help to learn the importance of clarity of expression.

So, writing a computer program can be like composing music, like building a house, like creating lots of stuff. It has been argued that in its current state, it is an *Art*, not engineering.

The **program development life cycle (PDLC)** is an outline of each of the steps used to build software applications.

The program development life cycle is a tool used to guide computer programmers through the development of an application. The program development lifecycle consists of six steps.



**Six Steps of PDLC**

STEP	PROCEDURE	DESCRIPTION
1	Analyze the problem	Precisely define the problem to be solved, and write program specifications – descriptions of the program’s inputs, processing, outputs, and user interface.
2	Design the program	Develop a detailed logic plan using a tool such as pseudo code, flowcharts, object structure diagrams, or event diagrams to group the program’s activities into modules; devise a method of solution or algorithm for each module; and test the solution algorithms. An algorithm must be: <ol style="list-style-type: none"> <li>1. Be lucid, precise, and unambiguous</li> <li>2. Give the correct solution in all cases</li> <li>3. Eventually end (be complete)</li> </ol>

3	Code the program	Translate the design into an application using a programming language or application development tool by creating the user interface and writing code; include internal documentation – comments and remarks within the code that explain the purpose of code statements.
4	Test and debug the program	Test the program, finding and correcting errors (debugging) until it is error free and contains enough safeguards to ensure the desired results.
5	Formalize the solution <b>Run/Execute</b>	Review and, if necessary, revise internal documentation; formalize and complete end-user (external) documentation. To run the program on a computer. When run a program, first the programs will <b>compile</b> the program. This translates the human code into binary language. When run the program, it will do further testing.
6	Maintain the program	Provide education and support to end users; correct any unanticipated errors that emerge and identify user-requested modifications (enhancements). Once errors or enhancements are identified, the program development life cycle begins again at Step 1.

### Pseudocode

(Pronounced SOO-doh-kohd) Pseudo code is a kind of structured English for describing algorithms. Pseudocode is sometimes used as a detailed step in the process of developing a program. It allows designers or lead programmers to express the design in detail and provides programmers a detailed template for the next step of writing code in a specific programming language.

**Pseudo** is a compact and informal high-level description of a computer programming algorithm that uses the structural conventions of programming languages, but omits detailed subroutines, variable declarations, and language-specific syntax.

An outline of a program, written in a form that can easily be converted into real programming statements.

For example, the pseudocode for a bubble sort routine might be written:

```
While not at end of list
compare adjacent elements
if second is greater than first
switch them
get next two elements
if elements were switched
repeat for entire list
```

Pseudocode cannot be compiled nor executed, and there is no real formatting or syntax rules. The benefit of pseudocode is that it enables the programmer to concentrate on the algorithms without worrying about all the syntactic details of a particular programming language.

### Examples of pseudocode

An example of how pseudocode differs from regular code is below.

Regular code (written in C): If (ccn >= 1 and ccn <= n if (is_valid(\$cc_number)) {	Pseudocode: if credit card number is valid execute transaction based on number and order
---	--

<pre> execute_transaction(cc_number, order); } else {   show_failure(); } </pre>	<pre> else   show a generic failure message end if </pre>
--	---

The pseudocode of the Hello world program is particularly simple:  
Output Hello World

## FLOW CHARTS

Flowcharting is the most popular and the oldest design tool system flowcharts detail the flow of data throughout an entire information system. Program flowcharts describe the processes taking place within an individual program in the system and the sequence in which they must be executed.

A flow chart is a pictorial representation of an algorithm that uses boxes of different shapes to denote **different types of instructions**.

The system flowchart is a graphic way of depicting all of the procedures that take input data and convert them to their final output form. ~~Using specialized symbols and flow lines, the system flowchart shows all of the processes taking place, the data acted on in each step, and the relationship between the processes. It is superior to narrative descriptions of the system because, in easily understood graphic form, it:~~

1. Shows the overall structure of the system.
2. Traces the flow of information and work.
3. Shows the physical media on which data are input, output and stored.
4. Highlights key processing and decision points.

~~The plain rectangle is a general symbol for a major computer processing function. Flow lines show the sequence of steps and the direction of information flow. Arrows are employed to show direction if it is not apparent in the diagram. System flowcharts can encompass different levels of details~~

- Quality Improvement Tool: Flow charts used specifically for a process.
- A flow chart is defined as a pictorial representation describing a process being studied or even used to plan stages of a project. ~~Flow charts tend to provide people with a common language or reference point when dealing with a project or process.~~
- Four particular types of flow charts have proven useful when dealing with a process analysis: top-down flow chart, detailed flow chart, work flow diagrams, and a deployment chart. ~~Each of the different types of flow charts tends to provide a different aspect to a process or a task. Flow charts provide an excellent form of documentation for a process, and quite often are useful when examining how various steps in a process work together.~~
- When dealing with a process flow chart, two separate stages of the process should be considered: the finished product and the making of the product. In order to analyze the finished product or how to operate the process, flow charts tend to use simple and easily recognizable symbols. The basic flow chart symbols below are used when analyzing how to operate a process.

## FLOWCHART SYMBOLS

In order to analyze the second condition for a flow process chart, one should use the ANSI standard symbols.

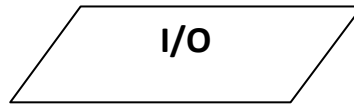
The American National Standard Institute (ANSI) has standardized the symbols:-

1. TERMINAL – The terminal symbol, as the name implies, is used to indicate the beginning (START), ending (STOP) and pauses (HALT) in the program logic flow. It is the first symbol and the last symbol in the program logic.



## BCA I Fundamental of Computers

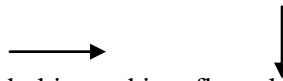
2. INPUT/OUTPUT – The I/O symbol is used to denote any function of an I/O device in the program.



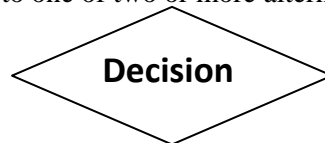
3. PROCESSING – A processing symbol is used in a flowchart to represent arithmetic and data movement instructions. Thus, all arithmetic processes of adding, subtracting, multiplying & dividing are shown by a processing symbol. The logical process of moving data from one location of the main memory to another is also denoted by this symbol.



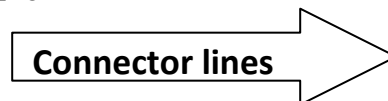
4. FLOW LINES – flow lines with arrowheads are used to indicate the flow of operation that is the exact sequence in which the instructions are to be executed. The normal flowchart is from top to bottom and left to right.



5. DECISION – the decision symbol is used in a flow chart to indicate a point at which a decision has to be made and a branch to one of two or more alternative points is possible.



6. CONNECTOR – if a flow chart becomes very long, the flow lines start cross crossing at many places that causes confusion and reduces understandability of the flowchart. Thus, whenever a flowchart becomes complex enough that the no and direction of flow lines is confusing or, it spreads over more than one page is useful to utilize the connector symbol as a substitute for flow lines.



### INSTRUCTIONS

Systematic process of how to develop a flow chart.

- Gather information of how the process flows: use a) conservation, b) experience, or c) product development codes.
- Trial process flow.
- Allow other more familiar personnel to check for accuracy.
- Make changes if necessary.
- Compare final actual flow with best possible flow.

Note: Process should follow the flow of Step1, Step 2... Step N.

Step N= End of Process

### CONSTRUCTION / INTERPRETATION

Tip for a flow chart.

- Define the boundaries of the process clearly.
- Use the simplest symbols possible.
- Make sure every feedback loop has an escape.
- There is usually only one output arrow out of a process box. Otherwise, it may require a decision diamond.

### INTERPRETATION

- Analyze flow chart of actual process.
- Analyze flow chart of best process.
- Compare both charts, looking for areas where they are different. Most of the time, the stages where differences occur is considered to be the problem area or process.
- Take appropriate in-house steps to correct the differences between the two separate flows.

### **Advantages of flowcharts**

The following benefits may be obtained when flowcharts are used for program planning:-

1. BETTER COMMUNICATION – the old saying that a picture is worth a thousand words holds true for flowcharts also.
2. EFFECTIVE ANALYSIS - A macro flowchart that charts the main line of logic of a software system becomes a system model, which can be broken down into detailed parts for study and further analysis of the system.
3. EFFECTIVE SYNTHESIS – Flowcharts are thus used as working models in the design of new programs and software system.
4. PROPER PROGRAM DOCUMENTATION – Program documentation involves collecting, organizing, storing and otherwise maintaining a complete historical record of programs.
5. EFFICIENT CODING – once a flowchart is ready programmers find it very easy to write the concerned program between the flowchart acts as a road map for them.
6. SYSTEMATIC DEBUGGING – Program errors are called bugs and the process of removing these errors is k/s DEBUGGING.
7. SYSTEMATIC TESTING – Testing is the process of confirming whether a program will successfully do all the jobs for which it has been designed under the specified constraints.

