HAND OUT NOTES ON

COMPUTER

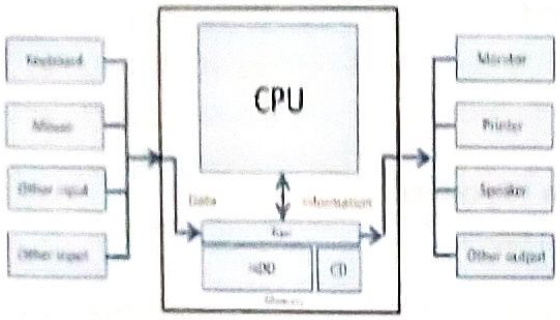
MODULE : MJI & MJP (C,W,D,ELEC)

SUBJECT CODE : MRT-14

WHAT IS COMPUTER?

Computer is an electronic device that is designed to work with Information. *The term computer* is *derived from the Latin term* '**computare**', this means to *calculate* or *programmable machine*. **Computer can not do anything without a Program**. It represents the decimal numbers through a string of binary digits.

A computer is a machine or device that performs processes, calculations and operations based on instructions provided by a software or hardware program. It is designed to execute applications and provides a variety of solutions by combining integrated hardware and software components.



Charles Babbage is called the "Grand Father" of the computer. The First mechanical computer designed by Charles Babbage was called **Analytical Engine.** It uses read-only memory in the form of punch cards.

Computer is an advanced electronic device that takes raw data as input from the user and processes these data under the control of set of instructions (called program) and gives the result (output) and saves output for the future use. It can process both numerical and non-numerical (arithmetic and logical) calculations.

HISTORY OF COMPUTER

The **history of computers** starts out about 2000 years ago in Babylonia (Mesopotamia), at the birth of the abacus, a wooden rack holding two horizontal wires with beads strung on them.

First half of 19thcentury, The Jacquard loom was a marvel of the Industrial Revolution. A textile-weaving loom, it could also be called the first practical information-processing device. The loom worked by tugging various-coloured threads into patterns by means of an array of rods. By inserting a card punched with holes,

The **computer** as we know it today had its beginning with a 19th century English mathematics professor name Charles Babbage. ... It was called the Atanasoff-Berry **Computer** (ABC).

GENERATION OF COMPUTER

First Generation of Computers (1942-1955)

The beginning of commercial computer age is from **UNIVAC (Universal Automatic Computer)**. It was developed by two scientists **Mauchly** and **Echert** at the Census Department of United States in 1947. **The first generation computers were used during 1942-1955**. They were based on vacuum tubes. Examples of first generation computers are **ENIVAC** and **UNIVAC-1**.

The "ENIVAC" was weighing 30 tons, power consume 200KW of electric power and consisting of approx.18000 vacuum tubes, 1500 relays and thousands of resistors, capacitors and inductors, was completed in 1945.

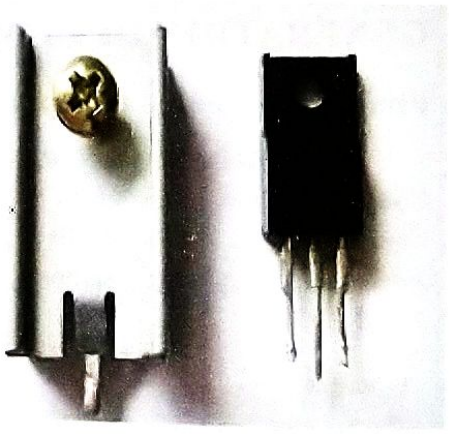
Advantages

- Vacuum tubes were the only electronic component available during those days.
- Vacuum tube technology made possible to make electronic digital computers.
- These computers could calculate data in millisecond.

Disadvantages

- The computers were very large in size.
- They consumed a large amount of energy. (200 Kw of power)
- They heated very soon due to thousands of vacuum tubes.
- They were not very reliable.
- Air conditioning was required.
- Constant maintenance was required.
- Non-portable.
- Costly commercial production.
- Limited commercial use.
- Very slow speed.
- Limited programming capabilities.
- Used machine language only.
- Used magnetic drums which provide very less data storage.
- Used punch cards for input.
- Not versatile and very faulty

Second Generation Computers (1955-1964)



The **second generation computers** used transistors. The scientists at Bell laboratories developed transistor in 1947. These scientists include John Barden, William Brattain and William Shockley. The size of the computers was decreased by replacing vacuum tubes with transistors. The examples of

second generation computers are **IBM 7094 series, IBM 1400 series** and **CDC 164** etc.

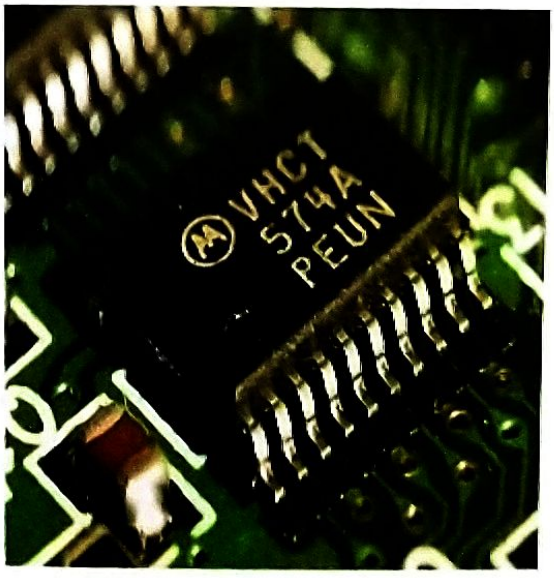
Advantages

- Smaller in size as compared to the first generation computers.
- The 2nd generation Computers were more reliable compare to first generation computers.
- Used less energy and were less heated.
- Better portability as compared to the first generation computers.
- Better speed and could calculate data in microseconds
- Used faster peripherals like tape drives, magnetic disks, printer etc.
- Used Assembly language instead of Machine language.
- Development of high level languages like COBOL, FORTRAN, PASCAL, BASIC & other
- Accuracy improved.

