computer system

Definition:-

System: A collection or combination of several units in a proper (systematic) way such that we can get our set goal/objectives. E.g.

   A traffic system, A system of courier, A system of school, a computer system etc.

Computer system:-

In very simple way we can understand its meaning. To achieve a goal or get solved our problem we combine many integrated components properly which in total is called "computer system". It is obviously that a computer system can have major components like, hardware, software and liveware. If we go deeply we can have many other sub-components. Like computer, we have other systems, Railway, Banking, Courier, Airlines system with computerised system.

Meaning of computer architecture and computer organization: Let's see following table to understand.

computer Architecture:	computer organization:
1.It says about design.	1.It says about association.
2. It comes first.	2.It comes after design.
3. It is time consuming task.	3. It is not.
4.The main target is "HOW".	4.The main target is "what you want to do on computer".
5.It is self dependent or on designers.	5. It is on architecture and can not do anything without architecture.
6. e.g. A layout or blueprint before construction of house.	6. Organization reveals its performance with placement of different components like brick,cement etc.
7. Design of circuit,memory processor (16/32 bits).	7. In computer sense, connection of keyboard,mouse etc

For example, if you buy a home, the empty house is a result of the architecture. But when you move in and fill it with your stuff, your stuff and where you put it is the organization. For example, if you put a desk, bookcase and computer in an upstairs bedroom, it's not a bedroom anymore, but an office. And if you put a desk and computers in the dining room, it's not a dining room anymore, but an office or family room. What it is depends on your organization.

Digital diagram/architecture of computer:-

The typical diagram of computer architecture with different unit is shown below.
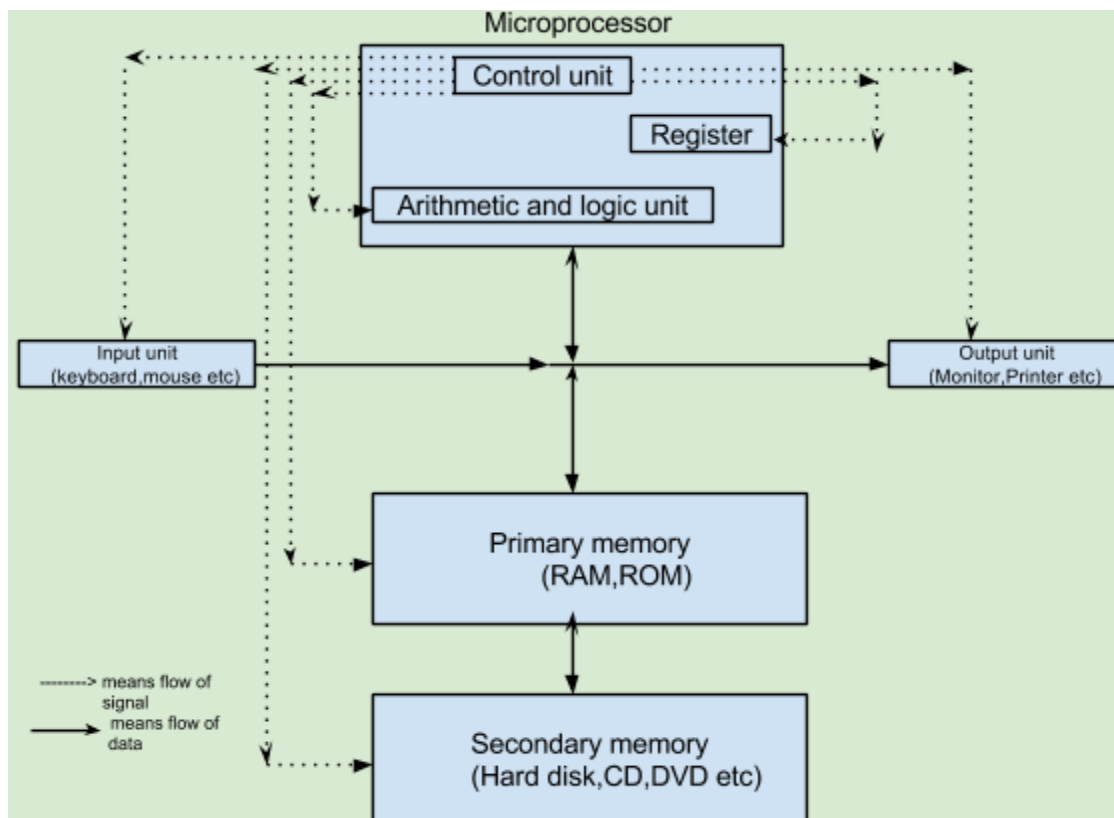
The explanation of every unit is given below.

Input Devices:

An input device is any peripheral (piece of computer hardware equipment) used to provide data and instructions to the computer. Input Devices Include the Mouse, Keyboard, Touch Screen Monitor, Scanner, Track Pad, Microphone, Joystick, Web Camera. These also can be use[1]d to activate the applications on screen.

FUNCTIONS OF CONTROL UNIT

Definition:

The control unit maintains/controls entire system.It works like in same way as our brain does. It follows the order within the computer system and directs the flow of traffic(operations) and data and instructions.
- It carries out many tasks such as encoding,decoding, fetching.
- It handles the execution and finally storing the results.
- It controls the execution of instructions in a sequential order.
- It guides the flow of data through the different parts of the computer.
- It regulates the time controls of the processor.

ALU functions:-

Definition:

A unit which carries out all necessary operations and takes decisions. It has following major roles.
- The arithmetic-logic unit (ALU) performs all arithmetic operations (addition, subtraction,multiplication, and division)
- responsible for logic operations.Logic operations test various conditions encountered during processing and allow for different actions to be taken based on the results.
- it fetches/stores all data from/to registers.

Further, it has one more unit called "Register" which it uses more frequently. It is simply a location inside microprocessor which holds data/instructions/outputs for a while. It has many types like, MAR (memory address register), MBR (memory buffer register), program counter, Accumulator register,Instruction Register etc.

Storage unit:-

Definition:-

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This unit (or a device) which system uses to store data or instruction or applications may be for short (temporarily) time or long time(permanently) is called storage unit.It stores information (i.e. instruction data intermediate and final result of processing) that arrives via the input unit or processing unit for a while or for longer time or so that this information is made available to the appropriate unit whenever needed.

It has two types:

1. Primary (main memory or internal memory or memory)
2. Secondary (back-up or mass)

Primary memory: The main functions of "main memory" are:

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1. to store instruction which is under process
2. to store data which is being processed
3.to store instruction waiting to be processed.
4. to store data waiting to be processed.
5. to store result and to use it for further process.
6. to store programs/applications,utilities used by computer to run smoothly.

The primary memory has further two types. They are:

1. RAM
2. ROM

Secondary memory:- The main function of secondary is to store huge amount of data/instructions,softwares etc and for everything for longer use.

Suppose, we want:

- to store unlimited data
- to back up our valuable data
- to analyze the data for future or decision taking
- not our data to be volatile etc
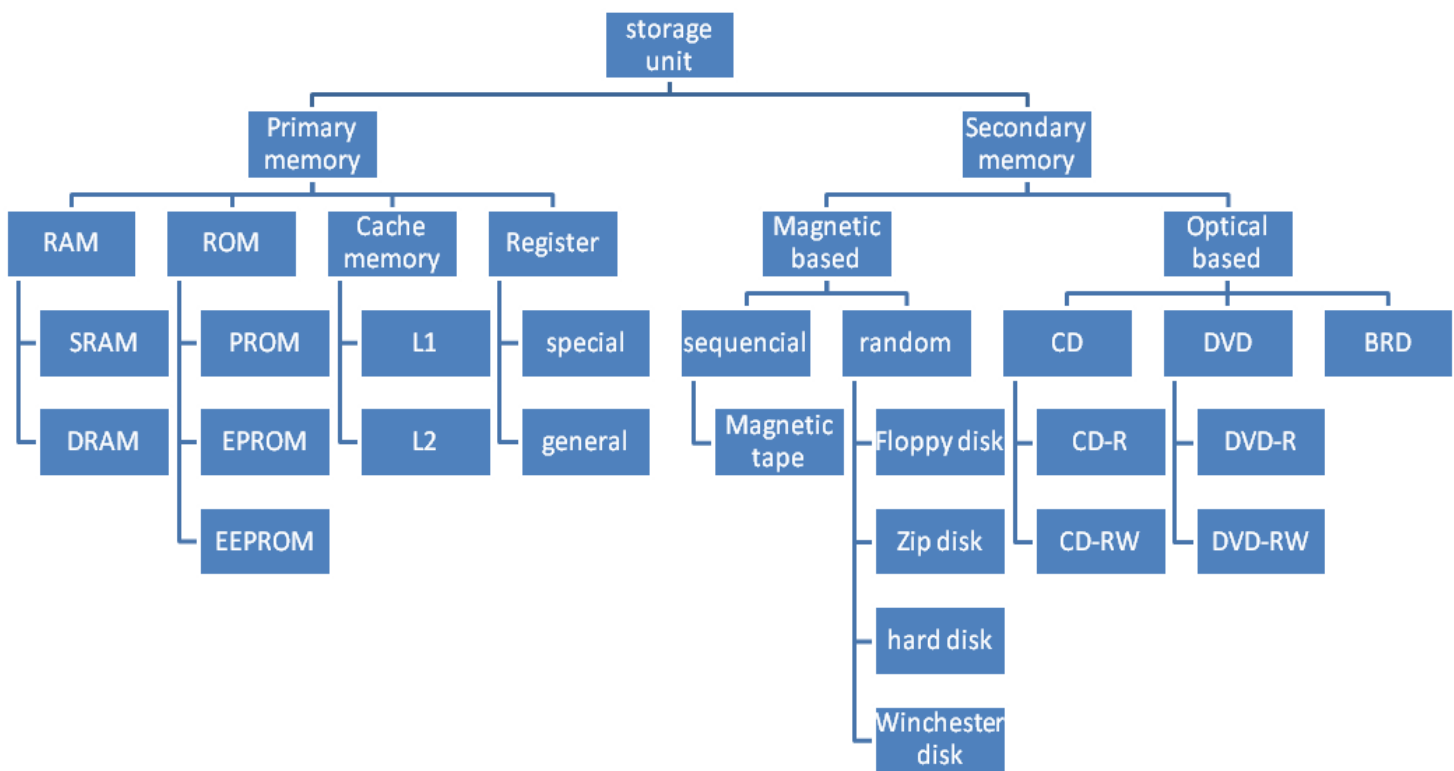
For these all we use secondary storage.