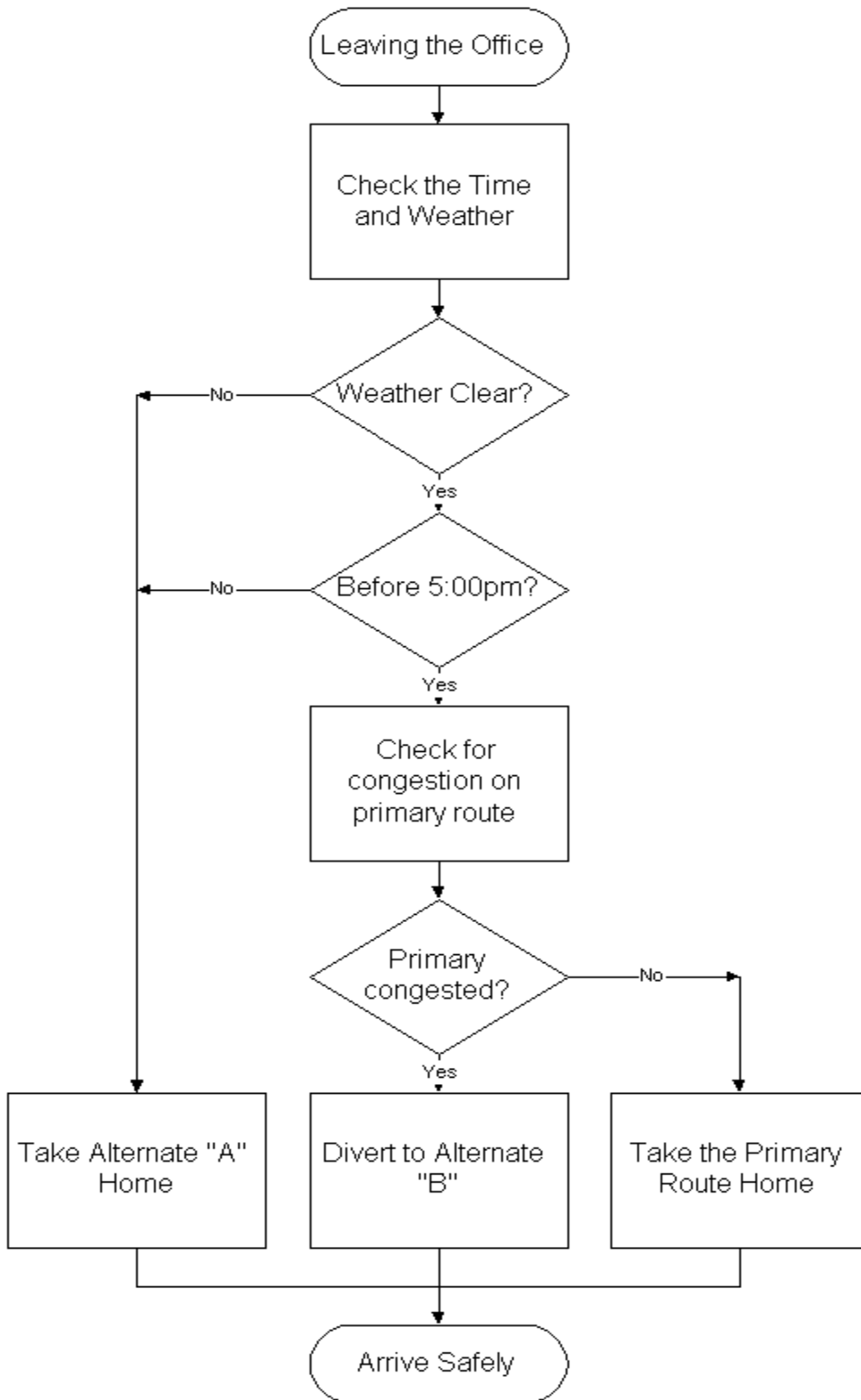
### **EXAMPLE**

Process Flow Chart- Finding the best way home

This is a simple case of processes and decisions in finding the best route home at the end of the working day.



### The Best Way Home



**Process Flow Chart- How a process works**

## Algorithm

An algorithm is any well-defined computational procedure that takes some value, or set of values as input and produces some value, or set of values, as output. Algorithm refers to the logic of a program. It is a step by step description of how to achieve at a solution to a given problem. It is define as a sequence of instruction that when executed in the specified sequence, the desired results are obtained. So it is a sequence of computational steps that transform the input into the output.

The term algorithm may be formally defined as a sequence of instruction designed in such a way that if the instructions are executed in the specified sequence, the desired results will be obtained. The instructions, however, should be precise and clear the result should be obtained after a finite no of executioner steps.

In other words, the algorithm represents the logic of the processing to be performed.

However, in order to qualify as an algorithm, a sequence of instructions must possess the following

Characteristics: -

1. Every instruction should be precise and unambiguous.
2. Each instruction should be such that it can be performed in a finite time.
3. One or more instructions should not be repeated infinitely. This ensures that the algorithm will ultimate terminate.
4. After performing the instruction, which is after the algorithm terminates the desired results must be obtained.

Example:-

There are 50student in a class who appeared in their final examination. Their mark sheets have been given to you. Write an algorithm to calculate and print the total no. of students who passed in first division.

Algorithm

Initialize TOTAL FIRST DIVISION and TOTAL MARKSHEETS CHECKED to zero.

Take the mark sheet of the next student.

Check the division column of the mark sheet to see- if it is I: go to step 5.

Add 1 to TOTAL FIRST DIVISION.

Add 1 to TOTAL MARKSHEETS CHECKED.

Is TOTAL MARKSHEET CHECKED = 50; if no, go to step two.

Print TOTAL FIRST DIVISION.

STOP

## **Programming Languages (The Microprocessor's Language)**

### **Programming languages**

Computers had to be instructed to perform a specific task. This way of instructing machines is known as a programming language.

Computer languages were first composed of a series of steps to wire a particular program – these changed into a series of steps keyed into the computer and then executed – later these languages acquired features such as logical branching and object orientation.

A programming language is a language intended to be used by a person to express a process by which a computer can solve a problem.

4 key components of definition:

- **Computer:** machine that will carry out the process described by program
- **Person:** programmer who serves as the source of the communication
- **Process:** the activity being described by the program
- **Problem:** actual system or environment where the problem arises

Languages to satisfy 4 components:

- Imperative is geared towards easy machine translation.
- Logical (Declarative): geared towards people and the logical thinking process
- Functional: focused on the function or operation being performed
- Object-Oriented: geared towards the problem domain.

## Language Processors

Aspects of Computer Structure

- **Data:** provide simple data structures
- **Primitive Operations:**  
simple operations to manipulate data
- **Data control:**  
mechanisms control data supplied to execution of operation
- **Storage Management:**  
mechanisms control allocation of storage for
  - programs
  - data
- **Operating environment:**  
mechanisms for communication with external environment (programs and data)

Computer programs, is describing how to do something. In its simplest form, it is a lot like writing down the steps it takes to do something - a *process*. We have many different languages in use throughout the world for us humans to communicate with; there are different languages that we use to communicate with a computer. Computer languages are used to tell the computer what to do, you instruct it.

If you instructed a computer in its native language (machine language), you would have to write instructions in the form of binary numbers. This is very, very hard to do. Although the pioneers of computers did this, no one does this these days.

- A computer program resides in *primary memory* where it is represented as a set of *machine instructions* which in turn are represented as sequences of *binary digits*.
- At any point in time the computer is said to be in a particular *state*.
- A central feature of the state is the *instruction pointer* which points to the next machine instruction to be executed.
- The execution sequence of a group of machine instructions is known as the *flow of control*.