Disadvantages

- Cooling system was required
- Constant maintenance was required
- Commercial production was difficult
- Only used for specific purposes
- Costly and not versatile
- Puch cards were used for input.

Third Generation Computers (1964-1971)



The **Third generation computers** used the integrated circuits (IC). Jack Kilby developed the concept of integrated circuit in 1958. It was an important invention in the computer field. The first IC was invented and used in 1961. The size of an IC is about ¼ square inch. A single IC chip may contain thousands of transistors. The computer became smaller in size, faster, more reliable and less expensive. The examples of third generation computers are **IBM 370, IBM System/360, UNIVAC 1108** and **UNIVAC AC 9000** etc.

Advantages

- Smaller in size as compared to previous generations.
- More reliable.
- Used less energy
- Produced less heat as compared to the previous two generations of computers.
- Better speed and could calculate data in nanoseconds.
- Used fan for heat discharge to prevent damage.
- Maintenance cost was low because hardware failure is reare.
- Totally general purpose
- Could be used for high-level languages.
- Good storage
- Versatile to an extent
- Less expensive
- Better accuracy
- Commercial production increased.
- Used mouse and keyboard for input.

Disadvantages

- Air conditioning was required.
- Highly sophisticated technology required for the manufacturing of IC chips.

Fourth Generation Computers (1971-1985)

The fourth generation computers started with the invention of Microprocessor. The Microprocessor contains thousands of ICs. The technology of integrated circuits improved rapidly. The LSI (Large Scale Integration) circuit and VLSI (Very Large Scale Integration) circuit was designed. It greatly reduced the size of computer. The size of modern Microprocessors is usually one square inch. It can contain millions of electronic circuits. The examples of fourth generation computers are **Apple Macintosh & IBM PC.**

Advantages

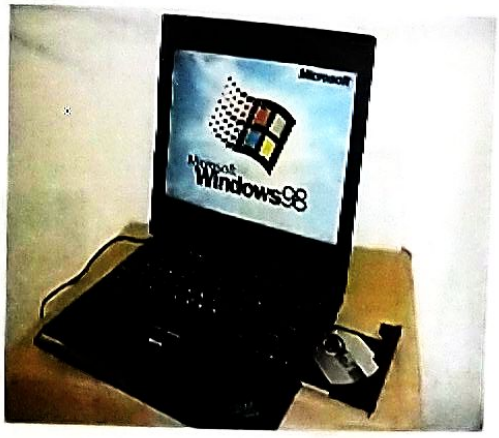
- More powerful and reliable than previous generations.
- Small in size
- Fast processing power with less power consumption
- Fan for heat discharging and thus to keep cold.
- No air conditioning required.
- Totally general purpose
- Commercial production
- Less need of repair.
- Cheapest among all generations
- All types of High level languages can be used in this type of computers

Disadvantages

- The latest technology is required for manufacturing of Microprocessors.

Fifth Generation Computers (1986-1995)

In fifth Generation of computer became more smart than fourth generation computer-



Advantages:

- More powerful and reliable than previous generations.
- Introduced ULSI (Ultra Large scale Integration) technology, Introduced Intel's Pentium and Dual core processors contains billions of transistors on a single *IC* chip.
- Object oriented language like JAVA suitable for Internet programming has been developed. Cost of data communication decreased.
- Introduced LCD monitor.
- Portable note book computer introduced.
- Storage technology advanced – large main memories and disc storage available.
- Introduction of E-mail, e- commerce, Vertual libraries/ classrooms, multimedia applications etc.
- New operating systems developed – Windows 95/ 98/ XP/ LINUX etc.

Sixth Generation Computers (From 1995 to Present & Beyond)

Artificial intelligence(AI)

In sixth generation, Computer devices with artificial intelligence are still in development, but some of these technologies are beginning to emerge and be used such as voice recognition.

AI is a reality made possible by using parallel processing and superconductors. Leaning to the future, computers will be radically transformed again by quantum computation, molecular and nano technology.

The essence of fifth generation will be using these technologies to ultimately create machines which can process and respond to natural language, and have capability to learn and organise themselves.

Advantages:

-

werful and reliable than previous generations.

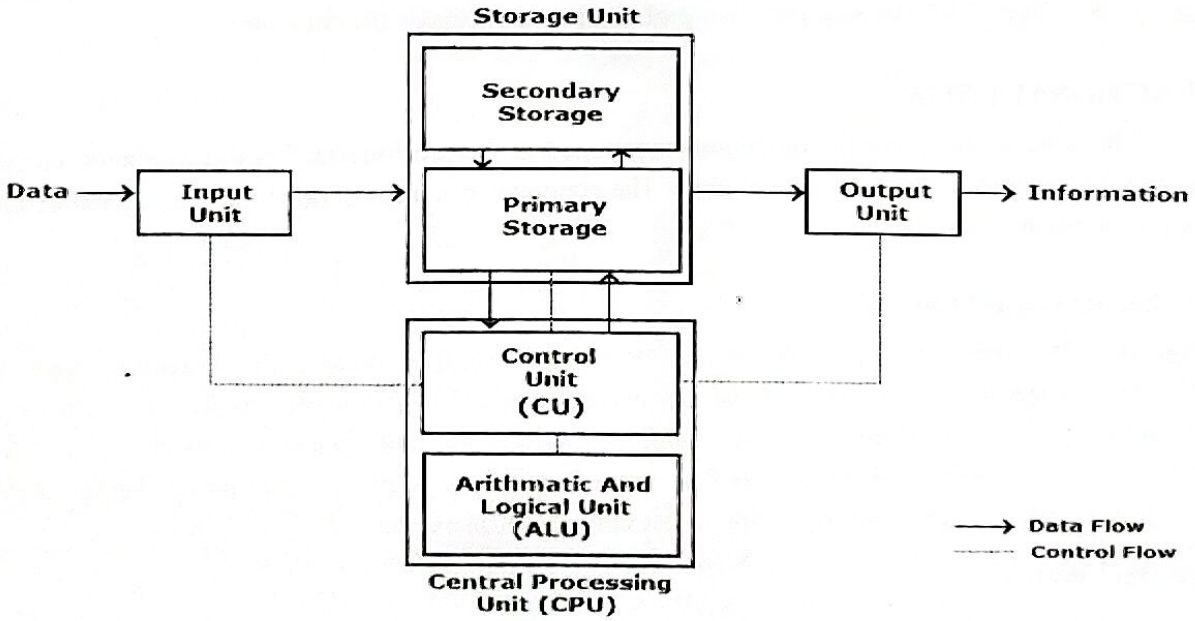
- Computer became too cost effective and absolutely user friendly and more versetile.
- The development of newer LED monitor after CRT and LCD panel monitor was made.
- Introduction of 2nd generation computer Processor from Intel Like i3,i5, i7, i9 etc and new operating system developed by Micosoft like Windows 7, Windows 8, 8.1 and latest Windows10.
- The Hard disk capacity is increased 1,2, 4 Tera byte (TB) and more.
- A revolutionery SSD (Solid State Device) is introduce, it has no moving perts.
- Introduction of Blu-Ray-Disc a high capacity optical disc format for data and high-definition video. It can stored 25 Gb to 100 Gb information where as CD (contain 700 Mb) and DVD (contains 4.7 Gb)