Output unit: A display/ unit which shows or displays everything like, on going processes,activated applications, what a user is entering , what is the output, what is the problem etc. This part is major part of system. For example, Monitor, plotter, printer etc. The purpose of these devices is to translate the machine's response to a usable form for the computer user. It can be categorized into two parts namely soft and hard output.

How digital architecture works?

To solve our problem we enter two things namely data and instructions. The data and instructions are entered via an input unit like keyboard or mouse under the control of control unit. Having entered, the data is stored inside main memory (RAM). The data resides there until the whole process is over. From 'RAM' the data to be processed under different instruction are taken into another location called 'Register'. Here the data/instruction or output is stored instantly by ALU. If anything more needed then it (may be by CU) asks with RAM or secondary media. The temporary output is displayed then on screen. If the user asks/thinks to store the output permanently then the computer takes that output from main memory to hard disk or any other media for future use.So, in this way we can see how different unit/s work together to solve our problem.

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Details about memory storage unit):-

The typical diagram of all storage units can be shown in following format.

storage unit
- Primary memory
  - RAM
    - SRAM
    - DRAM
  - ROM
    - PROM
    - EPROM
    - EEPROM
  - Cache memory
    - L1
    - L2
  - Register
    - special
    - general
- Secondary memory
  - Magnetic based
    - sequencial
      - Magnetic tape
    - random
      - Floppy disk
      - Zip disk
      - hard disk
      - Winchester disk
  - Optical based
    - CD
      - CD-R
      - CD-RW
    - DVD
      - DVD-R
      - DVD-RW
    - BRD

Let's see in detail about all.

Primary memory:

RANDOM-ACCESS MEMORY (RAM).— RAM, also called read/write memory, is like a chalkboard. You can write notes, read them, and erase them when you no longer need them. In the computer, RAM is the working memory. Data can be read (retrieved) from or written (stored) into RAM just by giving the computer the address of the RAM location where the data is stored or is to be stored. When the data is no longer needed, you can simply write over it. This allows you to use the storage again for something else. RAM which stands for "Random Access Memory" , here, 'Random' means frequently writing and reading from and to. It can handle/store contents as long as power is on. As the power cuts off it loses everything. Due to this behavior it is also called "Volatile memory".

It has following major responsibilities.

`   1. to store instruction which is under process
2. to store data which is being processed
3.to store instruction waiting to be processed.
4. to store data waiting to be processed.
5. to store result and to use it for further process.
6. to store programs/applications,utilities used by computer to run smoothly.

The primary memory has further two types. They are:

1. SRAM
2. DRAM

SRAM	DRAM
a)It stores as long as power is on. It is static.	a)it stores for very short time; not the matter whether power is on or off. It is dynamic.
b) Transistors are used.	b) Memory cells are made up of small tiny capacitors
c) It is less dense.	c) It is dense in nature.

d) Charge doesn't leaks from transistors.	d) Charge leaks from capacitor.
e) It doesn't need periodic refreshing.	e) It needs periodic refreshing.
f) It is more expensive.	f) It is less expensive.
g) it is faster than DRAM	g) it is slower than SRAM

READ-ONLY MEMORY (ROM).— Just think for a while, from where computer gets instructions during start up, do we? Or do we enter any instructions in beginning, no. It is due to programs stored in a small chip called "ROM".It is useful to have often used instructions, such as those used to bootstrap (initial system load or start up) the computer or other specialized programs, permanently stored inside the computer. The memory that enables us or computer to do this without the programs and data being lost even when the computer is powered down or off is read-only memory (ROM). The contents are readable as many as a user or computer wants but can not be changed. It is non-volatile means it does not dependent on power or instructions do not get lost after power cut off.

It has following types.

PROGRAMMABLE READ-ONLY MEMORY (PROM).— A type of 'ROM' which we can buy already programmed by the manufacturer or in a blank state. Using a blank PROM and a device (PROM programmer) designed to write (burn) a program into PROM, we can enter any program into the memory. However, we cannot make any changes to the program once it has been written into PROM. But, PROM does provide flexibility not available with ROM. Of course, we must be sure the program is error free before it is written into PROM.

ERASABLE PROGRAMMABLE READ- ONLY MEMORY (EPROM).— The erasable programmable read-only memory (EPROM) was developed to overcome the drawback of PROM. We can write programs at our command/activity using a special device. The big difference with EPROM is that we can erase it if and when the need arises. The data and programs can be retrieved many times. If you want to re-program memory, you first erase the EEPROM with a burst of ultraviolet light by taking it out and through a small window. This not only enables you to reprogram when requirements change, but also, you can erase and write the program again if a mistake is made while programming the EPROM. It it mostly done by skilled hardware engineers.

Electrically ERASABLE PROGRAMMABLE READ- ONLY MEMORY (EPROM).— This chip removes the biggest drawbacks of EPROMs.This chip can be electrically erased and reprogrammed.We do not need to take it out of system and no need to use UV rays. Just by using "Power" we can delete the contents and re-write the programs.It does not need to have small window like EPROM. Simply we can use software and hardware technology to change the programs. It is also called or has same nature as a Flash drive has with except some.

Register: For a while, let's suppose, our computer is going to perform 2+2x2. For this computer needs data (2) and instructions. We enter via an input unit. The data and instructions are first stored in memory unit called "RAM". But fetching data and instruction from "RAM" takes more time so our computer stores the data and instructions in a unit called "Register" and from there it goes for process.

Def:-

This unit is high speed storage area existing inside microprocessor. It can hold different things like operand, operator, instruction,output etc. It can have different types:

1.**Memory Address Register (MAR)**:- This register holds the memory addresses of data and instructions.

2.**Memory Buffer Register (MBR):-** This register holds the contents of data or instruction read from, or written in memory.

3.**Instruction register:-** Instruction register is the part of a CPU ' s control unit that stores the instruction currently being executed or decoded.(general purpose)

4.**Program Counter :**The program counter **(PC)**, commonly called the **instruction pointer** (IP) register which holds the address of the memory location of the next instruction to be executed.(general purpose)

5.**Accumulator Register**: This Register is used for storing the Results those are produced by the System.

Besides these all, we can have some other special purpose registers. Totally there can be 14 or more inside microprocessor.

Comparison of RAM and ROM:-

RAM	ROM
1. It is used for writing as well as reading.	1 it is used for only reading.
2. It holds the contents only if there is power.	2. It holds the contents in presence /absence of power.
3.it is used after start-up.	3. it is used mostly during start-up.
4. it has more storage capacity.	4. less storage capacity.
5.not so expensive.	5. it is expensive.
6. Mostly it is in unfixed form.	6. it is in fixed form.
7. two types namely SRAM and DRAM.	7. Many types PROM, EPROM and EEPROM

Firmware (microcode or microprogram):-

Just think for a while, from where computer gets instructions during start up, do we enter? Or do we enter any instructions in beginning, no. It is due to programs stored in a small chip called "ROM".

Only the computer manufacturer can install these programs into ROM, and, once installed, they cannot be changed. Yeah, these programs are called "Firmware".

Firmware is a software program permanently etched into a hardware device such as a keyboards, hard drive, BIOS, or video cards. It is programmed to give permanent instructions to communicate with other devices and perform functions like basic input/output tasks. Firmware is typically stored in the flash ROM (read only memory) of a hardware device. It can be erased and rewritten.Without firmware, a hardware device would be non-functional. Think about your remote control, think about mobile phone, etc. they all work by using firmware. It can have different level like,:

1. Low Level Firmware:
2. High Level Firmware:
3. Subsystems:

Concept of Microprocessor design: We can use two types of technology to design processor. They are RISC and CISC.

CISC	RISC
1. It has complex (more)instructions.	1. It has fewer instructions.
2.It has very complex architechture.	2. It has simple architecture.
3.It is slow and uses more power.	3. It is fast and uses less power.
4.It uses more no. of transistors.	4.It uses less no. of transistors.
5.It is expensive to produce.	5.It is cheaper to produce.
6.It utilizes more no. of cycles.	6. It utilizes less no. of cycles.

Concept of "BUS":- To have a communication between several units our computer uses many or a set of wires,which is called Bus.
 Or
We can say a medium or a physical path used by system to carry signal,data,instruction from one unit to another. It can be considered as a highway on which data travels with high speed inside the system. It is measured in MHZ.