### Classification of programming languages:

1. Machine Languages
2. Assembler and
3. High Level Languages

## Machine Language

- Only language of a computer understood by it without using a translation program
- Normally written as strings of binary 1s and 0s
- Written using decimal digits if the circuitry of the computer being used permits this

### Advantages of Machine Language

- i) It makes fast and efficient use of the computer.
- ii) It requires no translator to translate the code i.e. Directly understood by the computer

### Disadvantages of Machine Language:

- i) All operation codes have to be remembered
- ii) All memory addresses have to be remembered.
- iii) It is hard to amend or find errors in a program written In the machine language
- iv) These languages are machine dependent i.e. a particular Machine language can be used on only one type of computer

## Advantages & Limitations of Machine Language

### Advantage

- Can be executed very fast

### Limitations

- Machine Dependent
- Difficult to program
- Error prone
- Difficult to modify

## Assembly/Symbolic Language

Programming language that overcomes the limitations of machine language programming by:

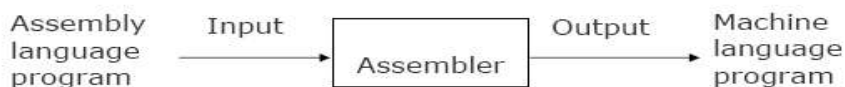
- Using alphanumeric mnemonic codes instead of numeric codes for the instructions in the instruction set  
e.g. using ADD instead of 1110 (binary) or 14 (decimal) for instruction to add
- Allowing storage locations to be represented in form of alphanumeric addresses instead of numeric addresses  
e.g. representing memory locations 1000, 1001, and 1002 as FRST, SCND, and ANSR respectively
- Providing pseudo-instructions that are used for instructing the system how we want the program to be assembled inside the computer's memory  
e.g. START PROGRAM AT 0000; SET ASIDE AN ADRESS FOR FRST

### ASSEMBLY LANGUAGE

- Assembly language (or assembler code) was our first attempt at producing a mechanism for writing programs that was more palatable (pleasant) to us.
- A program written in machine code, in order to "run", must first be translated (assembled) into machine code.

## Assembler

- Software that translates as assembly language program into an equivalent machine language program of a computer



(Source Program)  $\xrightarrow{\text{One-to-one correspondence}}$  (Object Program)

### Advantages of Assembly Language

- i) It is easier to understand and use as compared to machine language.
- ii) It is easy to locate and correct errors.
- iii) It is modified easily

## Advantages of Assembly Language Over Machine Language

- Easier to understand and use
- Easier to locate and correct errors
- Easier to modify
- No worry about addresses
- Easily relocatable
- Efficiency of machine language

### Disadvantages of Assembly Language

- i) Like machine language it is also machine dependent.
- ii) Since it is machine dependent therefore programmer should have the knowledge of the hardware also.

## Limitations of Assembly Language

- Machine dependent
- Knowledge of hardware required
- Machine level coding

## High-Level Languages

- Machine independent
- Do not require programmers to know anything about the internal structure of computer on which high-level language programs will be executed
- Deal with high-level coding, enabling the programmers to write instructions using English words and familiar mathematical symbols and expressions

## Compiler

- Translator program (software) that translates a high-level language program into its equivalent machine language program
- Compiles a set of machine language instructions for every program instruction in a high-level language



## Syntax Errors

In addition to doing translation job, compilers also automatically detect and indicate syntax errors

Syntax errors are typically of following types:

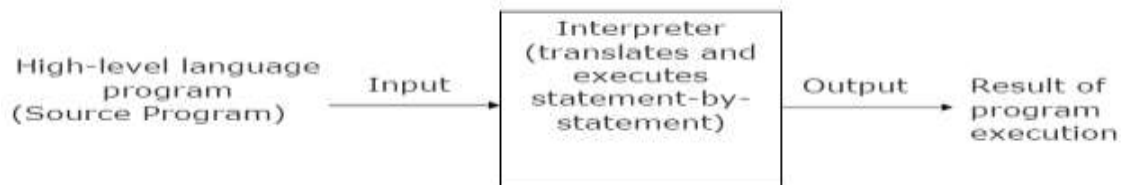
- Illegal characters
- Illegal combination of characters
- Improper sequencing of instructions in a program
- Use of undefined variable names

*Note* : A compiler cannot detect logic errors in a program

## Interpreter

- Interpreter is a high-level language translator
- Takes one statement of a high-level language program, translates it into machine language instructions
- Immediately executes the resulting machine language instructions
- Compiler simply translates the entire source program into an object program and is not involved in its execution

## Role of an Interpreter



## Intermediate Language Compiler & Interpreter

- New type of compiler and interpreter combines the speed, ease, and control of both compiler and interpreter
- Compiler first compiles the source program to an *intermediate* object program
- Intermediate object program is not a machine language code but written in an intermediate language that is virtually machine independent
- Interpreter takes intermediate object program, converts it into machine language program and executes it

### **Advantages of High Level Language**

Following are the advantages of a high level language:

- User-friendly
- Similar to English with vocabulary of words and symbols
- Therefore it is easier to learn.
- They require less time to write.
- They are easier to maintain.
- Problem oriented rather than 'machine' based.
- Program written in a high-level language can be translated into many machine language and therefore can run on any computer for which there exists an appropriate translator.
- It is independent of the machine on which it is used i.e. Programs developed in high level language can be run on any Computer

### **Advantages of High-Level Languages**

- Machine independent
- Easier to learn and use
- Fewer errors during program development
- Lower program preparation cost
- Better documentation
- Easier to maintain

### **Disadvantages of High Level Language**

- A high-level language has to be translated into the machine language by a translator and thus a price in computer time is paid.
- The object code generated by a translator might be inefficient Compared to an equivalent assembly language program

### **Limitations of High-Level Languages**

- Lower execution efficiency
- Less flexibility to control the computer's CPU, memory and registers

### **Factors for Selecting a Language for Coding an Application**

- Nature of the application
- Familiarity with the language
- Ease of learning the language
- Availability of program development tools
- Execution efficiency
- Features of a good programming language



## The different Generations of Programming Languages

Ever since the invention of Charles Babbage's different engine in 1822. There are currently five generations of computer programming languages. In each generation, the languages syntax has become easier to understand and more human-readable.

- **First generation languages (abbreviated as 1GL)**  
Represent the very early, primitive computer languages that consisted entirely of 1's and 0's - the actual language that the computer understands (machine language).
- **Second generation languages (2GL)**  
Represent a step up from the first generation languages. Allow for the use of symbolic names instead of just numbers. Second generation languages are known as assembly languages. Code written in an assembly language is converted into machine language (1GL).
- **Third generation languages (3GL)**  
With the languages introduced by the third generation of computer programming, words and commands (instead of just symbols and numbers) were being used. These languages therefore, had syntax that was much easier to understand. Third generation languages are known as "high level languages" and include C, C++, Java, and JavaScript, among others.
- **Fourth generation languages (4GL)**  
The syntax used in 4GL is very close to human language, an improvement from the previous generation of languages. 4GL languages are typically used to access databases and include SQL and ColdFusion, among others.
- **Fifth generation languages (5GL)**  
Fifth generation languages are currently being used for neural networks. A neural network is a form of artificial intelligence that attempts to imitate how the human mind works.

### First generation Language ((1GL) 1940- Machine Language)

*I think there is a world market for maybe five computers.*

*-Thomas Watson*

- When computers were no longer being rewired but rather programmed using some form of input, computer programming took the form of numbers and numbers alone. This exclusive use of numbers to command or instruct computers in their operations was called first -generation language. It is a low - level language.
- A first generation language (1GL) is a machine language, that is, programs are coded in 0s and 1s. The main benefit of 1GL is that code written by a user can run very fast and efficiently due to the fact that the Central Processor Unit (CPU) executes the instructions directly. However, there were many drawbacks to 1GL.
- In the first place, portability is a problem because of various architectural considerations, for example, if two CPU's differ in their architecture, the program has to be rewritten completely. It is also very difficult to code and even more difficult to debug.
- Machine dependent
- Faster execution
- Difficult to use and understand
- More prone to errors
- Introduced in the 1940s
- Instructions/Data entered directly in binary
- Memory must be manually moved around
- Very difficult to edit/debug
- Simple programs only

**Examples:**

- Architecture specific binary delivered on Switches, Patch Panels and/or Tape.

**Second generation Language ((2GL) 1950 Assembly Language)**

*He who hasn't hacked assembly language as a youth has no heart. He who does as an adult has no brain.*

*-John Moore*

- Second – generation language (2GL) refers to some form of assembly language but the code, unlike 1GL, can be fairly easily written or read by a programmer. It must be converted into machine-readable form before running it on a computer. This means converting the assembly language into binary machine language. This low – level language has major speed advantages but requires a great deal of programming effort and is difficult to use effectively in large applications.
- Machine dependent
- Faster execution
- More prone to errors
- Relatively simple to use
- Introduced in the 1950s
- Written by a programmer in an intermediate instruction language which is later compiled into binary instructions
- Specific to platform architecture
- Designed to support logical structure, debugging
- Defined by three language elements: Opcodes (CPU Instructions), Data Sections (Variable Definitions) and Directive (Macros)

**Examples:**

- Almost every CPU architecture has a companion assembly language. Most commonly in use today are RISC, CISC and x86 as that is what our embedded systems and desktop computers use.