BLOCK DIAGRAM OF COMPUTER

A computer can process data, pictures, sound and graphics. They can solve highly complicated problems quickly and accurately. A computer as shown in Fig. performs basically five major computer operations or functions irrespective of their size and make. These are

1) it accepts data or instructions by way of input,
2) it stores data,
3) it can process data as required by the user,
4) it gives results in the form of output, and
5) it controls all operations inside a computer.

We discuss below each of these Computer operation



1. Input: This is the process of entering data and programs in to the computer system. You should know that computer is an electronic machine like any other machine which takes as inputs raw

data and performs some processing giving out processed data. Therefore, the input unit takes data from us to the computer in an organized manner for processing.

2. Storage: The process of saving data and instructions permanently is known as storage. Data has to be fed into the system before the actual processing starts. It is because the processing speed of Central Processing Unit (CPU) is so fast that the data has to be provided to CPU with the same speed. Therefore the data is first stored in the storage unit for faster access and processing. This storage unit or the primary storage of the computer system is designed to do the above functionality. It provides space for storing data and instructions.

The storage unit performs the following major functions:

- All data and instructions are stored here before and after processing.
- Intermediate results of processing are also stored here.

3. Processing: The task of performing operations like arithmetic and logical operations is called processing. The Central Processing Unit (CPU) takes data and instructions from the storage unit and makes all sorts of calculations based on the instructions given and the type of data provided. It is then sent back to the storage unit.

4. Output: This is the process of producing results from the data for getting useful information. Similarly the output produced by the computer after processing must also be kept somewhere inside the computer before being given to you in human readable form. Again the output is also stored inside the computer for further processing.

5. Control: The manner how instructions are executed and the above operations are performed. Controlling of all operations like input, processing and output are performed by control unit. It takes care of step by step processing of all operations inside the computer.

FUNCTIONAL UNITS

In order to carry out the operations mentioned in the previous section the computer allocates the task between its various functional units. The computer system is divided into three separate units for its operation. They are

Arithmetic Logical Unit (ALU)

Logical Unit : After you enter data through the input device it is stored in the primary storage unit. The actual processing of the data and instruction are performed by Arithmetic Logical Unit. The major operations performed by the ALU are addition, subtraction, multiplication, division, logic and comparison. Data is transferred to ALU from storage unit when required. After processing the output is returned back to storage unit for further processing or getting stored.

Control Unit (CU)

The next component of computer is the Control Unit, which acts like the supervisor seeing that things are done in proper fashion. Control Unit is responsible for co-ordinating various operations using time signal. The control unit determines the sequence in which computer programs and

instructions are executed. Things like processing of programs stored in the main memory, interpretation of the instructions and issuing of signals for other units of the computer to execute them. It also acts as a switch board operator when several users access the computer simultaneously. Thereby it coordinates the activities of computer's peripheral equipment as they perform the input and output.

Central Processing Unit (CPU)

The ALU and the CU of a computer system are jointly known as the central processing unit. You may call CPU as the brain of any computer system. It is just like brain that takes all major decisions, makes all sorts of calculations and directs different parts of the computer functions by activating and controlling the operations.

Types of computers

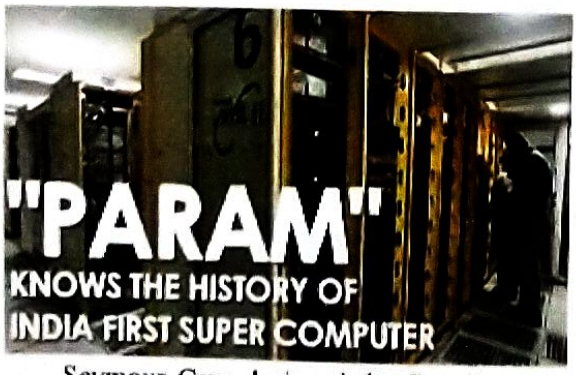
The four basic types of computers are as under:

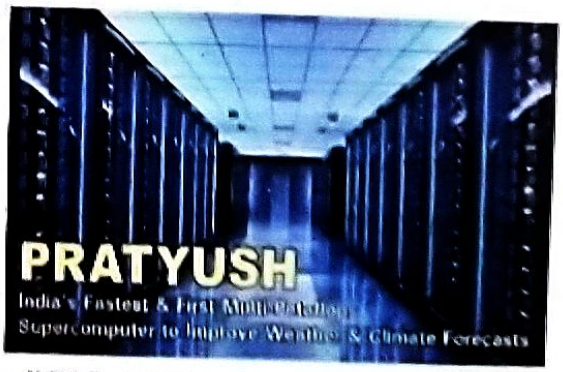
1. Supercomputer
2. Mainframe Computer
3. Minicomputer
4. Microcomputer

1. Supercomputer

The most powerful computers in terms of performance and data processing are the Supercomputers. These are specialized and task specific computers used by large organizations. These computers are used for research and exploration purposes, like NASA uses supercomputers for launching space shuttles, controlling them and for space exploration purpose.