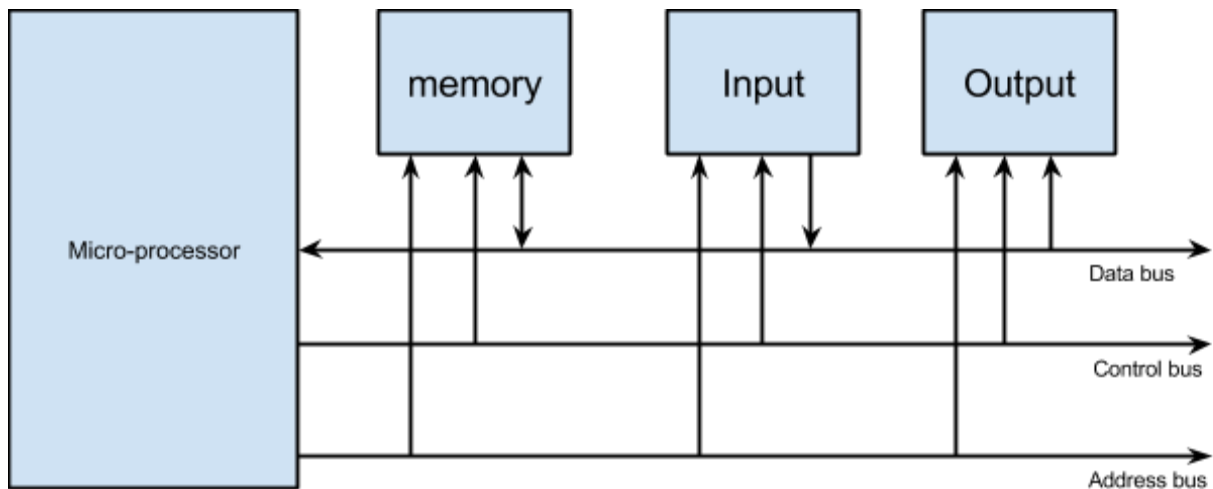The diagram of bus architecture is shown below.

Fig. 1 Bus architecture

Types and explanation:-

        1. Address bus:- A bus which

                ->carries the address of data,device etc

                -> is unidirectional (just like one lane).

                ->can have many wires (8 or 16 or more)

        2. Control Bus:- A bus which

                ->carries controlling signal incoming from control unit

                ->carries signal like reading or writing or interpreting.

                ->is one way(unidirectional)

        3.Data bus:-A type of bus which

                -> carries data to/from different units

                ->is bidirectional

                ->can have 16/32 wires to carry data.

memory types..

      continued.....

cache memory:

        A high speed storage area or location which is used to store data/information.Normally we say it is a part of RAM or simply SRAM.It uses special high-speed storage mechanism. This memory can be seen in fixed form between processor and RAM or in some inside the processor and provides frequently used data.The CPU uses cache memory to store instructions that are repeatedly required to run programs, improving overall system speed.

        There are two types.

        1. Internal cache (L1): An L1 (level 1) cache is on the same chip as the microprocessor i.e. it exists inside the microprocessor chip. so It can be said internal to processor.

        2. External cache(L2):- An L2 (level 2) is usually a separate static RAM (SRAM) chip. The main RAM is usually a dynamic RAM (DRAM) chip. It is external to processor and lies in middle part of processor and RAM.

        Some other processors can have L3 cache built on it.

      How it works:-

        Suppose, we have opened some applications or going to activate. As we open that the

computer first searches that application/data/instruction in cache memory, if it is there then computer loads from there,this process is called cache hit. Suppose, the data searching for is not there then computer gives command to main memory to load into cache. This process is called cache miss.

Buffer:-

It is an area or a part of RAM used by system to store input,output temporarily. It is used before the data is used by the system. For example, when we give a command to printer to print, the data or document first is stored in buffer area an then transferred to printer. when you download an audio or video file from the Internet, it may load the first 20% of it into a buffer and then begin to play. While the clip plays back, the computer continually downloads the rest of the clip and stores it in the buffer. Because the clip is being played from the buffer, not directly from the Internet, there is less of a chance that the audio or video will stall or skip when there is network congestion.

let' see following diagram to be more clear about reading,writing, storing from and to.
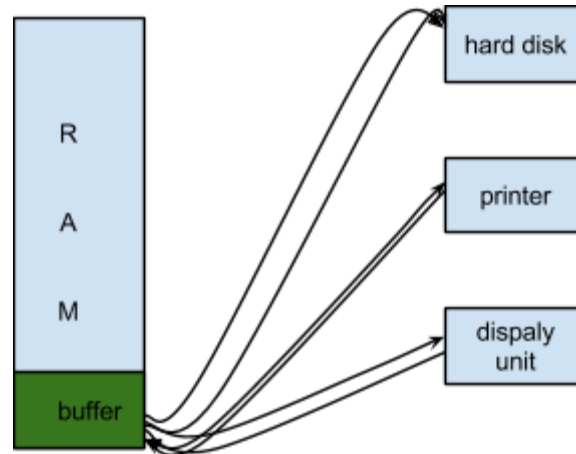
Flash drive:-

A flash drive is a small storage device that can be used to transport files from one computer to another. Flash memory is a type of EEPROM chip, which stands for Electronically Erasable Programmable Read Only Memory. It uses mostly NAND gate to store data. unlike others it does not contain any moving part because it uses completely semiconductor technology. It can store huge amount of data and is available in different size like 4 GB,8GB,16 GB etc.

PERIPHERAL DEVICES:- Peripheral devices include all the I/O,memory,output devices connected to system for a particular function. They can work dependently or independently.

SECONDARY STORAGE:- Suppose, we want:

- to store unlimited data
- to back up our valuable data
- to analyze the data for future or decision taking
- not our data to be volatile etc

then any ways left?????????

Yeah, we have. That is by using storage media like hard disk, cd or DVD etc.

This is memory outside the main body of the computer where we store programs and data for future use. When the computer is ready to use these programs and data, it reads them into primary storage. Secondary (auxiliary) storage media extends the storage capabilities of the computer. We need secondary storage for two reasons. First, because the computer's working memory (primary storage) is finite and limited in size, it cannot always hold all the data we need. Second, in secondary storage, data and programs do not disappear when power is turned off as they do when semiconductor memories are used. Secondary storage media are nonvolatile memories. This means the information is lost only if you or the users intentionally erase it. The secondary storage media can have following types.
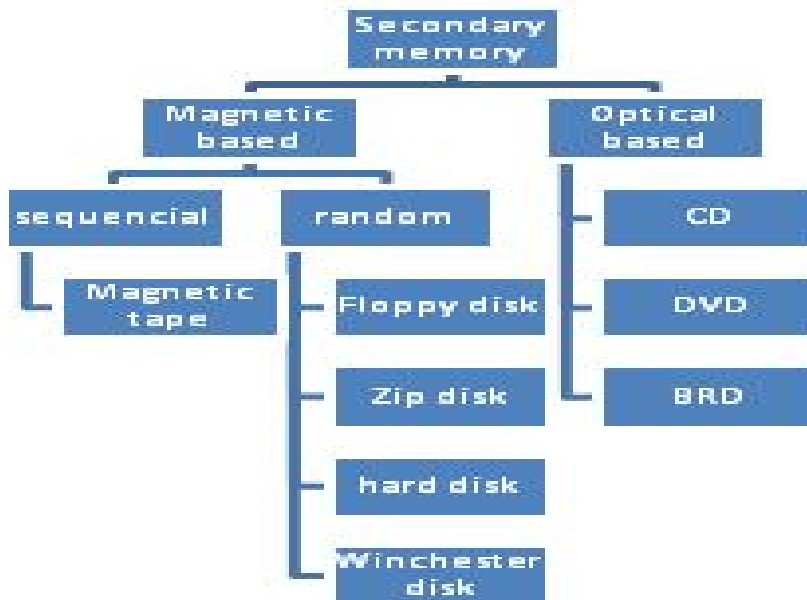
Floppy disk:-

Below is a graphic of a 3.5" floppy diskette. As can be seen by the below picture, this particular diskette is clear, which enables you to see inside of the diskette. You can notice that the floppy has a circular cloth that is located on both sides of the floppy; this cloth helps clean and protect the magnetic disk within the diskette.In the diagram, notice the small write protect tab. This tab enables the floppy disk to be switched from write-protected and unwrite-protected. Move the tab to the top position, creating a hole, makes the disk write protected. This means that nothing can be written or deleted from the diskette. Moving the tab to the bottom position allows the disk to be un-write protected, which means the diskette can be written too, erased, or have information deleted from the diskette. Some diskettes, which are cheaper diskettes, will be missing this tab. To write information to the diskette you will have to place a piece of scotch tape over the hole.

Second, the top-right hand of the back of the floppy you will notice a small hole. This tells the computer if the diskette within the computer is a High Density diskette.

Third, the circular metal disk in the middle of the floppy diskette. This is used to rotate the magnetic medium within the floppy disk casing. Finally, there is a metal door (shutter) that can be moved left and then will snap back to its original position. This door is used to allow the read/write head within the floppy drive to have the capability of accessing the magnetic medium within the casing. Once the diskette is removed, this door will snap back into position, helping to prevent anything from getting on the magnetic medium and destroying it. This also makes these types of diskettes more reliable than the earlier 5.25" diskettes.
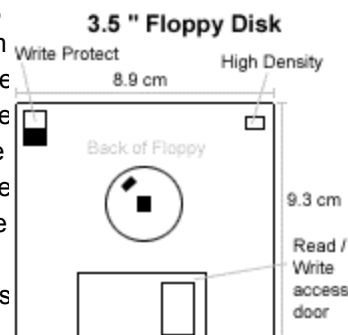
Hard disk:-

When we save data or install programs on your computer, the information is typically written to our hard disk.

The hard disk is a spindle of magnetic disks, called platters (with read/write head), that record and store information and they are fixed in a sealed unit.