**Third generation Language ((3GL) 1950-1970 FORTRAN, LISP, COBOL, ALGOL 60, BASIC, APL)**

*“Real programmers can write assembly code in any language.”*

*- Larry Wall*

- A third – generation language (3GL) is a high – level programming language designed to be easier to understand for the user and includes named variables and structured programming. 3GL uses a compiler to convert the statements or instructions of a specific language into machine language. A 3GL language requires a great deal of programming language.
- High level languages
- Easy to develop and understand programs
- Less prone to errors
- Introduced in the 1950s
- Designed around ease of use for the programmer
- Driven by desire for reduction in bugs, increases in code reuse
- Based on natural language
- Often designed with structured programming in mind

**Examples:**

- Most Modern General Purpose Languages such as C, C++, C#, Java, Basic, COBOL, Lisp and ML.

**Fourth generation Language ((4GL) 1970-1990 C, C++, Forth, Prolog, Smalltalk, Ada, Perl, SQL)**

*"A programming language is low level when its programs require attention to the irrelevant."*  
-Alan J. Perlis

- A fourth – generation language (4GL) is designed to be closer to natural language than a 3GL language. 4GL programs were developed with a specific purpose in mind, such as the development of commercial business software. Most 4GL languages are used to access databases and are typically non – procedural. They are designed to be used by end users and to develop applications quickly.
- Very high-level languages
- Easier to learn
- Highly portable
- Introduced in the 1970s, Term coined by Jim Martin
- Driven by the need to enhance developer productivity
- Further from the machine
- Closer to the domain

Some examples: SQL, SAS, R, MATLAB's GUIDE, ColdFusion, CSS

**Fifth – generation Language ((5GL) 1990 Java, HTML, VB, PHP, XML, C# )**

*"There are two ways of constructing a software design: One way is to make it so simple that there are obviously no deficiencies, and the other way is to make it so complicated that there are no obvious deficiencies. The first method is far more difficult."*

- Tony Hoare

- A fifth – generation language (5GL) is a programming language based on solving problems using constraints given to the problem, rather than using algorithm written by a programmer. An algorithm is like a recipe used to bake a cake. In 4GL the programming adds all the ingredients together to bake the cake, but a fifth – generation language is itself a master cook that uses the given ingredients to bake a cake.
- The different between 4GL and 5GL is that the programmer only needs to worry about which problem to solve and which conditions to meet.
- Today fifth – generation languages have lost part of their initial appeal and are mostly used in academic circles
- Internet-based languages
- Object oriented languages
- more efficient
- reliable and robust
- Introduced in the 1990s
- Constraint-based instead of algorithmic
- Used for AI Research, Proof solving, Logical Inference
- Not in common use

Some examples: Prolog, Mercury

## Characteristics of a good programming language

Every computer requires appropriate instruction set (programs) to perform the required task. The quality of the processing depends upon the given instructions. If the instructions are improper or incorrect, then it is obvious that the result will be superfluous. Therefore, proper and correct instructions should be provided to the computer so that it can provide the desired output. Hence, a program should be developed in such a way that it ensures proper functionality of the computer. In addition, a program should be written in such a manner that it is easier to understand the underlying logic. A few important characteristics that a computer program should possess are as follows:

- **Readability:** A good high-level language will allow programs to be written in some ways that resemble a quite-English description of the underlying algorithms. If care is taken, the coding may be done in a way that is essentially self-documenting.
- **Portability:** High-level languages, being essentially machined independent, should be able to develop portable software.
- **Generality:** Most high-level languages allow the writing of a wide variety of programs, thus relieving the programmer of the need to become expert in many diverse languages.
- **Brevity:** Language should have the ability to implement the algorithm with less amount of code. Programs expressed in high-level languages are often considerably shorter than their low-level equivalents.
- **Error checking:** Being human, a programmer is likely to make many mistakes in the development of a computer program. Many high-level languages enforce a great deal of error checking both at compile-time and at run-time.
- **Cost:** The ultimate cost of a programming language is a function of many of its characteristics.
- **Familiar notation:** A language should have familiar notation, so it can be understood by most of the programmers.
- **Quick translation:** It should admit quick translation.
- **Efficiency:** It should permit the generation of efficient object code.
- **Modularity/ Structural:** It is desirable that programs can be developed in the language as a collection of separately compiled modules, with appropriate mechanisms for ensuring self-consistency between these modules.
- **Widely available:** Language should be widely available and it should be possible to provide translators for all the major machines and for all the major operating systems.
- **Documentation:** Documentation is one of the most important components of an application development. Even if a program is developed following the best programming practices, it will be rendered useless if the end user is not able to fully utilize the functionality of the application. A well-documented application is also useful for other programmers because even in the absence of the author, they can understand it.
- The vocabulary of the language should resemble English (or some other human language). Symbols, abbreviations, and jargon should be avoided unless they're already familiar to most people.
- Programs should consist mostly of instructions; tedious declarations should be kept to a minimum.
- The language and its class or function library should be fully documented. Source code, even if provided, is no substitute for documentation. At least for beginners and part-timers, a page of documentation is far more intelligible than a page of source code. Any function will generally invoke a number of other functions, and therefore the source code is completely unintelligible unless you already know what every function does.

- There should be no need to manipulate pointers explicitly, and no means of doing so. Pointers are tedious to deal with and they're a fruitful source of bugs; they should be managed by the language and not by the programmer. This approach has been tried and shown to be feasible in a number of languages.
- The language should provide arrays of unlimited size: there should be no need to declare array bounds. Sorting facilities should be included as standard; we shouldn't have to write our own sort routines.
- Integers of unlimited size (as in Smalltalk) are nice to have in principle, though in practice not urgently needed for most programs.
- The language should provide full facilities for handling a graphical user interface. These should be defined as a standard part of the language, irrespective of the operating system in use. Algol-60 was a failure in practice because it failed to define input/output as a part of the language, and therefore its input/output statements varied from one implementation to another. Input/output now includes the graphical user interface, and any programming language should take responsibility for it.
- The language should probably be object-oriented. However, I've never actually written a pure object-oriented program, so I say this with more faith than experience.
- In Smalltalk, everything you write yourself is included in the "image file" and effectively becomes part of the language from then on. I dislike this approach: I prefer to keep one project separate from another and my projects separate from the libraries supplied with the language. When I create classes that I want to use in more than one project, I should be able to put them in a Personal Library folder or something.
- Any concept that can't easily be explained to children probably shouldn't be included in the language. Part-time programmers don't want to struggle with difficult concepts; they just want to get a job done quickly and easily.

### Computer Software

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

1. **Software (S/W):** - Software is the part of the computer system which enables the Hardware to operate. The term Software means collections of programs. A program is a set of logical instruction that is required to accomplish a particular task. The instruction may be given using any of the many computer language. (It is sets of instruction stored as programs that govern the operation of a computer system and it makes Hardware to do task.). It is 2 types:-

(A) **System Software:** - A system is a set of program that manages the resource of a computer system so that they are used in an optimal fashion, and provide routine service. It include the computer programs that run a computer system itself or that assist a computer in running application programs like operating system.

**System software** is the software used to manage and control the hardware components and which allow interaction between the hardware and the other types of software. The most obvious type of system software is the computer's operating system but device drivers are also included within this category.

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

### Features of System Software-

1. It is Close to system.

2. It is fast in speed.
3. It is Difficult to manipulate.
4. It is smaller in size.
5. It is Difficult to design.
6. It is Difficult to understand.
7. It is generally written in low level language.

### Types of System Software-

1. System control program
2. System support program
3. System development programs

System control program-they control the execution of programs. E.g. Operating system Device drivers-Device drivers are system programs, which are responsible for proper functioning of device. E.g. device like printer, a user must load the device driver of that particular printer.

**System support programs**-They provide routine service function to other computer programs and users. E.g. utility programs.

Some utility programs are-Text editors, they are used to create and edit files. For exp-notepad is the text editor.

Backup utilities-These utility programs help us to backup of our important data. By using these programs files are backed up to floppies, CD and DVD.

Data recovery software-Sometimes an illegal operation may result in an accidental loss of data which was still to be needed then we used data recovery software. E.g. Recycle bin.

Compression utilities- Compression utility are used to compress large sized files so that they can be stored in storage of low capacity. Win-zip is a popular compression utility used in window based desktops.

Anti virus utility- Any program that affects the normal working of the other programs or affects the boot sector of the disk is a virus. The anti virus software detects the virus, identify and prevent it from spreading. Some examples of anti-virus software are Norton's anti virus, McAfee etc.

**System Development Programs**- They assists in the creation of computer programs. Examples of system development are – programming language, language translations.

**(B) Application Software:** - Application Software is the programs which on the other hand performs specific tasks for computer user. An appropriate program is designed to handle a particular task required by the end-user (Like, if an appropriate Software is designed to design images will only work for image designing.) e.g. Are MS-Excel, MS-Word, Photoshop etc.

**Applications software** (also known as 'apps') are designed to allow the user of the system complete a specific task or set of tasks. They include programs such as web browsers, office software, games and so on. They are usually the reason you bought the computer system in the first place and aren't concerned with the management or maintenance of the system itself.