The supercomputers are very expensive and very large in size. It can be accommodated in large air-conditioned rooms; some super computers can span an entire building.





Seymour Cray designed the first Supercomputer **"CDC 6600"** in 1964. CDC 6600 is known as the first ever Supercomputer.

Exascale Supercomputer

On 29th July, 2015, President of the United States, Barack Obama, approved the development of an **Exascale Super Computer**. The Exascale Super computer will be 30 times faster and more powerful than today's fastest Super Computers. The need to develop such a high performance Supercomputer comes after China's surge in high performance computing. However, the US still tops the list of Supercomputers with 233 high performance machines. China has 37 Supercomputers but they lead the list of the most powerful and high performance supercomputers since June 2013.

Presently, China's **"Tianhe – 2"** is the world's faster Supercomputer.

The Tianhe – 2 can perform 100 Petaflops, i.e quadrillions of floating point operations per second.

The following table shows list of top five most powerful Supercomputers in the world. you can also view complete list of Top 500 Supercomputers in the world.

Top five Supercomputers

RANK	SITE	SYSTEM
1	National Super computer in Guanzhou, China	Tianhe - 2 (MilkyWay - 2)
2	DOE/SC/Oak Ridge National Laboratory, United States	Titan - Cray XK7, Cray Inc.
3	DOE/NNSA/LLNL, United States	Sequoia - BlueGene/Q, IBM
4	RIKEN Advanced Institute for Computational Science (AICS) Japan	K Computer, Tofu Interconnect Fujitsu.
5	DOE/SC/Argonne National Laboratory, United States	Mira - BlueGene/Q, Custom IBM

Uses of Supercomputers

Space Exploration

Supercomputers are used to study the origin of the universe, the dark-matters. For these studies scientist use IBM's powerful supercomputer "Roadrunner" at National Laboratory Los Alamos.

Earthquake studies

Supercomputers are used to study the Earthquakes phenomenon. Besides that supercomputers are used for natural resources exploration, like natural gas, petroleum, coal, etc.

Weather Forecasting

Supercomputers are used for weather forecasting, and to study the nature and extent of Hurricanes, Rainfalls, windstorms, etc.

Nuclear weapons testing

Supercomputers are used to run weapon simulation that can test the Range, accuracy & impact of Nuclear weapons.

Popular Supercomputers

- IBM's Sequoia, in United States
- Fujitsu's K Computer in Japan
- IBM's Mira in United States
- IBM's SuperMUC in Germany
- NUDT Tianhe-1A in China

2. Mainframe computer

Although Mainframes are not as powerful as supercomputers, but certainly they are quite expensive nonetheless, and many large firms & government organizations uses Mainframes to run their business operations. The Mainframe computers can be accommodated in large air-conditioned rooms because of its size. Super-computers are the fastest computers with large data storage capacity, Mainframes can also process & store large amount of data. Banks educational institutions & insurance companies use mainframe computers to store data about their customers, students & insurance policy holders.

Application

Used to process large amount of data at very high speed such as in the case of Banks/ Insurance Companies/ Hospital/ Railways...which need online processing of large number of transactions and requires massive data storage and processing capabilities.

Popular Mainframe computers

- Fujitsu's ICL VME
- IBM 3000 series
- Hitachi's Z800

3. Minicomputer

Minicomputers are used by small businesses & firms. Minicomputers are also called as "Midrange Computers". These are small machines and can be accommodated on a disk with not as processing and data storage capabilities as super-computers & Mainframes. These computers are not designed for a single user. Individual departments of a large company or organizations use Mini-computers for specific purposes. For example, a production department can use Mini-computers for monitoring certain production process.

Popular Minicomputers

- K-202
- Texas Instrument TI-990
- SDS-92
- IBM Midrange computers

4. Microcomputer

Desktop computers, laptops, personal digital assistant (PDA), tablets & smartphones are all types of microcomputers. The micro-computers are widely used & the fastest growing computers. These computers are the cheapest among the other three types of computers. The Micro-computers are specially designed for general usage like entertainment, education and work purposes. Well known manufacturers of Micro-computer are HP, Dell, Apple, Samsung, Sony & Toshiba etc.

Desktop computers, Gaming consoles, Sound & Navigation system of a car, Netbooks, Notebooks, PDA's, Tablet PC's, Smartphones, Calculators are all type of Microcomputers.

Definition of computer

Hardware is the collection of physical parts of a Computer system that has shape and size and can be feel. The most essential hardware components are Motherboard, CPU, RAM memory, IO system, power supply, video display controller, Bus and hard disk drive. Some of the normal hardware parts you see like a mouse, keyboard, monitor and CPU are the basic components of a computer. But inside the CPU box there is hard disk, motherboard, and RAM, video card, CPU Fan, sound card, server components, CD/DVD drive and many more. The hardware components does change in shape and size as in a desktop computer the CPU integrates all the components that are connected by wires but in laptop computers the components are integrated into a single portable unit. Basically the hardware components in a Computer system are connected through wires in order to function properly. From power supply to network connection all are connected through wires.

Hardware Components:

The most important hardware component is Mother Board that holds all the important components of a Computer including CPU, memory and various connectors for input/output device. Some of the input devices like keyboard, mouse, microphone, modem, joystick, USB devices, joystick and many more are connected for better functioning. Similarly the output devices like the computer monitor, modem, projectors, printers etc are connected to the available connectors of motherboard. It is the main mother board that includes graphic processors for better display screen on your monitor. There is CPU socket, CPU fan memory connector, super IO chip, DIMM memory slots, IDE connector, SATA connector, BIOS flash chip that are the most essential components to run a Computer system. It also integrates audio codec chip for sound and gigabit Ethernet chip for network connection on a computer.