It has several components as shown in figure. Some are :

Boom:- a support bar for write/read heads

Spindles:- A spindle/axis around which plates rotate

Cylinder:- a shape in which all plates are arranged etc.

The arrangements are like in cylindrical form. Because the data is stored magnetically, information recorded to the hard disk remains intact after we turn our computer off. This is an important distinction between the hard disk and RAM, or memory, which is reset when the computer's power is turned off.

The hard disk is housed inside the hard drive, which reads and writes data to the disk. The hard drive also transmits data back and forth between the CPU and the disk. When you save data on your hard disk, the hard drive has to write thousands, if not millions, of ones and zeros to the hard disk. It is an amazing process to think about, but may also be a good incentive to keep a backup of your data. a hard disk can store normally 40 GB, 80Gb,160 or
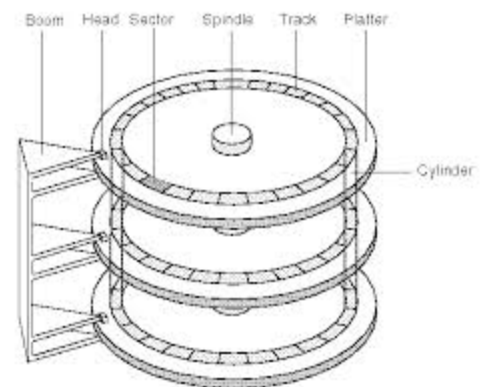
more. But now-a-days hard disk with semiconductor technology is available.

External and Internal hard drives

Although most hard drives are internal hard drives, many users also use external hard drives to backup data on their computer and expand the total amount of space available to them. External drives are often stored in an enclosure that helps protect the drive and allow it to interface with the computer, usually over USB or eSATA. A great example of a backup external device that supports multiple hard drives is the Drobo.

External hard drives come in many shapes and sizes. Some are large, about the size of a book, while others are about the size of a cell phone. External hard drives can be very useful for backing up important data and taking with you on the go. They can store a lot of information, including music and movies.

advantages:-

    1. huge amount of data can be stored.
    2. long term storing.
    3.protection from dust.
    4.back up.

Magnetic tape (sequential access medium):-

- A sequential storage medium used for data collection, backup and archiving. Like videotape, computer tape is made of flexible plastic with one side coated with a ferromagnetic material.
- Tapes were originally open reels, but were superseded by cartridges and cassettes of many sizes and shapes.
- Tape is much less expensive than other storage mediums but commonly a much slower solution that is commonly used for backup.
- Tape has been more economical than disks for archival data, but that is changing as disk capacities have increased enormously. If tapes are stored for the duration, they must be periodically recopied or the tightly coiled magnetic surfaces may contaminate each other.

Sequential Medium

The major drawback of tape is its sequential format. Locating a specific record requires reading every record in front of it or searching for markers that identify predefined partitions. It stores data in an order i.e. one after another.so reading a particular record is sometimes cumbersome and takes more time. so why it is called sequential.

Track Formats

- Tracks run parallel to the edge of the tape (linear recording) or diagonally (helical scan). A linear variation is serpentine recording, in which the tracks "snake" back and forth from the end of the tape to the beginning.
- Legacy open reel tapes used nine linear tracks (8 bits plus parity), while modern cartridges use 128 or more tracks having ½ inch width or less and 2400 feet.
- Data are recorded in blocks of contiguous bytes, separated by a space called an "inter record gap" or "interblock gap."
- Tape drive speed is measured in inches per second (ips). The head is used to read/write/erase data written over tape. typically it can store 200 GB or more.

advantages:

    1.more data
    2. very compact in size.
    3.economical

Disadvantages:

    1. fear of data loss if not used for long time(rusting)
    2. slow.
    3.unreliability

Optical media:

CD ROM:-

A compact disc is a thin, circular disc of metal and plastic about 12cm (just over 4½ inches) in diameter.

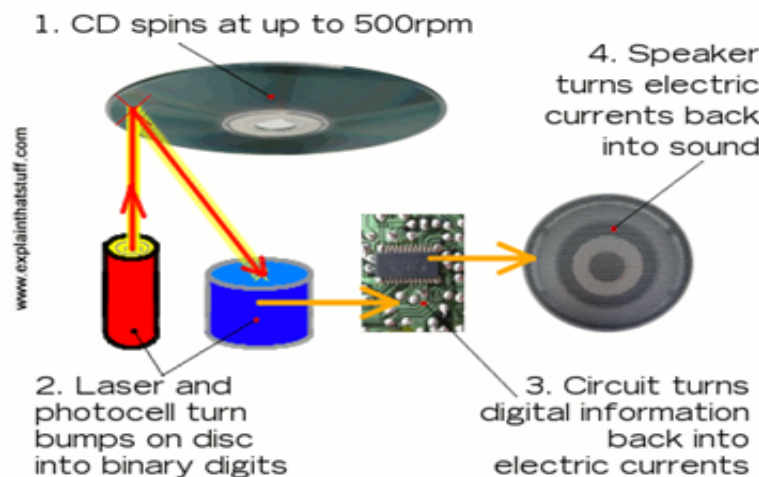It's actually made of many (two or three) layers.

Most of a CD is made from a tough, brittle plastic called polycarbonate. we can have many types like CD,,DVD,BRD.

How it works:

- Inside your CD player, there is a miniature laser beam (called a semiconductor diode laser) and a small photoelectric cell (an electronic light detector).
- When you press play, an electric motor (not shown in this diagram) makes the disc rotate at high speed (4000 rpm).

The laser beam switches on and scans along a track, with the photocell, from the center of the CD to the outside.
- The motor slows the disc down gradually as the laser/photocell scans from the center to the outside of the disc (as the track number increases, in other words).
- Otherwise, as the distance from the center increased, the actual surface of the disk would be moving faster and faster past the laser and photocell, so there would be more and more information to be read in the same amount of time.
- We have many cds like DVD and BRD. The storage capacity varies from disc to disc. They can store more bits because of writing data in small size and in different layer. Comparatively BRD has more number of layers which use short wavelength (blue rays)to read/write/erase.
- The laser flashes up onto the shiny (underside of the CD, bouncing off the pattern of pits (bumps) and lands (flat areas) on the disc. The lands reflect the laser light straight back, while the pits scatter the light. The BRD has very close distance between lands so it can store large amount of data in comparison of CD and DVD.
- Every time the light reflects back, the photocell detects it, realizes it's seen a land, and sends a burst of electric current to an electronic circuit that generates the number one. When the light fails to reflect back, the photocell realizes there is no land there and doesn't register anything, so the electronic circuit generates the number zero. Thus the scanning laser and electronic circuitry gradually recreates the pattern of zeros and ones (binary digits) that were originally stored on the disc in the factory. Another electronic circuit in the CD player (called a digital to analog converter or DAC) decodes these binary numbers and converts them back into a changing pattern of electric currents.

1. CD spins at up to 500rpm
www.explainthatstuff.com
2. Laser and photocell turn bumps on disc into binary digits
3. Circuit turns digital information back into electric currents
4. Speaker turns electric currents back into sound

Input devices

Keyboard:-

As the name implies, a keyboard is basically a board of keys. Along with the mouse, the keyboard is one of the primary input devices used with a computer (mostly for CUI interfaces). The keyboard's design comes from the original typewriter keyboards, which arranged letters and numbers in a way that prevented the type-bars from getting jammed when typing quickly. This keyboard layout is known as the QWERTY design, which gets its name from the first six letters across in the upper-left-hand corner of the keyboard.

While the design of computer keyboards may have come from typewriters, today's keyboards have many other keys as well.

1. Modifier keys, such as Control, Alt, and Command (Mac) or the Windows key (Windows)
2. function keys (F1 through F16) along the top of the keyboard, arrow keys arranged in an upside-down
3. numeric keypad on the right-hand side for mathematical calculations.
4. Internet keys such as your e-mail or Web browser.
5. Alphanumeric keys (a,b,c.....A...Zand 01,2,3..9)
6. Cursor movement keys (to move cursor key in any direction) etc
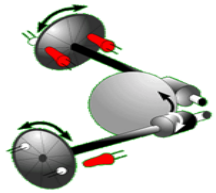
Mouse:-

A device that controls the movement of the cursor or pointer on a display screen.

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

It has following types.

1. Mechanical: Has a rubber or metal ball on its underside that can roll in all directions. Mechanical sensors within the mouse detect the direction the ball is rolling and move the screen pointer accordingly.

2. Opt mechanical: Same as a mechanical mouse, but uses optical sensors to detect motion of the ball.

3. Optical: Uses a laser to detect the mouse's movement. You must move the mouse along a special mat with a grid so that the optical mechanism has a frame of reference. Optical mice have no mechanical moving parts. They respond more quickly and precisely than mechanical and opto mechanical mice, but they are also more expensive.

How a ball mouse works:-

- A mouse contains a rotating ball with two rollers held at right angles to each other which touch the ball. The rollers register the x and y axis movements of the ball.
- Each roller is attached to an optical encoder, a disc which has gaps in its surface. The rotation of the encoder interrupts two beams of light between the LEDs and their detectors. These pulses of light are fed to the computer and are used to determine the speed and direction of the mouse's movement.
- An optical mouse works in a completely different way. It shines a bright light down onto your desk from an LED (light-emitting diode) mounted on the bottom of the mouse. The light bounces straight back up off the desk into a photocell (photoelectric cell), also mounted under the mouse, a short distance from the LED. The photocell has a lens in front of it that magnifies the reflected light, so the mouse can respond more precisely to your hand movements. As you push the mouse around your desk, the pattern of reflected light changes—and the chip inside the mouse uses this to figure out how you're moving your hand.