Any individual software package, whichever of the above types it falls into, can be either **generic** (or 'off-the-shelf') or it can be **bespoke** (custom-built). Generic software is mass produced with the intention that it will be used by a wide variety of different users in a range of different situations.

Bespoke software is created for a specific purpose which will be used in a known environment.

Application software-Application software is the software that is designed to satisfy a particular need of a particular environment. All software prepared by us in the computer lab. Examples of application software are-student record software, railway reservation software, income tax software, word processors etc.

**Features of application software:-**

1. It is close to user.
2. It is Slow in speed
3. It is Easy to understand.
4. It is Easy to manipulate
5. It is generally, written in high level language
6. It is easy to design.

**TYPES OF APPLICATION SOFTWARE**

**General purpose application software**-General purpose application software are designed to satisfy common needs of various business. **SOME GENERAL PURPOSE SOFTWARE ARE-**  
**WORD PROCESSOR**-word processor is the software used to word processing. There are many word processors available in the market. The common and the popular among are: Word Star, MS-WORD.  
**ELECTRONIC SPREADSHEET**:-A spreadsheet contains grid of cells arranged in columns and rows. Data is entered into the cells to represent information. Examples of electronics spreadsheet are lotus 1, 2, 3 and excel.

**PRESENTATION SOFTWARE**-presentation software are the software which are used to present information to a large number of people. Microsoft PowerPoint is one of the most popular presentation software.

**DESKTOP PUBLISHING SOFTWARE**- desktop publishing software is used for type setting and designing purposes. Well know desktop publishing software is page marker and Coral Draw.

**WEB BROWSER SOFTWARE**-with an internet connection, this type of software enables a user to visit from one site to another by following, to search locations and view web documents .Examples are Netscape communicator, Microsoft internet explorer 6.

**SPECIAL PURPOSE APPLICATION SOFTWARE**-application software is created to satisfy specific needs of an organization. Example are payroll software, railway reservation software etc.

**Utility software** is software such as anti-virus software, firewalls, disk defragmenters and so on which helps to maintain and protect the computer system but does not directly interface with the hardware.

**Different between system Software and application Software**

	<b>System Software</b>	<b>Application Software</b>
1.	System S/W include the computer program that run a computer system it self or that assists the computer in running application programs.	Application S/W is a program that runs over the operating system.
2.	System S/W directly interacts with H/W	Application S/W interacts with H/W through system S/W.
3.	System S/W are common for various users.	Application S/W varies according to the user requirements.
4.	System S/W helps the user to interact with computer.	Application S/W helps the user to solve their problems.
5.	eg :- O.S. , compiler, interpreter etc.	e.g.:- MS-Word, MS-EXCEL, TALLY, AUTOCAD, PHOTOSHOP etc.

**Computer system has 2 basic parts** (1) Hardware (2) Software

2. **Hardware:** - The equipment associated with a computer system is the hardware computer hardware is responsible for performing the job. The physical and tangible components of computer are called hardware i.e. which can be touched and seen. Computer hardware consists of interconnected electronic devices that are to control the computer operation.

They include the 5 basic operations:-

- b. **Input:** - to send data and instruction into the computer system (CPU). This input is further stored or to be manipulated some Input devices are Key board, Mouse, Scanner, Digital camera etc.
- c. **Output:** - the process of producing the result on paper or on screen is called Output operation; Output devices are Monitor, Printer, speaker, plotters etc.
- d. **Processing / CPU:** - performing arithmetic and logical operations on the data to produce some information is called.
- e. **Storage/memory:** - A devices or medium that can accept data, hold them and deliver them on demand at a later time. E.g. (1) primary (2) secondary
- f. **Controlling:** - Directing the method and sequence in which all the above operation is performed.

**Different between Hardware and Software**

	<b>Hardware</b>	<b>Software</b>
1.	The physical units of a computer referred To as its h/w	A collection of one or more programs for a task is called s/w (it is not a Physical part of computer just a Sequence of instruction)
2.	The h/w of a computer working under the Control of CPU can do complex tasks for us.	S/W can be fed through an device or it can be kept/stored on a second storage device.
3.	H/W does not task take instruction directly from the user.	S/W can take instruction directly from the user.
4.	H/W actually provides the resources to solve the problems	S/W solves the problems through the h/w.
5.	E.g. Hard disks CD-ROM, Printer	E.g. MS office, Auto CAB, Photoshop

**Relationship between Hardware and Software are brought out by this analogy (similarity):-**

**Hardware** or commonly called computer hardware is one component of a computer that the nature of his instrument can be seen and touched, directly or in the form of real, which serves to support the computerization process. Hardware can work based on predetermined commands available to him, or what is also referred to by the term instruction set. With the commands that can be understood by the hardware, then the hardware can perform a variety of activities that have been determined by the command. Physically, the computer consists of several components that constitute a system. Systems are the components that work together to form a union. If one component is not working, will result in non-functioning of existing processes with good computer

**Software** is a set of instructions that serves to execute a command, such as providing information about the hardware, determines the function of the hardware, and run the system.

So that the computer can read, remembering, making decisions (compare), counting, sorting, and produce the output of the monitor or printed information, the computer must be able to read and incorporate the program into the main memory. Program is instruction in machine language or that can be read by a machine designed for a specific purpose so that the operator runs the computer and



massaging certain key ( e.g. to process accounting data ) called by the application program ( user application program )

Understanding software refers to programs and other tools that are adding the ability of computers as a tool to carry out a specific task or operation. Application programs can be created specifically to meet the special needs anyway (tailor -made) or a package that has general application. Also called software, is a collection of some of the commands executed by the engine computer in the work. This software is a record for the engine computer to save the command, as well as documents and other records.

1. Both Hardware and Software are necessary for a Computer to do useful job. Both are complementary to each other.
2. Same Hardware can be loaded with different Software to make a Computer perform different types of jobs just as different songs can be played using the same cassette player.
3. Except for upgrades (like increasing Main Memory and Hard Disk capacities, or adding Speakers, Modems, etc.); Hardware is normally a one- time expense, whereas Software is a continuing expense. Like we buy new cassettes for newly released songs or for songs whose cassettes, we do not have, we buy, new Software to be run on the same hardware as and when need arises, or funds become available.

### UNIT-IV

**Operating System:** Introduction of operating system, types of operating system, functions of an operating system, modern operating systems.

**Data Communication and Computer Network:** Introduction, data communication, transmission media, multiplexing, switching, computer network, network topologies, communication protocols, network devices.

**Internet Basics:** Introduction, evolution of Internet, basic Internet terms, getting connected to Internet, Internet applications, electronic mail, searching the web (search engines), languages of Internet, viruses.

An **operating system (OS)** is an interface between hardware and user which is responsible for the management and coordination of activities and the sharing of the resources of a computer, that acts as a host for computing applications run on the machine.

The operating system is the component that on one side manages and controls the hardware and on the other manages the applications.

### Characteristics of OPERATING SYSTEM

1. An operating system is a program that acts as an intermediate between a 'user' & the 'comp'.
2. The purpose of an operating system is to provide an environment in which a user can execute programs.
3. The primary goal of an operating system is thus to make the comp system convenient to use & seen the goal is to use the comp hardware in an efficient manner.
4. A comp is a complex system - it is required that a person with minimal technical skills should be able to use a computer. This is made possible by the operating system of the computer.
5. An operating system is a system software - it manages the resources of a computer like memory, process, peripheral i.e. I/O devices, files.

So the operating system is a set of specialized programs that are used to manage the resources & overall operations of a computer. it acts as an interface between the user & the computer.

### Classification of OPERATING SYSTEM

#### 1. on the basis of convenience & efficiency

#### 2. on the basis of characteristics.

1. **On the basis of convenience & efficiency-** the primary goal of an operating system is convenience for the user. Operating system exists because they are supported to make it easier to compute with them than without them. A secondary goal is efficient operation of the comp sys. This goal is particularly imp for large shared multiuser system.

**(A) Batch processing-** a batch is a sequential of user jobs means it automatically keep executing one job to the next job in a batch. It reduce the interference the operator during the processing or execution of jobs by the comp. Batch processing is implemented by locating a component of the Batch processing system called the batch monitor or supervisor permanently is one part of the comps memory. The remaining memory is used to process a user job. The current job in the batch. (FCFS).

**(B) Multi program system** – to improve utilization of CPU, I/O devices & memory. It is many times useful to have more than one process in memory at once. When more than processes are executing. It is called multi program environment. In MP system, the operating system simply switches to & executes another job. When that job needs to wait, d CPU is switched to & executes second job & so on. So in MP the first job finishes waiting & gets the CPU back. E.g. UNIX, WIN NT.