There are several hardware components attached to the CPU or Central Processing Unit which is also called as the brain of Computer. The CPU includes all the processors that interprets and execute program instructions. It includes control unit that instructs, maintains and also control the flow of information, arithmetic logic unit for simple logic operations and a controller. Inside the CPU, memory is an important component that stores all the information or data on your computer. It includes the main memory slot called RAM (Random Access Memory), ROM (Read only Memory), CMOS battery, internal hard disk that is connected to Computer system to store abundant data and applications, and an optical disk drive known as CD/DVD drive that can read and write from CD or

Types of Memory

Mainly computer have two types memory

1. **Primary Memory / Volatile Memory.**
2. **Secondary Memory / Non Volatile Memory.**

A. Primary Memory / Volatile Memory– Primary memory is internal memory of the computer. It is also known as main memory and Temporary memory .Primary Memory holds the data and instruction on which computer is currently working. Primary Memory is nature volatile. It means when power is switched off it lost all data.

Types of Primary Memory– Primary memory is generally of two types.

1. **RAM**
2. **ROM**

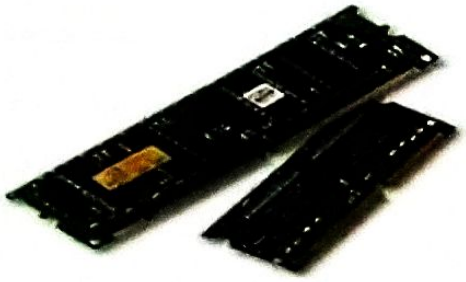
1. RAM (Random Access Memory) – It stands for Random Access Memory.RAM is known as read /writes memory. It generally refereed as main memory of the computer system. It is a temporary memory. The information stored in this memory is lost as the power supply to the computer is switched off. That's why RAM is also called **"Volatile Memory"**

Types of RAM– RAM is also of two types:

a) Static RAM- Static RAM also known as SRAM ,retain stored information as long as the power supply is ON. SRAM are of higher coast and consume more power .They have higher speed than Dynamic RAM

b)Dynamic RAM– Dynamic RAM also known as DRAM, its stored information in a very short time (a few milliseconds) even though the power supply is ON. The Dynamic RAM are cheaper and moderate speed and also they consume less power.

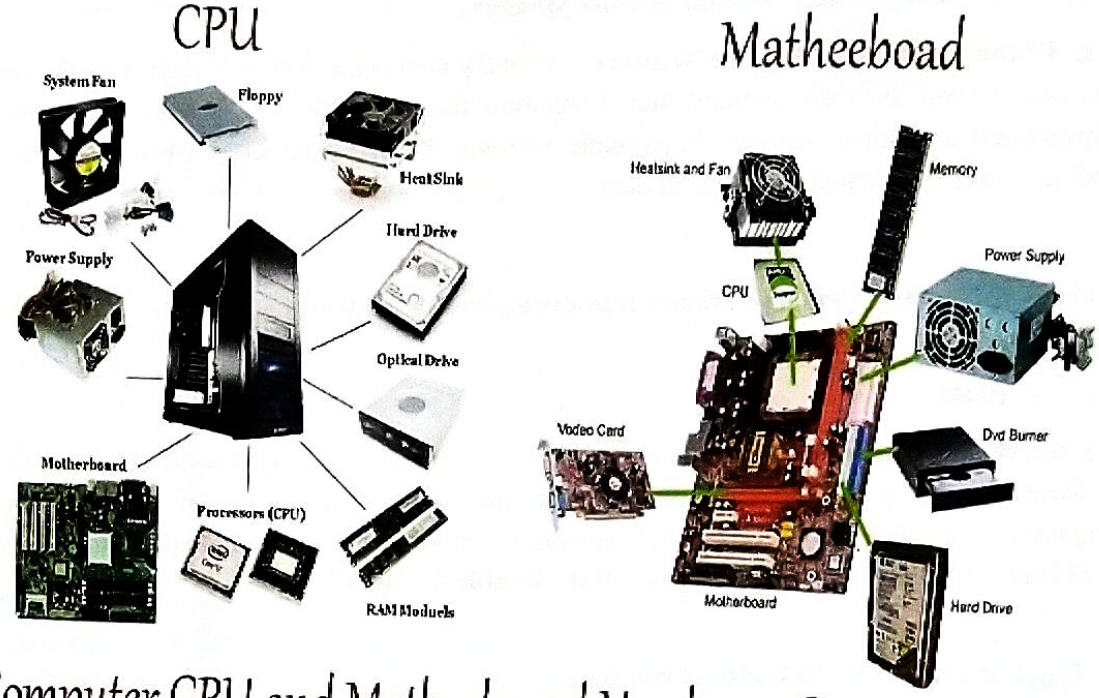
2. ROM (Read Only Memory) – It stands for Read Only Memory.ROM is a Permanent Type memory. Its content are not lost when power supply is switched off. Content of ROM is decided by the computer manufacturer and permanently stored at the time of manufacturing. ROM cannot be overwritten by the computer. It is also called **"Non-Volatile Memory".**



RAM

ROM

DVD's. There are also points for external storage devices like USB, flash drive, external hard disk to be connected for memory storage.



Computer CPU and Motherboard Hardware Components

Computer Memory

Memory is storage part in computer. It is store the data, information, programs during processing in computer. It stores data either temporarily or permanent basis. Memory used to important role in saving and retrieving data.

Computer memory is measured in terms of how many bits it can store. Here is a chart for memory capacity conversion.