Joystick:

- In simple terms, a joystick transfers the motion of your hand, something very real, into the digital information needed to make the computer action happen.
- With a good joystick the computer user or gamer is able to interact with this virtual world.

  Principle:

- The printed wires form a simple electrical circuit made up of several smaller circuits.
- The circuits just carry electricity from one contact point to another. When the joystick is in the neutral position -- when you're not pushing one way or another -- all but one of the individual circuits are broken. The conductive material in each wire doesn't quite connect, so the circuit can't conduct electricity.
-
- It is based on the principle of conversion of physical movement into a digital signal which when accepted by the device produce same results on the screen. The joystick starts working only when it is connected to the computer or the gaming device. While playing the game, every time the user makes a movement on the joystick, the wires in the device connects a game or circuit with one another and the computer to produce the same movement in the virtual body in the game or the application.
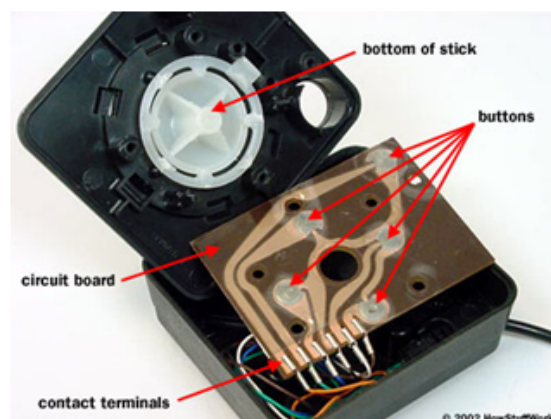
Light pen:
- A small, photosensitive device connected to a computer and moved by hand over an output display in order to manipulate information in the computer.
- A light-sensitive stylus wired to a video terminal used to draw pictures or select menu options.
- The user brings the pen to the desired point on screen and presses the pen button to make contact and photocell inside the pen senses that.. Contrary to what it looks like, the pen does not shine light onto the screen; rather, the screen beams into the pen.
- Screen pixels are constantly being refreshed. When the user presses the button, the pen senses light, and the pixel being illuminated at that instant identifies the screen location.

Touch pad:
- A touchpad allows users to drag their fingers along in the direction they want the mouse pointer to go.
- It does this by sensing the pressure of the finger along a vertical and horizontal electrode grid just beneath the surface "skin." AC travels through the electrodes to the circuits.
- These circuits check the capacitance of both grid layers against each other. This determines where the pointer is and where it should be moved to. It's sort of an electronic version of triangulation in that the touchpad has to take your three-dimensional movements, figure out where your finger is and where it's going, and then translates this into two-dimensional movement of the pointer on the screen

Trackball:
- A trackball is essentially a different kind of computer mouse.
- It is a plastic case containing a ball on the top that moves a computer cursor around on the screen.
- The user can move the ball with their thumb or fingers, and sensors inside the case detect which direction the ball is moving. Unlike a mouse, however, the case doesn't move. The user simply rests a hand on it and uses the thumb to move the ball around. Buttons on the side allow users to click on things on screen.
- Optical trackballs work with infrared light sensors and have tiny dots on the balls themselves. As you use the trackball, the optical sensors record the moving dots and send the data to the computer.
- Uses while the standard mouse has replaced the trackball for the majority of home computer users, a lot of specialized work environments still use trackballs due to their precision. Trackballs are used in a variety of fields, from air-traffic controlling to operating equipment to drafting and design work.
- They are considered more durable than a mouse and more precise, which is why they are still used in these fields.

Touch screen:
A touch screen is a bit like an invisible keyboard glued to the front of your computer monitor. It can have following main parts.
- The touch sensor is a panel with a touch responsive surface. Systems are built based on different types of sensors: resistive (most common;it contains two resistive materials with an air gap in between them. Touching the screen causes the two materials to come closer, which is then detected as an input by the electronic device.), surface acoustic wave (sound wave over its surface which gets absorbed by touching then chip figures out the position), and capacitive (most smart phones having multi layer glass;electrodes to sense the touch of an object that simply has the dielectric value different than that of air.). However, in general sensors have an electrical current running through them and touching the screen causes a voltage change. The voltage change signals the location of the touching.
- The controller, is the hardware that converts the voltage changes on the sensor into signals the computer or other device can receive.
- Software tells the computer, smartphone, game device, etc, what's happening on the sensor and the information coming from the controller. Who's touching what, where; and allows the computer or smartphone to react accordingly.

Digitizing tablet:-
A graphics tablet (or digitizer, digitizing tablet, graphics pad, drawing tablet) is a computer input device that enables a user to hand-draw images and graphics, similar to the way a person draws images with a pencil and paper. These tablets may also be used to capture data or handwritten signatures. It can also be used to trace an image from a piece of paper which is taped or otherwise secured to the surface. Capturing data in this way, either by tracing or entering the corners of linear poly-lines or

shapes is called digitizing.

Digitizing tablet or digital representation is the use of a set of preordained points to represent an object, image, sound, or document in digital format. The tablet combined with a pen or stylus serves as the means to enter the data into a computer. Tablet and stylus are input devices just like a keyboard or mouse. The mechanism for sending the data is found in the tablet but the stylus plays a large roll in what is recorded. Not only are the coordinates noted through the tablet but the angle, the pressure and the distance of the stylus can have an affect on what appears on the monitor. The stylus transmits signals that the tablet identifies through coordinates and then transmits when plugged into the computer.

Digital camera:-

Digital camera that stores images digitally rather than recording them on film.

Once a picture has been taken, it can be downloaded to a computer system, and then manipulated with a graphics program and printed. Unlike film photographs, which have an almost infinite resolution, digital photos are limited by the amount of memory in the camera, the optical resolution of the digitizing mechanism, and, finally, by the resolution of the final output device. Even the best digital cameras connected to the best printers cannot produce film-quality photos. However, if the final output device is a laser printer, it doesn't really matter whether you take a real photo and then scan it, or take a digital photo. The entire digital image file is then a collection of numbers that represent the location and brightness values for each square in the array. These numbers are stored in a file that our computers can work with.

Microphone:

A microphone is an electromechanical device that uses vibration to create an electrical signal proportional to the vibration, which is usually an air pressure wave.

1.   When you speak, **sound waves** created by your voice carry energy toward the microphone. Remember that sound we can hear is energy carried by vibrations in the air.

2.   Inside the microphone, the **diaphragm** (much smaller than you'd find in a loudspeaker and usually made of very thin plastic) moves back and forth when the sound waves hit it.

3.   The **coil**, attached to the diaphragm, moves back and forth as well.

4.   The **permanent magnet** produces a magnetic field that cuts through the

coil. As the coil moves back and forth through the magnetic field, an electric current flows through it.

5.you could amplify (boost the size of) the current and then feed it into a loudspeaker, turning the electricity back into much louder sound. That's how PA (personal address) systems, electric guitar amplifiers, and rock concert amplifiers work.Microphones are commonly used in television, radio, concerts, telephones, and public address systems, but also in other unusual applications.
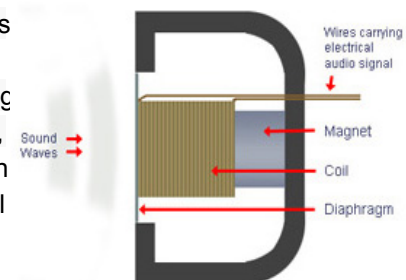
Scanner:

Devices that can read text or illustrations printed on paper and translate the information into a form the computer can use. A scanner works by digitizing an image -- dividing it into a grid of boxes and representing each box with either a zero or a one, depending on whether the box is filled in. (For color and gray scaling, the same principle applies, but each box is then represented by up to 24 bits.) The resulting matrix of bits, called a bitmap, can then be stored in a file, displayed on a screen, and manipulated by programs.

Types:-

·   Flatbed scanners, also called desktop scanners, are the most versatile and commonly used scanners.

·   Sheet-fed scanners are similar to flatbed scanners except the document is moved and the scan head is immobile. A sheet-fed scanner looks a lot like a small portable printer.

·   Handheld scanners use the same basic technology as a flatbed scanner, but rely on the user to move them instead of a motorized belt. This type of scanner typically does not provide good image quality. However, it can be useful for quickly capturing text.

OCR:

Often abbreviated OCR, optical character recognition refers to the branch of computer science that involves reading text from

paper and translating the images into a form that the computer can manipulate (for example, into ASCII codes).

An OCR system enables you to take a book or a magazine article, feed it directly into an electronic computer file, and then edit the file using a word processor.

All OCR systems include an optical scanner for reading text, images including bitmap or others and sophisticated software for analyzing images. Most OCR systems use a combination of hardware (specialized circuit boards) and software to recognize characters, although some inexpensive systems do it entirely through software. Advanced OCR systems can read text in large variety of fonts, but they still have difficulty with handwritten text.

How it works:

Here are two basic methods used for OCR: Matrix matching and feature extraction. Of the two ways to recognize characters, matrix matching is the simpler and more common.

Matrix Matching compares what the OCR scanner sees as a character with a library of character matrices or templates. When an image matches one of these prescribed matrices of dots within a given level of similarity, the computer labels that image as the corresponding ASCII character.