**(C) Time sharing sys** - A TSOS uses CPU scheduling & MP to provide each user with a small portion of a processes time called time slice. TS or multitasking is a logical extension of MP. Multiple jobs are executed by the CPU switching b/w them, but the switches occurs so frequently that the user may interact with each program, while it is running. (Share computer simultaneously).

**(D) Real time sys** – A RT sys is used when there are rigid time constraints on the operation of a processor or the flow of data. The RT OPERATING SYSTEM is used often as control device in a dedicated application. A RT OPERATING SYSTEM has well defined fixed time constrains. Processing must be done within the defined constraint or the sys will fail.

There are **2 type of RT** –

**(a) Hard RT sys-** critical tasks complete in time. This goal requires that all delays in the sys be bounded.

**(b) Soft RT sys** – A less restrictive type of RTS in this. Where a critical real-time task gets priority over other tasks & retains that priority until it complete.

These sys are referred to as loosely coupled system or distributed system. The processor in a DS may vary in size & functions. Reasons for building DS. 1. Resources sharing 2. Computation speed up 3. Reliability 4. Communication

**(E) Distributed sys** – distribute computation among several processors. The processors communicate with one another through various communication lines such as high speed buses or telephone lines.

#### 2. on the basis of characteristics -

**(A) Open or standard OPERATING SYSTEM** which are available on a wide variety of comp h/w from different companies are called open or standard. E.g. DOS, UNIX, WIN95, NT, Netware.

**(B) Proprietary OPERATING SYSTEM** - POS are bound to the comp of a particular co. this operating system make it difficult for the users to move from the h/w of one co. to the other. E.g. IBM-MVS, DEC-VMS.

**(C) Single user OPERATING SYSTEM** - an operating system which lets only one user work with a comp at a time is called SUOS. E.g. Ms-dos, ms-windows.

**(D) Multi user OPERATING SYSTEM** - in this multiple users works with the comp simultaneously. Here is a single comp which is connected to many nodes. E.g. UNIX.

**(E) Network** – it allow multiple computers to be connected in a network. In a network environment each node has CPU, kb, monitor. E.g. Novell network, Win NT.

**Components of an OPERATING SYSTEM** – an OPERATING SYSTEM performs large number of functions. Each function is carried out by a component of the OPERATING SYSTEM. The component of an OPERATING SYSTEM are –

1. Process mgmt sub sys
2. Memory mgmt sub sys,
3. File mgmt sub sys,
4. I/O mgmt sub sys,
5. Secondary storage mgmt sub sys
6. Network mgmt sub sys
7. Protection mgmt sub sys,
8. User interface mgmt sub sys.

**Operating system functions.**

Action	OS Does This
You turn on the computer	Hardware mgmt
You execute an application	Process mgmt
Application reads a tape	Hardware mgmt
Application waits for data	Process mgmt
Process waits while other process runs	Process mgmt
Process displays data on screen	Hardware mgmt
Process writes data to tape	Hardware mgmt
You quit, the process terminates	Process mgmt
You turn off the computer	Hardware mgmt

**Data Communication/Computer Network Overview**

A computer network or data network is a telecommunications network that allows computers to exchange data. In computer networks, networked computing devices pass data to each other along data connections. Data is transferred in the form of packets.

**Introduction**

A system of interconnected computers and computerized peripherals (such as printers) is called network. This interconnection among computers facilitates information sharing among them. Computers may connect to each other by wired media or wireless media.

A system of interconnected computers and computerized peripherals (such as printers) is called network. This interconnection among computers facilitates information sharing among them. Computers may connect to each other by wired media or wireless media.

A computer network is a group of interconnected “network capable devices”.

- Components: Network Interface Cards, Hubs, Switches, Routers and galvanic cable.

We need a protocol: Set of rules governing data communication.

- TCP/IP is such a protocol

### **Basic Hardware Components**

- Network Interface Card (NIC)
- Hub
- Switch
- Router
- Cable

### **Network Interface Card**

- Allows a network capable device access to a computer network such as the internet.
- The MAC address identifies the vendor and the serial number of the NIC which is unique to the card.

### **Hub**

- A network hub or repeater hub is a device for connecting multiple twisted pair or fiber optic Ethernet devices together.
- When a packet arrives at one port, it is copied to all the ports of the hub for transmission

### **Switch**

- A switch is a device that performs switching.
- It forwards and filters datagram's (chunk of data communication) between ports based on the Mac-Addresses in the packets.

### **Cables**

- Category 5 cable, known as Cat 5 or "Cable and Telephone", is a twisted pair cable.(100 Mbps)
- An optical fiber is a glass or plastic fiber that carries light along its length. (40 Gbps)

### **Classifying Networks**

- On the basis of scale or extent of reach of network: LAN, MAN, WAN.
- On the basis of connection method: hardware technology: Optical fiber, Ethernet, Wireless LAN.
- Functional relationship: Client-Server, Peer-to-peer.
- On the basis of network topology, Physical layout: Mesh, Star, Bus, Ring, and Hybrid.

### **Networking basics**

- What is a Proxy?
- What is an IP address?
- What is subnet mask?
- What is Default gateway?
- Domain Name System (DNS)

### **Proxy**

- Interface between internal and external network(Internet)
- Primary advantages:
  - Security (from outside)
  - Access control (sites, virus)
  - Efficient network utilization due to caching

### IP address

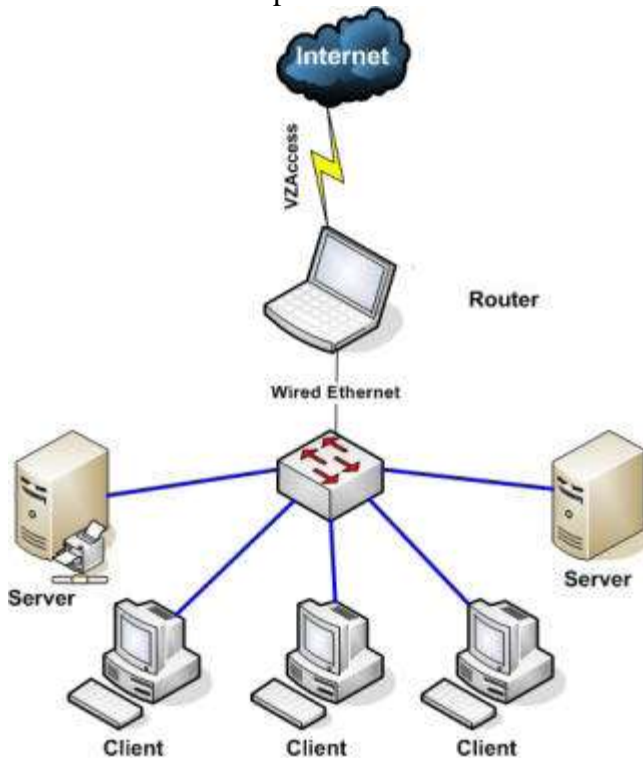
- An Internet Protocol (IP) address is a numerical identification that is assigned to devices participating in a computer network utilizing the Internet Protocol for communication between its nodes.
- The format of an IP address is a 32-bit numeric address written as four numbers separated by periods. Each number can be zero to 255.

### Subnet mask

- A portion of the network's computers and network devices that have a common, designated IP address routing prefix.
- A mask used to determine what subnet an IP address belongs to.
- An IP address has two components, the network address and the host address
- Hostel-2 subnet is 255.255.0.0, so allowed ip-addresses are 10.2.xxx.xxx

### Default gateway

- A node (a router) on a computer network that serves as an access point to another network.
- Viewed simply as an entry point and an exit point in a network.
- A default gateway is used by a host when an IP packet's destination address belongs to someplace outside the local subnet.
- Hostel-2 has a computer: 10.2.250.1



### Domain Name System (DNS)

- Associates various information with domain names;
- It serves as the "phone book" for the Internet by translating human-readable computer hostnames, e.g. www.google.com, into IP addresses, e.g. 208.77.188.166, which networking equipment needs to deliver information

### Categories

Computer Networks are classified into many categories based on their respective attributes. This includes:

- Geographical span
- Inter-connectivity
- Administration
- Architecture

### **Geographical Span**

Geographically a network can be seen in one of the following categories:

1. It may be spanned across your table, among Bluetooth enabled devices. Ranging not more than few meters.
2. It may be spanned across a whole building, including intermediate devices to connect all floors.
3. It may be spanned across a whole city.
4. It may be spanned across multiple cities or provinces.
5. It may be one network covering whole world.

### **Inter-connectivity**

Components of a network can be connected to each other differently in some fashion. By connectedness we mean either logically or physically or both ways.

1. Every single device can be connected to every other device on network, making the network mesh.
2. All devices can be connected to a single medium but geographically disconnected, created bus like structure.
3. Each device is connected to its left and right peers only, creating linear structure.
4. All devices connected together with a single device, creating star like structure.
5. All devices connected arbitrarily using all previous ways to connect each other, resulting in a hybrid structure.