- 1 byte (B) = 8 bits
- 1 Kilobytes (KB) = 1024 bytes
- 1 Megabyte (MB) = 1024 KB
- 1 Gigabyte (GB) = 1024 MB
- 1 Terabyte (TB) = 1024 GB
- 1 Exabyte (EB) = 1024 PB
- 1 Zettabyte = 1024 EB
- 1 Yottabyte (YB) = 1024 ZB

Type of ROM: ROM memory is three types names are following-

1. **PROM(Programmable Read Only Memory)**-PROM chip is programmable ROM.it is PROM chips to write data once and read many.once chip has been programmed ,the recorded information cannot be changed. PROM is also nonvolatile memory.
2. **EPROM (Erasable Programmable Read Only Memory)**- EPROM chip can be programmed time and again by erasing the information stored earlier in it. Information stored in EPROM exposing the chip for some time ultraviolet light .
3. **EEPROM (Electrically Erasable Programmable Read Only Memory)**-The EEPROM is programmed and erased by special electrical waves in millisecond. A single byte of a data or the entire contents of device can be erased.

B. Secondary Memory / Non Volatile Memory–

Secondary Memory is external memory of the computer. It is also known as Auxiliary memory and permanent memory. It is used to store the different programs and the information permanently. Secondary Memory is nature non volatile. It means data is stored permanently even if power is switched off.

The secondary storage devices are:

1. Floppy Disks
2. Magnetic (Hard) Disk
3. Magnetic Tapes
4. Pen Drive
5. Winchester Disk
6. Optical Disk(CD,DVD)

Differences between Primary and Secondary Memory

S.No.	Primary memory	Secondary memory
1	Primary memory is temporary	Secondary memory is permanent
2	Primary memory is directly accessible by Processor/CPU	Secondary memory is not directly accessible by CPU
3	Nature of Parts of Primary memory varies. RAM-volatile in nature. ROM- Non-volatiler	It's always Non-volatile in nature
4	Primary memory devices are more expensive than secondary storage devices	Secondary memory devices are less expensive when compare to primary memory devices
5	The memory devices used for primary memory are semiconductor memories	The secondary memory devices are magnetic and optical memories
6	Primary memory is also known as Main memory or Internal memory	Secondary memory is also known as External memory or Auxiliary memory
7	Examples: RAM, ROM, Cache memory, PROM, EPROM, Registers etc	Examples: Hard Disk, Floppy Disk, Magnetic Tapes etc

Primary and Secondary Memory in Computer

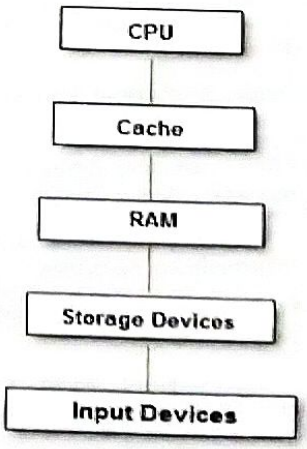
Cache Memory

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

Advantages

The advantages of cache memory are as follows –

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



Differences between Primary and Secondary Memory

Disadvantages

The disadvantages of cache memory are as follows –

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

Virtual Memory

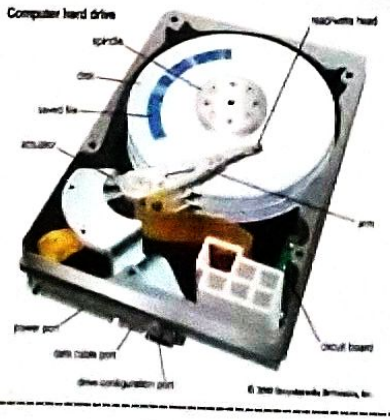
The concept of virtual memory in computer organisation is allocating memory from the hard disk and making that part of the hard disk as a temporary RAM. In the earlier days, when the concept of virtual memory was not introduced, there was a big troubleshooting that when RAM is already full but program execution needs more space in RAM. The computers became unresponsive in such type of situation since processor forced the program to be in RAM but RAM can't hold them because it is already running out of space. To deal with this type problem the concept of virtual memory was introduced.

The concept of virtual memory in computer organization:

Basically, virtual memory provides an illusion to the users that the PC has enough primary memory left to run the programs. Though the size of programs i.e. to be executed may sometimes very bigger than the size of primary memory left, the user never feels that he needs a bigger primary storage to run that program. When the RAM is full, but program execution needs more space in RAM, then the operating system occupies a portion of the hard disk and uses it as a RAM. In that part of the secondary storage, the part of the program which not currently being executed is stored and all the parts of the program that are eventually executed are first brought into the main memory.

Hard Disc:

The hard drive, which typically provides storage for data and applications within a computer, has four key components inside its casing -- the platter (for storing data), the spindle (for spinning the platters), the read/write arm (for reading and writing data) and the actuator (for controlling the actions of the read/write arm). Only the most technically proficient IT professionals should attempt to work on the components inside a hard drive.



Different component inside Hard Disc:

Platters

The platters are the circular discs inside the hard drive where the 1s and 0s that make up your files are stored. Platters are made out of aluminum, glass or ceramic and have a magnetic surface in order to permanently store data. On larger hard drives, several platters are used to increase the overall capacity of the drive. Data is stored on the the platters in tracks, sectors and cylinders to keep it organized and easier to find.

The Spindle

The spindle keeps the platters in position and rotates them as required. The revolutions-per-minute rating determines how fast data can be written to and read from the hard drive. A typical internal desktop drive runs at 7,200 RPM, though faster and slower speeds are available. The spindle keeps the platters at a fixed distance apart from each other to enable the read/write arm to gain access. (ref 1+3)

The Read/Write Arm

The read/write arm controls the movement of the read/write heads, which do the actual reading and writing on the disk platters by converting the magnetic surface into an electric current. The arm makes sure the heads are in the right position based on the data that needs to be accessed or written; it's also known as the head arm or actuator arm. There is typically one read/write head for every platter side, which floats 3 to 20 millionths of an inch above the platter surface.

Actuator

The actuator or head actuator is a small motor that takes instructions from the drive's circuit board to control the movement of the read/write arm and supervise the transfer of data to and from the platters. It's responsible for ensuring the read/write heads are in exactly the right place at all times.