OMR:

Short for Optical Mark Reading or Optical Mark Readers

- OMR is a system that gathers information by using a hardware device that detects a reflection or an absence of reflection from a card or piece of paper. OMR enables the processing of hundreds or thousands of documents every hour automatically.
- Optical mark recognition' is the process of capturing data by contrasting reflectivity at predetermined positions on a page.
- By shining a beam of light onto the paper the scanner is able to detect a marked area because it reflects less light than the blank areas of the paper.
- Some OMR devices use forms which are pre printed onto 'Transoptic' paper and measure the amount of light which passes through the paper, thus a mark on either side of the paper will reduce the amount of light passing through the paper.
- OMR processing is popular for tests, where students receive a special card containing several empty circles and a packet that contains the questions and possible answers to each of the questions. The student must complete the test by using a pencil to fill in each blank circle with what he or she believes is the correct answer.
- For example, if the answer is "B", the student would have to completely fill in the "B Circle" in order to get the answer correct.

MICR:-

- MICR is a font capable of recognition using magnetically charged ink.
- Computers equipped with the right hardware and software can print or read the character printed in such ink.
- In computing, a technique that enables special characters printed in magnetic ink to be read and input rapidly to a computer.
- MICR is used extensively in banking because magnetic-ink characters can be machine-read with much greater accuracy than human reading or other optical character recognition (OCR) systems, and are therefore ideal for marking and identifying the account and sort code numbers on cheques.
- Magnetic ink character recognition is used most exclusively by the banking industry for processing checks.
- The characters represent the check number, the bank number, and the account number of customers.
- When a machine reads a document printed with magnetic ink characters, it looks for very specific characters and character placement. Machines first look in very specific areas of the document for the magnetic ink data. Machines configured to read bank checks, for example, always look in the lower left corner of the document and read characters left to right; machines configured for other purposes may look in different parts of the document for the magnetic data. Machines then read the special MICR characters that indicate what data the machine is to read, and finally read the special magnetic fingerprints of the characters themselves. If the special characters tell the reader to expect certain data, and that data is not present or is not printed with magnetic ink, the machine rejects the document and returns an error. If all of the data is properly read and magnetic ink character recognition computers can assemble the data, they develop a complete and accurate recreation of the read data in an electronic version.

Output devices:

Softcopy: The output received on the display screen or in the audio or video forms, is called soft copy output. This kind of output is not tangible and it cannot be touched. Although this may seem to be a limitation, the image can quickly be changed, as in the case of graphic animation, to create movement. It can be transported from one computer to another through file

transfer/downloading mechanisms such as ftp or http, as an email attachment, or through USB drives and other disk drives. Keeping a digital copy of a document can allow easy editing of it later on.

Monitor:

CRT:

- It contains glass vacuum tubes (fragile) into which an electron gun emits a flow of electrons guided by an electrical field towards a screen covered in small phosphorescent elements.
- The electron gun is made up of a cathode, a negatively charged metallic electrode, and one or more anodes (positively charged electrodes). The cathode emits the electrons attracted by the anode.
- The anode acts as an accelerator and concentrator for the electrons, forming a flow of electrons aimed at the screen.
- A magnetic field guides the electrons from left to right and from top to bottom.
- It (magnetic field) is created with two electrified X and Y plates (called deflectors) which send the flow horizontally and vertically, respectively.
- The screen is covered with a fine layer of phosphorescent elements, called phosphors, which emit light by excitation when electrons strike them, creating a lit-up dot called a pixel.
- Activating the magnetic field causes the electrons to follow a scan pattern, going from left to right and then down to the next row once they reach the end.
- For color monitors, three electron beams (coming from three different cathodes) each strike a point with a specific color: red, green, and blue (RGB). Take a look on picture given alongside.

1. The size: This is calculated by measuring the diagonal of the screen, and is expressed in inches (an inch is about 2.54 cm).

2. The resolution: This determines the number of pixels per surface unit (given in linear inches). This is abbreviated DPI for Dots Per Inch.

3. The refresh rate: This represents the number of images which are displayed per second, or more precisely the number of times the image is refreshed each second.

4. The dot pitch: This represents the distance which separates two phosphors of the same color. The lower the dot pitch, the better the image quality.
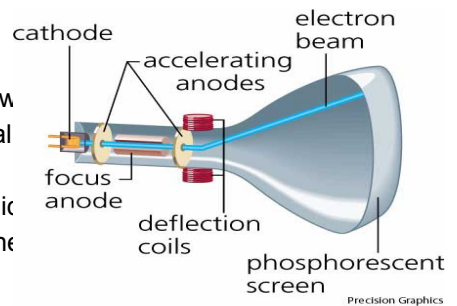
LCD:-

- Liquid crystal display technology works by blocking light.
- Specifically, an LCD is made of two pieces of polarized glass (also called substrate).
- It contains a liquid crystal material covered in transparent electrode between glass and holds it.
- A backlight creates light that passes through the first substrate. At the same time, electrical currents cause the liquid crystal molecules to align to allow varying levels of light to pass through to the second substrate and create the colors and images that you see.
- As electricity is coursed through the panel, the liquid inside changes its orientation, and sends the electricity to the electrodes covering the glass. This changes the illumination captured by the sub-pixels.
- It's a digital display technology that produces images on a flat surface by shining light through liquid crystals and colored filters
- Takes up less space, consumes less power, and produces less heat than traditional cathode-ray tube monitors.
- Lack of flicker and low glare reduce eyestrain.
- Much more expensive than CRTs of comparable size.

Most LCD displays use active matrix technology and some use passive. **under active:**

- A thin film transistor (TFT) arranges tiny transistors and capacitors in a matrix on the glass of the display.
- To address a particular pixel, the proper row is switched on, and then a charge is sent down the correct column.
- Since all of the other rows that the column intersects are turned off, only the capacitor at the designated pixel receives a charge. The capacitor is able to hold the charge until the next refresh cycle.
- The other type of LCD technology is passive matrix. This type of LCD display uses a grid of conductive metal to charge each pixel.
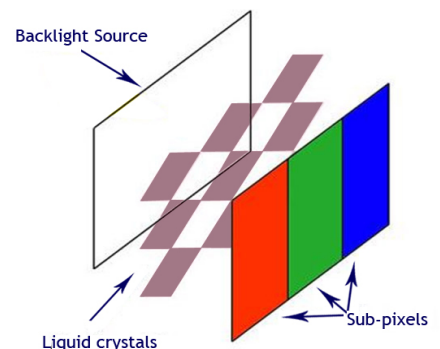
LED monitor:-

- It is a monitor called LED LCD where backlighting is only a different.
- The first thing to know about LED (Light Emitting Diode) TVs is that they are simply LCD TVs with a different kind of backlighting. The screen remains the same but LEDs are used in place of Cold Cathode Fluorescent Lamps (CCFL) that are found in most LCD TVs.
- backlighting is covered by Light Emitting Diodes which alleviates the poor fidelity color of LCDs.
- thinner and compact
- more life span than LCD
- offers more colours
- In LEDs, it sets better black, colors, contrast, and more even image across the panel
- Each cluster on an LED screen has a red, green and blue LED, which light up accordingly to create the correct colour.
- By looking very closely at an LED screen, all we can see is lots of very bright little lights, because the pixels are much bigger, but when you get further away the picture becomes clearer.

Gas plasma:

- It's a type of thin display screen, called a flat-panel display.
- It works by sandwiching neon gas between two plates.
- Each plate is coated with a conductive print.
- The print on one plate contains vertical conductive lines and the other plate has horizontal lines.
- Together, the two plates form a grid.
- When electric current is passed through a horizontal and vertical line, the gas at the intersection glows, creating a point of light, or pixel. We can think of a gas-plasma display as a collection of very small neon bulbs.

The basic idea of a plasma display is to illuminate tiny, colored fluorescent lights to form an image. Each pixel is made up of three fluorescent lights -- a red light, a green light and a blue light.

comparison of CRT,LCD and Gas plasma monitor:-

CRT	LCD	Gas plasma
1.Fairly bright, but not as bright as LCDs.	1.Produces very bright images	1.Higher levels of brightness and contrast. Viewing quality best where lighting can be controlled. Better display of black.
2.Gives off electric, magnetic and electromagnetic fields.	2.Produce considerably lower electric, magnetic field.	2.The plasma panel is not affected by magnetic fields.
3.Use more power and produce more heat .	3.Energy efficient. Consume less than 1/3 the power of a comparable CRT.	3. Variable power consumption (dimmer picture draws less power).
4.Larger, weigh more.	4.LCDs are thin and compact.	4.Relatively heavy weight
5.Normally sharper than LCDs (except when the LCD is at it's native resolution).	5.At the native resolution, the image is perfectly sharp.	5.Plasmas inherently deliver vivid color, true blacks, and deep contrast. They do this right out of the box. They are a better overall image.
6.Operate at the highest pixel resolutions generally available. Will operate at any resolution, geometry and aspect ratio without having to adjust the image.	6.Works best at the native resolution. The native resolution can not be changed.	6.Designed only for one optimum resolution; can't adjust images.
7.Viewable from almost every angle.	7.Restricted viewing angles. Viewing angles affect the brightness, contrast and colors shown.	7.Excellent viewing angle.

Hard copy:

Hard copy is something hard that you can touch and see. Like a paper print out.

Printer:

Impact Printers use a print head containing a number of metal pins which strike an inked ribbon placed between the printhead and the paper.

serial (character) printer:

Dot matrix printer:-

- A type of printer that produces characters and illustrations by striking pins against an ink ribbon to print closely spaced dots in the appropriate shape.
- Dot-matrix printers are relatively expensive and do not produce high-quality output.
- However, they can print to multi-page forms (that is, carbon copies),
- Some printheads have only 9 pins to make the dots to build up a character; some have 24 pins which produce a better resolution.

Dot-matrix printers vary in two 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 to 24.