### **Administration**

From an administrator's point of view, a network can be private network which belongs a single autonomous system and cannot access outside its physical or logical domain. Or a network can be a public network, which can be accessed by all.

### **Network Architecture**

There can be one or more systems acting as Server. Other being Client, request the Server to serve requests. Servers take and process request on behalf of Clients.

1. Two systems can be connected Point-to-Point, or in other words back-to-back fashion. They both reside on same level and called peers.
2. There can be hybrid network which involves network architecture of both the above types.

Computer systems and peripherals are connected to form a network provides bunch of **advantages:**

1. Resource sharing such as printers and storage devices.
2. Exchange of Information by means of eMails and FTP.
3. Information sharing by using Web or Internet.
4. Interaction with other users using dynamic web pages.
5. IP phones

6. Video Conferences
7. Parallel computing
8. Instant Messaging

### **Computer Network Types**

Generally, networks are distinguished based on their geographical span. A network can be as small as distance between your mobile phone and its Bluetooth headphone and as large as the Internet itself, covering the whole geographical world, i.e. the Earth.

#### **1. Personal Area Network**

A Personal Area Network or simply PAN is smallest network which is very personal to a user. This may include Bluetooth enabled devices or infra-red enabled devices. PAN has connectivity range up to 10 meters. PAN may include wireless computer keyboard and mouse, Bluetooth enabled headphones, wireless printers and TV remotes for example.

[Image: Personal Area Network | Bluetooth]

Piconet is an example Bluetooth enabled Personal Area Network which may contain up to 8 devices connected together in a master-slave fashion.

#### **2. Local Area Network**

A computer network spanned inside a building and operated under single administrative system is generally termed as Local Area Network. Usually, Local Area Network covers an organization's offices, schools, college/universities etc. Number of systems may vary from as least as two to as much as 16 million

LAN provides a useful way of sharing resources between end users. Resources like Printers, File Servers, Scanners and internet is easy sharable among computers.

[Image: Local Area Network]

Local Area Networks are composed of inexpensive networking and routing equipment. It may contain local servers serving file storage and other locally shared applications. It mostly operates on private IP addresses and generally do not involve heavy routing. LAN works under its own local domain and controlled centrally.

LAN uses either Ethernet or Token-ring technology. Ethernet is most widely employed LAN technology and uses Star topology while Token-ring is rarely seen.

LAN can be wired or wireless or in both forms at once.

#### **3. Metropolitan Area Network**

MAN, generally expands throughout a city such as cable TV network. It can be in form of Ethernet, Token-ring, ATM or FDDI.

Metro Ethernet is a service which is provided by ISPs. This service enables its users to expand their Local Area Networks. For example, MAN can help an organization to connect all of its offices in a City.

[Image: Metropolitan Area Network]

Backbone of MAN is high-capacity and high-speed fiber optics. MAN works in between Local Area Network and Wide Area Network. MAN provides uplink for LANs to WANs or Internet.

#### 4. Wide Area Network

As name suggests, this network covers a wide area which may span across provinces and even a whole country. Generally, telecommunication networks are Wide Area Network. These networks provide connectivity to MANs and LANs. Equipped with very high speed backbone, WAN uses very expensive network equipment.

[Image: Wide Area Network]

WAN may use advanced technologies like Asynchronous Transfer Mode (ATM), Frame Relay and SONET. WAN may be managed under by more than one administration.

#### Internetwork

A network of networks is called internetwork, or simply Internet. It is the largest network in existence on this planet. Internet hugely connects all WANs and it can have connection to LANs and Home networks. Internet uses TCP/IP protocol suite and uses IP as its addressing protocol. Present day, Internet is widely implemented using IPv4. Because of shortage of address spaces, it is gradually migrating from IPv4 to IPv6.

Internet enables its users to share and access enormous amount of information worldwide. It uses www, ftp, email services, audio and video streaming etc. At huge level, internet works on Client-Server model.

Internet uses very high speed backbone of fiber optics. To inter-connect various continents, fibers are laid under sea known to us as submarine communication cable.

Internet is widely deployed on World Wide Web services using HTML linked pages and is accessible by some client software known as Web Browsers. When a user requests a page using some web browser located on some Web Server anywhere in the world, the Web Server responds with the proper HTML page. The communication delay is very low.

Internet is serving many purposes and is involved in many aspects of life. Some of them are:

1. Web sites
2. E-mail
3. Instant Messaging
4. Blogging
5. Social Media
6. Marketing
7. Networking
8. Resource Sharing
9. Audio and Video Streaming

#### The Internet: Basic terms

The Internet is a worldwide collection of networks that links together millions of businesses, government agencies, educational institutions and individuals. Through the Internet society has access



to information from all around the world, it offers many conveniences. The magnificence of the Internet is you can access it from a computer anywhere.

Some of uses of the Internet:

1. Access a wealth of information, news and research material
2. Communicate with others around the world
3. Bank and invest
4. Shop for goods and services
5. Download and listen to music or download and watch movies
6. Take a course or access other educational material
7. Access sources of entertainment and leisure such as online games, magazines and holidays planning guides
8. Access other computers, mobile phones or PDA and exchange files
9. Share and edit documents with others in real time
10. Provide information, photographs, audio clips or video clips

### Basic Internet Terms

Below are basic internet terms or concepts useful for understanding what happens when searching for information in the internet. Terms are in yellow and definitions are in black.

Domain abbreviations (last three characters in URL or address)

1. .edu - Educational institutions
2. .com - Commercial businesses
3. .gov - U.S. government
4. .mil - The U.S. military
5. .org - Other organizations
6. .net - Network/Internet Service Providers

~ - In a URL address, means an individual is responsible for the contents

**Favorites** - A menu option at the top of the screen that shows any websites that have been previously saved for you to return to on a different day, much like a traditional bookmark is used for books.

**Go** - A command in Explorer that sits on the top of the screen with other commands. In Go, Explorer keeps track of most sites that a user has visited during a session of using Explorer. This is not saved once you quit Explorer.

**Homepage** - Default setting, or the page that opens up when you start your Browser. A homepage can also be the entry point for people viewing information that is provided.

**Internet** - Network of millions of computers used to send information back and forth to one another. No one person or group decides what can and cannot be published on the internet. This means that virtually anyone can publish, and means that there are large numbers of sites that contain false and misleading information. It is important to check who takes credit for the site you are viewing.

**Links** - Hypertext which, when clicked, connects you to another site or another page within the same site. In most cases, these links are usually highlighted in blue and are always underlined.

**Online Databases** - These are sites that provide access to mostly newspaper and magazine articles which are not available through Google or any other search engine. The only way to see these articles online is to pay a fee. Online databases are usually specialized and focus on subjects like social studies or science.

**Page** - What is on your screen at any given time? The page includes all the information available to you by scrolling up or down; however, when you click on hypertext your computer will 'jump' to a new page.

**Printing** - Printing directly off the internet wastes paper because it is difficult to tell how long a document is. Internet printing will also include graphics and images you don't need. The more pictures, fancy fonts, and images, the slower the printing will be.

To prevent slower printing jobs and save paper, copy the text you want printed, open a word processing program, paste the text into a new file, and then print.

**Search Engines** - Software that allows you to search the Web by typing in a topic of interest. Examples of search engines we use are Google, HotBot, and Northern Light. These search engines find exact matches from what has been typed in the search screen to either documents (files) or subjects of files on the WWW.

**URL or Uniform Resource Locator** - The address for a specific file on the web, as well as a method for directing users to a specific file, at a specific site. To type in a different URL, press command and L at the same time on a Macintosh computer, control and L on a PC, or locate the address bar at the top of the screen, type in the URL, and then press return. The URL for the Blaine School District Home page is: <http://www.blaine.k12.wa.us>.

**Web Browser** - To access the WWW, you need a Browser. A Web Browser is client software that gets information from a server. It interprets the information, formats it, and displays it on your computer screen. The most popular browser, and the one we use most often in Blaine, is Internet Explorer.

**WWW, World Wide Web or Web** - Interactive collection of hypertext pages linked to one another. They may include text, graphics and/or links to other spots in the Web. The Web is interactive because a user can click on text or graphics to navigate (move) to more information or other graphics, sounds and video that is of interest to them.

### **The Internet services**

To support these and other activities, the Internet provides a variety of services that include:

1. www (World wide web / web)
2. e-mail
3. file transfer
4. instant messaging
5. chat rooms
6. message boards, newsgroups

1. The **www** is just one of the many services available on the Internet (the Internet developed in the late 1960s, the www in the early 1990s). However it became the most widely used service on the Internet.

It consists of a worldwide collection of electronic documents (**web pages**).