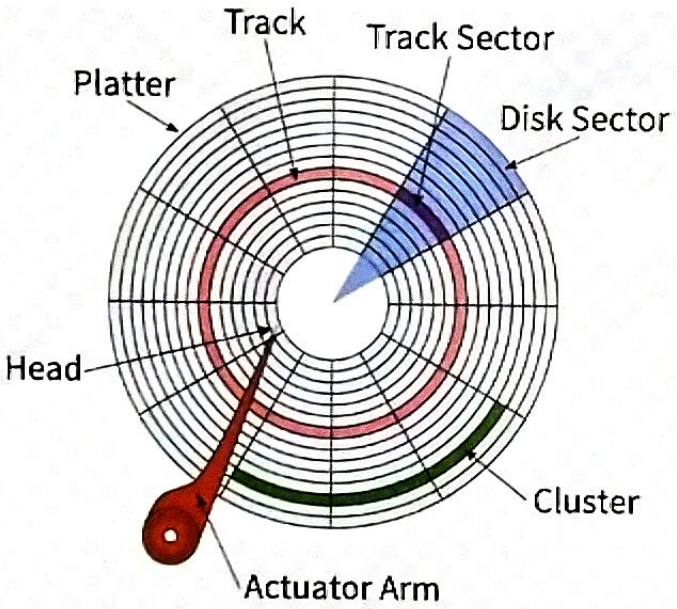
Other Components

As well as the casing on the outside of the hard disk that holds all of the components together, the front-end circuit board controls input and output signals in tandem with the ports at the end of the drive. No matter what the type of drive, it has one port for a power supply and one port for transferring data and instructions to and from the rest of the system.

Tracks and Sectors of a Hard disc:

Platters are organized into specific structures to enable the organized storage and retrieval of data. Each platter is broken into *tracks*--tens of thousands of them--which are tightly-packed concentric circles. These are similar in structure to the annual rings of a tree (but *not* similar to the grooves in a vinyl record album, which form a connected spiral and not concentric rings).

A track holds too much information to be suitable as the smallest unit of storage on a disk, so each one is further broken down into *sectors*. A sector is normally the smallest individually-addressable unit of information stored on a hard disk, and normally holds 512 bytes of information. The first PC hard disks typically held 17 sectors per track. Today's hard disks can have *thousands* of sectors in a single track, and make use of zoned recording to allow more sectors on the larger outer tracks of the disk.



Hard Drive Types:

Currently, we can group hard drives into four types:

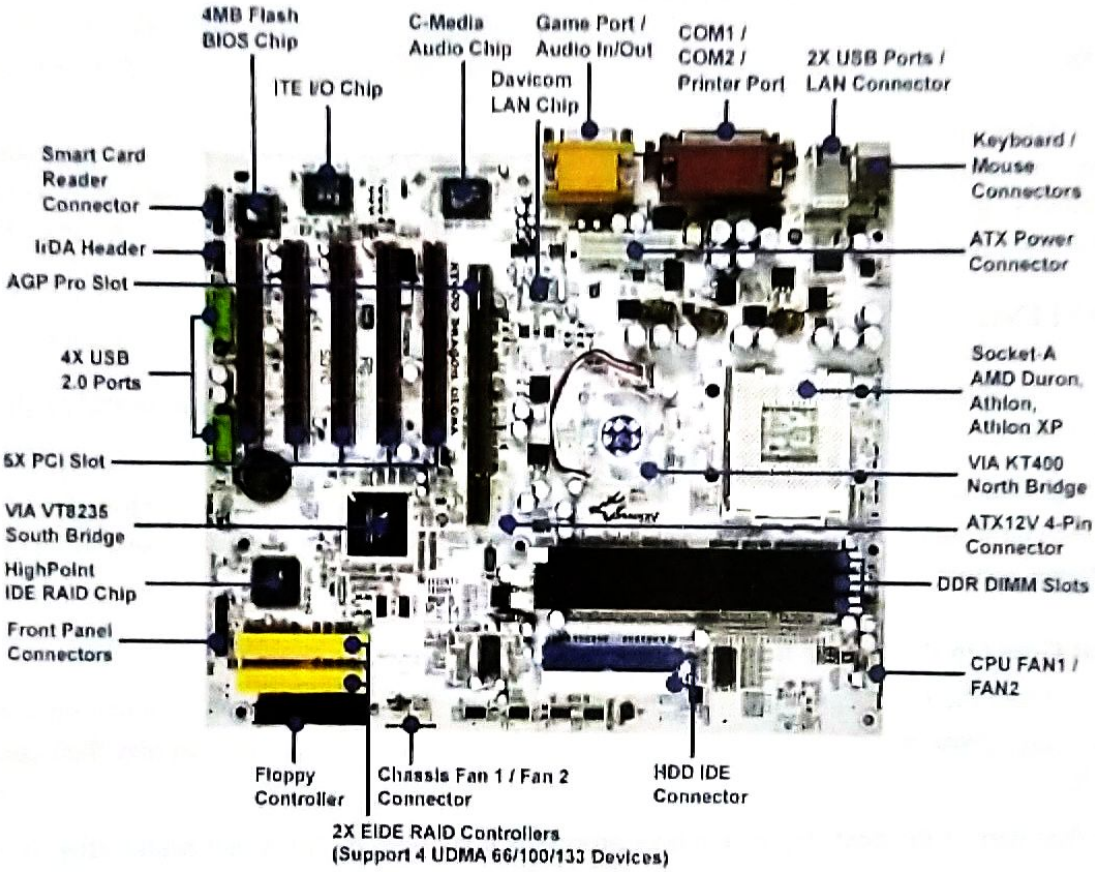
- Parallel Advanced Technology Attachment (PATA)
- Serial ATA (SATA)
- Small Computer System Interface (SCSI)
- Solid State Drives (SSD)
- External USB HDD

S.S.D

SSD stands for Solid State Drive. It is the current technology this has begun to replace Hard Disk Drives (HDD). The HDD or SDD is the hardware component in a computer that stores data. The operating system (usually Windows on PCs and MacOS on Apple computers) is installed on the drive. It allows the computer to boot into an interface that the user can navigate. When you create a document and save it, it is saved to your storage drive. You can also save files to external devices, such as a flash drive or external hard drive. Without a storage drive, you wouldn't be able to save any files or even boot into the operating system.