How it works:-

The pins, contained in the print head, are about one inch long and are driven by several hammers which force each pin into contact with the ink ribbon (and paper) at a certain time. The force on these hammers comes from the magnetic pull of small wire coils (solenoids) which are energized at a particular time, depending on the character to be printed. Timing of the signals sent to the solenoids is programmed into the printer for each character, and translated from information sent by the command of computer about which characters to print.

Daisy wheel printer:

- A type of printer that produces letter-quality type.
- 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, and in general they are noisy and slow, printing from 10 to about 75 characters per second.
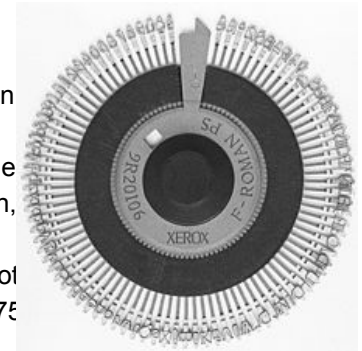

Line printer:-

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.

Drum printer:

- An impact printer in which a complete set of characters for each print position on a line is on a continuously rotating drum behind an inked ribbon, with paper in front of the ribbon; identical characters are printed simultaneously at all required positions on a line, on the fly, by signal-controlled hammers.
- An old line printer technology that used formed character images around a cylindrical drum as its printing mechanism.
- When the desired character for the selected position rotated around to the hammer line, the hammer hit the paper from behind and pushed it into the ribbon and onto the character.
- 600 to 1200 lines-per-minute (approximately 10 to 20 pages per minute) were common. In this a revolving cylinder acts as the printing element.
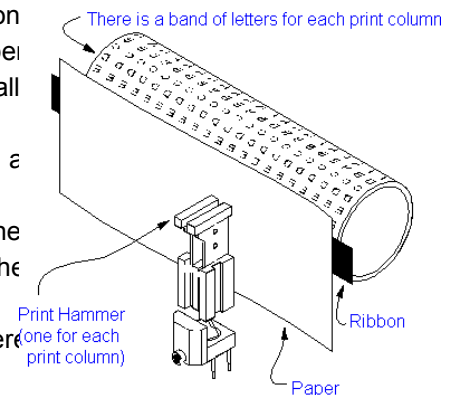
Chain printer:

- Chain printers (also known as train printers) placed the type on moving bars(a horizontally-moving chain).
- Print characters are contained in a chain, which is moved continuously at a rapid rate by two geared pulleys.
- Circuitry within the printer senses when the correct character appears at the desired print position on the page. At that point, a hammer strikes the page.
- This action presses the paper against a ribbon and against the character located at that position. The result leaves an impression of the character.
- As the chain continues to move transversely across the page, additional characters
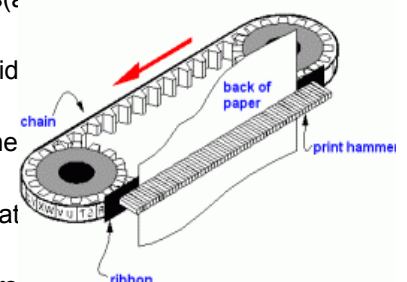
are printed as they reach the position required by the commands of the computer.
- When the requirements of the printed line are fulfilled, the printer carriage control moves the page to the next line position. Chain printers are medium- and high-speed printers.
- They print over 300 lines per minute.

Band printer:-
- Band printers are a variation of chain printers.
- Where a thin steel band is used instead of a chain, with the characters embossed on the band. Band printers work on the same principle as chain printers except that a scalloped, steel print band is used instead of a print chain.
- A band printer is a type of impact printer with a printing mechanism that uses a metal loop or band to produce typed characters.
- The loop or band has a set of characters permanently embossed on it and this set of characters cannot be changed unless the band is replaced.
- The band itself spins or revolves around hammers that push the paper against the ribbon, allowing the desired character to be produced on the paper.
- It can print up to 3000 lines/minute.
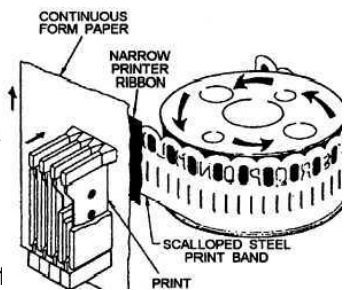
Non-impact printer:-
Nonimpact printers, used almost everywhere now, are faster and quieter than impact printers because they have fewer moving parts. Nonimpact printers form characters and images without direct physical contact between the printing mechanism and the paper.

Two types of nonimpact printers often used with microcomputers are laser printers and ink-jet printers.

Laser Printer:
1. A photoconductive drum is initially charged by charging electrode.
2. Then a high intensity laser beam is used to discharge selected areas on the drum. These discharged areas correspond to the white areas of the printed document.
3. Toner is attracted to parts of the drum with a high charge. The
4. drum rotates and transfers the toner to the paper which has an even greater electrical charge. Finally a heater fixes the toner onto the paper.
5. Characters are formed as a result of electrically charged or heated ink being sprayed in fine jets onto the paper. Individual nozzles in the printing head produce high resolution (up to 400 dots per inch or 400 dpi) dot matrix characters.
6. They are quiet and fast. They can print 4-32 text-only pages per minute for individual microcomputers, and more than 120 pages per minute for mainframes. (Pages with more graphics print more slowly.)
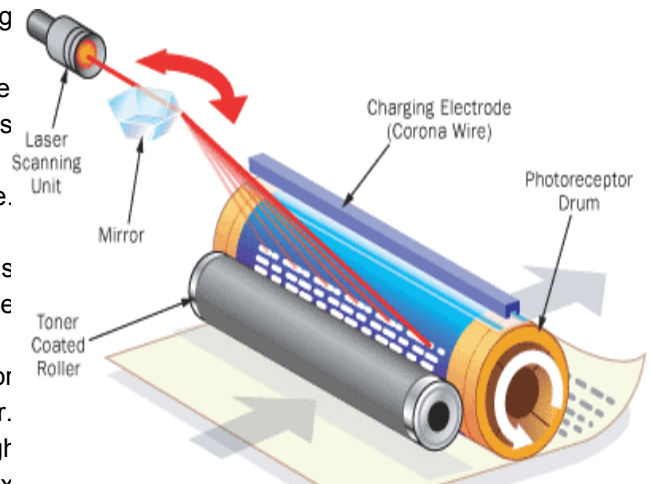
Ink-jet printer:
1. Ink-jet printers spray small, electrically charged droplets of ink from four nozzles through holes in a matrix at high speed onto paper.
2. Ink-jet printers can print in color and are quieter and much less expensive than a color laser printer.
3. They are slower and print in a somewhat lower resolution (300-720 dpi) than laser printers. Some new, expensive ink-jet printers print up 1200 or 1400 dpi.
4. High resolution output requires the use of special coated paper, which costs more regular paper.
5. Inkjet printers use colour cartridges which combine magenta, yellow and cyan inks to create colour tones. A black cartridge is also used for crisp monochrome output.
6. This method of printing can generate up to 200 cps and allows for good quality, cheap colour printing.

comparison of impact and nonimpact printer:-

Impact	Non-impact
1.Text is formed in contact of paper and the printer head.	1.Text is formed without any physical contact of the paper and the printer head.
2.It uses (almost all) striking mechanism.	2.It uses different mechanism like fusing,spraying etc.
3.It is Noisy and slow.	3.It is Noiseless and fast.
4.The graphics can not be supported.	4.They support graphics.
5. It gives poor quality output.	5.It gives high quality output.
6.These printers are cheaper.	6.these printers are expensive.
7.The output is long lasting due to striking by hammer.	7. comparatively the output is for short time.
8.supports limited fonts.	8. supports many fonts.
9.used components are hammer,inked ribbon etc.	9. used components are toner (ink), laser beam, heat generator etc.
10..Example – Dot matrix.	10.Example: laser printer

Thermal printer:-
- A thermal impact printer or electrothermal printer is a printer that uses heated pins to "burn" images onto heat-sensitive paper.
- These printers are commonly used in calculators and fax machines; and although they are inexpensive and print relatively fast, they produce low resolution print jobs.
- It has 4 components:
  - Thermal head: It generates heat
  - Platon: It's a rubber roller to feed the paper
  - spring: It is used to apply pressure to thermal head.
  - Controller band:- it controls the mechanism.
  It works on:
- A printer that adheres a wax-based ink onto paper.
- A thermal printhead melts wax-based ink from the transfer ribbon onto the paper.
- When cool, the wax is permanent. This type of thermal printer uses an equivalent panel of ink for each page to be printed.
- Monochrome printers have a black page for each page to be printed, while color printers have either three (CMY) or four (CMYK) colored panels for each page

Plotter:
Plotters are used to produce (draw) graphs or diagrams/maps,engineering drawings/plans in large scale etc.
Plotters can be of two types:
- Pen based plotters

Flatbed Plotter:-
- A flat-bed plotter is a mechanical drafting device used with many CAD programs for designers.
- The paper remains stationary on a flat surface while a pen moves across it horizontally and vertically.

- This plotter may use several different colors of pens to create the graphics.
- The size of the graphic is limited to the size of the flat-bed plotter's surface.

Drum Plotter:-

- A drum plotter is pen plotter that wraps the paper around a drum with a pin feed attachment.
- The drum then rotates the paper as pens move across it and draw the image.
- It was the first output device used to print graphics and large engineering drawings. There are two types of drum plotters, external and internal. With an external drum plotter, the paper is wrapped around its external surface, while the internal drum plotter uses a sheet of paper wrapped around its internal surface.