A **web page** can contain text, graphics, sound and video as well as built-in connections to other documents. Web pages can use multimedia (graphics, sound, video, virtual reality, or other media instruments)

**Six basic types of Web pages:** advocacy, business/marketing, informational, news, portal (Google, Yahoo, Seznam, Centrum,..., wireless portals), personal

A **website** is a collection of related Web pages.

**Browser** – a software program that allows you to access and view Web pages (Internet Explorer, Netscape, Mozilla Firefox ...)

**Hyperlink** (link) –a built-in connection to another related Web page or a part of a Web page.

Links allow us to obtain information in a nonlinear way

**Surfing the web** – jumping from one Web page to another

**URL** (Uniform Resource Locator) – a Web address

**Web server** – a computer that delivers (serves) Web pages you request. When we enter the URL in the browser, it sends a request to the server and it organizes the connection between the URL and your computer.

**Web casting** - a server automatically downloads content of a particular Web page to your computer at regular intervals or whenever updates are made to the site when you want. The information is available in your computer whether you are online or offline.

**E-commerce** (*Electronic commerce*) – a financial business transaction. With e-commerce, transactions can occur instantaneously and globally (investing, shopping through an electronic storefront).

A **weblog** (usually shortened to **blog**, but occasionally spelled web log or weblog) is a web based publication consisting primarily of periodic articles. Early weblogs were simply manually updated components of common websites. Now there is a distinct class of online publishing that produces blogs we recognize today. For instance, the use of some sort of browser-based software is now a typical aspect of "blogging". Blogs can be hosted by dedicated **blog hosting services**, or they can be run using blog software on regular web hosting services.

**2. E-mail** (*electronic mail*) is the transmission of messages and files via a computer network.

It was one of the original services on the Internet, enabling scientists and researchers working on government-sponsored projects to communicate with colleagues at other locations. Some Web sites provide e-mail services free of charge.

**POP3 server** (Post Office Protocol) - a communications technology for retrieving an e-mail from a mail server. It holds the message until the recipient retrieves it with his or her e-mail software.

**3. FTP** (*File Transfer Protocol*) – an Internet standard that allows us to upload and download files with other computers on the Internet. Some FTP sites limit file transfers to individuals who have authorized accounts (user names and passwords). Many program files on anonymous FTP sites are freeware or public domain software, others are shareware.

#### **4. Newsgroups and Message Boards**

A **newsgroup** is an online area in which users conduct written discussion about a particular subject. To participate in a discussion, a user sends a message to the news group, and other users in the newsgroup read and reply to the message. To participate in a newsgroup, you use a program called a **newsreader**, which is included with most browsers. It enables you to access a newsgroup to read the previously entered message, called an article. You also can post or add an article of your own.

Newsgroups are technically distinct from, but functionally similar to, **discussion forums on the web**. Weblogs have replaced some of the uses of newsgroups (especially because, for a while, they were less prone to spamming).

A **message board** (discussion board) – it typically is easier to use than newsgroups, a newsreader is not required.

**5. A chat room** is an online forum where people can chat online (talk by broadcasting messages to people on the same forum in real time). Sometimes these venues are moderated either by limiting who is allowed to speak (not common), or by having moderation volunteers patrol the venue watching for disruptive or otherwise undesirable behavior.

A **chat** is a real-time typed conversation that takes place on a computer (you are online at the same time). Others connected to the same chat room server can see what you have typed on your computer screen. (Voice and video chats are possible in some chat rooms).

**Chat client** – a program on your computer (today's browsers usually include a chat client).

6. **Instant messaging (IM)**- a real-time Internet communications service that notifies you when one or more people are *online* and then allows you to exchange messages or files or join a private chat room with them. To use IM you install software from an instant messaging service, sometimes called an *instant messenger* (ICQ, Skype, AIM, MSN, Jabber ...).

Instant messaging is by far the most common form of communication in recent times; it can (exchange text, voice, and video).

7. **Mailing list** - a group of e-mail names and addresses given a single name. When a message is sent to a mailing list, every person on the list receives a copy of the message in his or her mailbox. You can *subscribe or unsubscribe*.

### Netiquette

In e-mail, newsgroups and chat rooms:

1. Keep messages brief using proper grammar and spelling.
2. Be careful when using sarcasm and humor, as it might be misinterpreted.
3. Be polite. Avoid offensive language.
4. Avoid sending or posting flames which are abusive or insulting messages. Do not participate in flame wars which are exchanges of flames.
5. Avoid sending spam, which is the Internet's version of junk mail
6. Do not use all capital letters which is the equivalent of SHOUTING!
7. Use emoticons to express emotion. Popular emoticons include:
  - ☺ , :) Smile
  - \_ , :( Frown
  - :| Indifference
  - :\ Undecided
  - :o Surprised
8. Use abbreviations and acronyms for phrases such as
  - BTW by the way
  - FYI for your information
  - FWIW for what it's worth
  - IMHO in my humble opinion
  - TTFN ta ta for now (pá, pá)
  - TYVM thank you very much
9. Clearly identify a spoiler, which is a message that reveals a solution to a game or ending to a movie or program.
10. Read the FAQ (frequently asked questions)
11. Use your user name for your personal use only.
12. Do not assume material is accurate or up to date. Be forgiving of other's mistakes.
13. Never read someone's private e-mail.

A **pager** is an electronic device used to contact people via a paging network. It pre-dates mobile phone technology, being most popular during the 1980s and 1990s, but similarly uses radio transmissions to communicate between a control/call centers and the recipient. Many of today's pagers use the FLEX on-air protocol.

Here are two related meanings to the word **paging** in telecommunications.

- The first is the general act of broadcasting a message through a network in order to contact a remote radio system. This is used in cellular networks, for example, and is covered in detail in that entry.

- **Paging** in the other, more widely known sense means the use of a paging device through a paging service. The paging device is a telecommunications device that alerts the user via a sensory message, such as an audible beep, flashing, vibration, or an updated display. The paging service is a service provided by the tele operator that can be used to send one-way messages to the subscriber of the paging service.

**Bluetooth** provides a way to connect and exchange information between devices like personal digital assistants (PDAs), mobile phones, laptops, PCs, printers and digital cameras via a secure, low-cost, globally available short range radio frequency.

**Wi-Fi** (also **WiFi**, **Wi-fi**, **Wifi**, or **wifi**): A person with a Wi-Fi device, such as a computer, telephone, or personal digital assistant (PDA) can connect to the Internet when in proximity of an access point. The region covered by one or several access points is called a hotspot.

Hotspots can range from a single room with a single person connecting to the internet, to large metropolitan areas. Wi-Fi also allows connectivity in peer-to-peer mode, which enables devices to connect directly with each other. This connectivity mode is useful in consumer electronics and gaming applications.

Electronic memory comes in a variety of forms to serve a variety of purposes. **Flash memory** is used for easy and fast information storage in such devices as digital cameras and home video game consoles. It is used more as a hard drive than as RAM.

### Basic Internet Terminology

1. Address Location: shows the URL (Uniform Resource Locator), address of the web document currently displayed on the monitor.
2. Browser: a software tool for exploring the World Wide Web and the Internet.
3. Home Page: the first web page displayed by the browser.
4. Internet: a vast network of computers connecting people and resources around the world.
5. Keyword: a word or phrase used as a descriptive reference to information that is being searched for on the internet.
6. Location: the address or URL of the web page shown on the monitor.
7. Net: a synonym for the internet
8. Network: the system of interconnected locations that makes up the internet and functions to link information providers together.
9. Search: the use of a browser or search engine to look for, and locate, information and/or resources on the internet.
10. Search Engine: an internet tool that speeds the search for information and resources on the internet. GOOGLE is an example of a search engine.
11. URL: uniform resource locator
12. Web: a synonym for the World Wide Web.
13. Web Address: the address of information and/or resources available on the internet.
14. World Wide Web: a collection of standards and protocols used to access information available on the internet.
15. WWW: the World Wide Web.

### URLs

The Uniform Resource Locator (URL) was developed as a standard way to specify the location of an electronic resource.

## BCA I Fundamental of Computers

There are several types of URL's but the most common one is http (hypertext transfer protocol).

URLs have two components (parts):

1. the protocol used
2. the address to the requested information

There are several protocols that you may encounter. Below are the three most common types:

1. http: http stands for hypertext transfer protocol. These are Web pages. A variation of this is https which stands for hypertext transfer protocol with a secure link.
2. ftp: ftp stands for File Transfer Protocol. It is used to upload or download various files.
3. mailto: mailto this protocol points to an e-mail address. With most browsers, simply clicking on a mailto link will launch your e-mail program.

URLs generally follow three rules. These are:

1. A URL has no spaces in it.
2. URLs always use the forward ( / ) slash.
3. There is no room for error.