Non-pen based:-

Inkjet Plotter:-

- The inkjet plotter creates an image by spraying small droplets of ink onto a piece of paper.
- It's a popular choice for advertising agencies and graphic designers, inkjet plotters are used generally for large outputs, such as banners and billboards and large signs often seen on roadsides.
- They are available in thermal or piezoelectric models.
- Thermal inkjet plotters use heat to apply droplets of ink, while piezoelectric plotters use charged crystals to apply the ink. Inkjet plotters tend to produce better quality graphics than other types of plotter

Interface:-It describes about connection of two or more devices to each other or a means for communication between two or more devices.

Port:
In computer networking, the term port can refer to either physical or virtual connection points. There are different types of port available in computer system. Like,

Serial port: The name "serial" comes from the fact that a serial port "serializes" data. That is, it takes a byte of data and transmits the 8 bits in the byte one at a time. T

Serial data transfer refers to transmitting data one bit at a time.

Parallel port:
It refers to processes that occur simultaneously. Parallel means the device is capable of receiving more than one bit at a time (that is, it receives several bits in parallel). Printers and other devices are said to be either parallel.

You can look at following table to understand about both.

comparison:

serial port	parallel port
1. it serializes the data.	1.It parallelizes the data.
2. one bit at a time.	2. many bits (8) at a time.
3.it's slow.	3.It is fast.
4.It contains one wire.	4.It contains many wires(8).
5.it can have pins upto 9.	5.It can have upto 25-pins.
6.It can be uni/bi-directional.	6.It is bi-directional
7.Uses one wire for transmission	7.Uses many wires (8) for transmission.
7.eg modem	7.eg printer/plotter

USB:-
- Short for Universal Serial Bus, an external bus standard that supports data transfer rates of 12 Mbps.
- A single USB port can be used to connect up to 127 peripheral devices, such as mice, modems, and keyboards.

- USB also supports Plug-and-Play installation and hot plugging.
- Inside the USB, we can see four cables (wires). One wire is used for power supply and three for sending data to and from. Today USB can be used to connect all types of devices may be serial or parallel. Obviously it sends the data with high speed.

Fire wire port(IEEE 1934):-
- FireWire is a method of transferring information between digital devices, especially audio and video equipment.
- The latest version achieves speeds up to 800 Mbps may jump to an unbelievable 3.2 Gbps
- It can connect maximum 63 devices.
- It supports hot pluggable with plug-play facility.
- Mostly it is used in the case of high volume of data transmission.

Difference interfaces:-

Slots:-

An open area where we insert extra devices or boards for extra functions. Mostly we use expansion slot (on printed board)for this.For example, if you wanted to install a new video card in the computer you'd purchase a video expansion card and install that card into the compatible expansion slot. Or if you want to insert extra sound card to boom the sound then you use sound card.There can be different types of slots. Like,

SCSI:- :Provides parallel bus for communication with different transfer speed.
:upto 8/16 devices can be connected to single bus
:can have many pins for communication(50/68/80);uses ribbon or round cable.
:printers ,scanners etc do use..

IDE:-An interface used by Floppy drive or hard drive or CD-ROM
:-uses parallel bus for communication.
:-have 40/44 pin connectors.
:--uses different color cables (18 " in length) for connections for master and slave.
:-

AGP:- This; we use for graphics.
:-It accelerates the 3D motions/drawing/games.
:-iT IS A SIMPLY A GRAPHICS/video CONTROLLER
:-It is mostly 32 bits wide.
:-Its speed can be up to 1.07GBPS
:- In different version, different and doubled speed is available.
:- Now, It is replaced by PCI express.

Similarly we can get memory (RAM)slots to insert memory chip into this.They can be said as a "port" via different devices to cpu front or back panel. We have many others microprocessor slot,ISa slot, EISA slot, VESA slot etc.

Personal computer specification:-

While buying a personal computer we should keep in mind that what components/units should be in a system such that we can solve our all tasks easily. And what are the major requirements to be there. The specification (configuration) differs from user to user. Like, if you want to use for games or graphics designing/animations/servers then obviously you have to buy some powerful graphics card, processor, memory high capacity hard disk and many others. But, normally or for normal users, we say;should be with following requirements.

Item	minimum requirement/can extend to higher level
Operating system	Windows 7/windows Basic/XP
browser	IE/opera/chrome/safari/mozilla
motherboard	Intel
processor	pentium dual core or IV (2GHz or higher)
VGA	Support for Highest Color (32 bit or more) and resolution (1024X768 or more)

memory (RAM)	1 GB or higher (2 GB recommended)
HArd disk	80 GB or more if back up needed
Monitor	17" LCD/LED
sound card	with high definition
keyboard	multimedia
mouse	optical

additionally we can have or include some more items/units like,

CD driver	DVD ROM/combo box
scanner	any compatible
printer	"
microphone	"
sound box	"

Software and its types:-A computer cannot do anything on its own. It must be instructed to do a desired job. Hence, it is necessary to specify a sequence of instructions, which a computer must perform to solve a problem.So It can be said as a collection of large number of integrated programs which are made and combined in such a way that they can work individually and combinedly to solve our work. we have many examples like, word ,excel,schooling software,graphics software, Windows XP ,unix etc.

It has following types.
1.system software
2.Application software

System Software: It helps in running computer hardware and the computer system. System software handles whole system. System software refers to the operating systems; device drivers, servers, windowing systems and utilities. System software helps an application programmer in abstracting away from hardware, memory and other internal complexities of a computer. An operating system provides users with a platform to execute high-level programs. Firmware and BIOS provide the means to operate hardware.

It has further following types.

Operating Systems: Every computer has an operating system software, which takes care of the effective and efficient utilization of all the hardware and software components of the computer system.

Programming Language Translators: Programming language translators are system software, which transform the instructions prepared by programmers in a programming language, into a form, which can be interpreted and executed.

Communication Software: In a network environment, communications software enables transfer of data and programs from one computer to another.

Utility Programs: A software which is used to run our computer smoothly. It is used to remove internal problems, to make our work easier and fast. It does the job like, removing viruses, formatting disk (partitioning disk), remote connection, sharing files, securing files, locking and unlocking the system etc. So, in overall we can say that they are doctors of our computers which diagnose the system and finds the best solution to work and helps the user to run or carry out their work without any difficulties.

.Utility programs, also called support, service or diagnostic software are system programs which provides a useful service to the user of the computer by providing facilities for performing common tasks of a routine nature. Some of the task commonly performed by utility programs include formatting of hard disk or floppy disks, taking backup of files stored on hard disk, sorting of the records stored in a file, etc.

Link Editors: Commonly known as linkers, link editors collect multiple object files that

the compiler programs, generate and put them together as an executable program which is capable of performing desired tasks as instructed by codified instructions.

Loaders: A loader is an inbuilt component of the operating system that loads programs onto the computer memory and makes them ready for execution. This process involves loading the program text from the executable file onto the computer memory and preparing the executable file to run.

Application Software: It enables the end users to accomplish certain specified tasks. Business software, databases and educational software are some forms of application software. Different word processors, which are dedicated to specialized tasks to be performed by the user, are other examples of application software.

It has further following types.

1. packaged software:-

Term used to describe software that is bunched together making a complete set. For example, Microsoft Office is packaged software that includes many software programs that may be used in the office, such as Ms-Office packaged" includes Microsoft Excel, Microsoft Word and Microsoft Access.

A package that consists of (a) one or more computer programs and possibly related material such as utility programs or tutorial programs, recorded on a medium suitable for delivery to the user, and from which the user can transfer the program(s) to a data-processing device, and (b) instructional materials such as handbooks and manuals, update information, and possibly support services information.

Advantages:-
1. Saving of time,expense and programming.
2. It's reliable.
3. It's fast.
4. It's user friendly.

Disadvantages
1. It's for many users so may not be for one's choice
2. No technical support.

2. Tailored software:-

A software which is made or designed by keeping in mind the requirements of user. It is just like a person going to tailoring center to have personal suit/dress according to his/her requirements. This type of software is designed for a particular/specified job. So it can not be used for any other company or user.It is designed step by step according to feedback/suggestion given by user. e.g. SLC software, software used by particular organization.

Advantages:
1. a good solution for particular purpose.
2.while developing, every risk/part/error/recovery is counted or taken into account.
3. Technical support 24x7 available.

Disadvantages:
1.It's expensive.
2. It can not be used by a mass or many companies.

Virus:-

Programs can be different types.Some can be for good purpose and some can be for bad purpose. The program designed for destruction of system and its contents is called virus. It is a program written by user to do illegal activities/works on others' computer. The virus is designed in such a way that it can copy itself to different location and can harm/infect different parts like hardware or files or applications or sometimes may steal confidential matters. The replication is intentional. To protect our computer we use a software called "Antivirus software". we have many like "Avira","Avast", Norton etc.

There are different types of virus.

File virus : Most viruses fall into this category. A virus attaches itself to a file, infects it and prevents from working.

Boot sector virus : These viruses infect floppy and hard drives and their MBR part.. The virus program will load first, before the operating system.

Macro Virus : This is a new type of virus that use an application's own macro programming feature to distribute themselves. Unlike other viruses, macro viruses do not infect programs; they infect documents.

system infector virus:- this type of virus infects the system files like msdos.sys,command.com with following executable files

ACCESS.CPL---->Accessibility Control Panel icons

ACCESS.HLP---->Accessibility Control Panel help

31USERS.HLP--->user's help file

APPWIZ.CPL----->Application install Control Panel

and stops the execution.

Besides these all, we have many other dangerous viruses like stealth,polymorphism,multipartite,message carrying etc which can disturb us while working or damage our whole system in just a moment. So while using we should be careful about the files stored in computer or our websites being visited or files being transfered from one to another computer.