Mother board:

A motherboard (sometimes alternatively known as the mainboard, system board, baseboard, planar board or logic board,[1] or colloquially, a mobo) is the main printed circuit board (PCB) found in general purpose microcomputers and other expandable systems. It holds and allows communication between many of the crucial electronic components of a system, such as the central processing unit (CPU) and memory, and provides connectors for other peripherals.



Optical Disc Drive

An optical drive is a type of computer disk drive that reads and writes data from optical disks through laser beaming technology. This type of drive allows a user to retrieve, edit and delete the content from optical disks such as CDs, DVDs and Blu-ray disks

Basic Terminologies

POST

Stands for "Power On Self Test. POST (or P.O.S.T.) is a series of system checks run by computers and other electronic devices when they are turned on. The results of the test may be displayed on a screen, output through flashing LEDs, or simply recorded internally. On computer systems, the POST operation runs at the beginning of the boot sequence. If all the tests pass, the rest of the startup process continues automatically.

BIOS

BIOS (basic input/output system) are the program a personal computer's microprocessor uses to get the computer system started after you turn it on. It also manages data flow between the computer's operating system and attached devices such as the hard disk, video adapter, keyboard, mouse and printer.

BOOTING

The term boot is used to describe the process taken by the computer when turned on that loads the operating system and prepares the system for use.

Booting, *boot up*, and *start up* are all synonymous terms and generally describe the long list of things that happen from the pressing of the power button to a fully-loaded and ready-to-use session of an operating system, like Windows.

What Goes On During the Boot Process?

From the very beginning, when the power button is pressed to turn the computer on, the power supply unit gives power to the motherboard and its components so that they can play their part in the whole system.

The first part of the next step of the boot process is controlled by BIOS and begins after the POST. This is when POST error messages are given if there's a problem with any of the hardware.

Following the display of various information on the monitor, like the BIOS manufacturer and RAM details, BIOS eventually hands the boot process over to the master boot code, that hands it to the volume boot code, and then finally to the boot manager to handle the rest.

This is how BIOS finds the right hard drive that has the operating system. It does this by checking the first sector of the hard drives it identifies. When it finds the right drive that has a boot loader, it loads that into memory so that the boot loader program can then load the operating system into memory, which is how you use the OS that's installed to the drive

Hard (Cold) Booting V/S Soft (Warm) Booting

You may have heard the terms hard/cold booting and soft/warm booting and wondered what was meant. Isn't booting just booting? How can you have two different types?

A cold boot is when the computer starts up from a completely dead state where the components were previously without any power at all. A hard boot is also characterized by the computer performing a power-on self-test, or POST.

However, there are conflicting perspectives on what a cold boot really involves. For example, restarting a computer that's running Windows may make you think that it's performing a cold reboot because the system appears to turn off, but it may not actually shut down the power to the motherboard, in which case it would be applying a soft reboot.

COMPUTER SOFTWARE

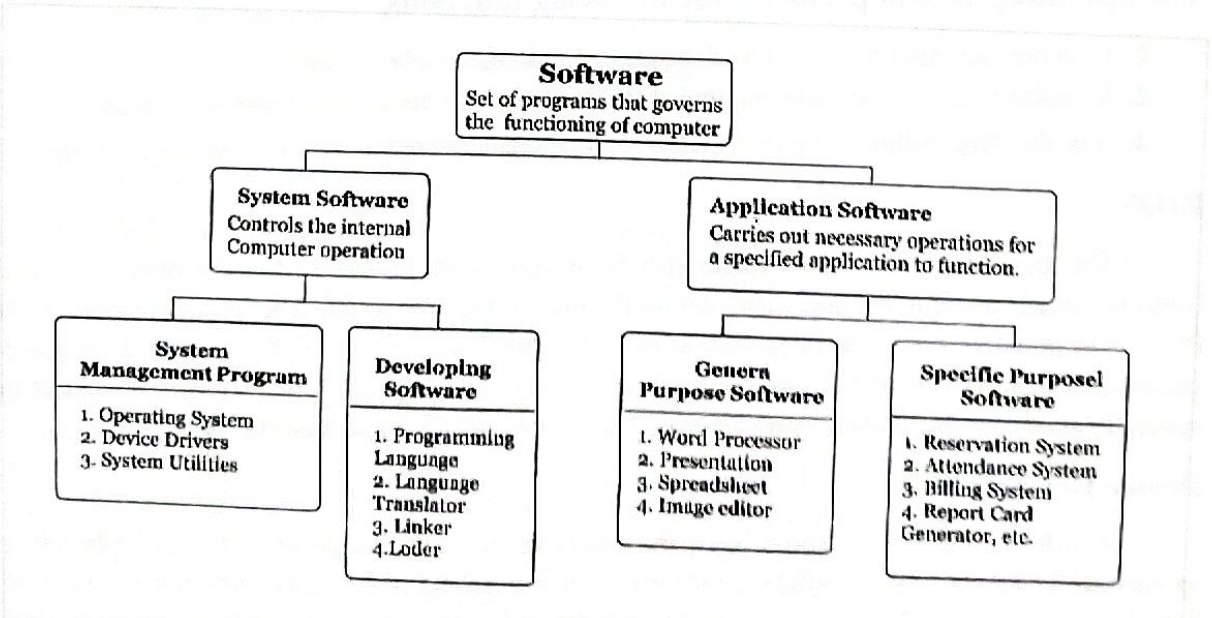
Software

Software is a collection of computer programs and related data that provide the instruction for telling a computer what to do and how to do it. A software is an interface between user and computer. It is a set of instructions, programs that are used to give command to hardware. It is responsible for controlling, integrating and managing the hardware components of a computer system and for accomplishing specific tasks.

Types of Software

Software can be divided into two major categories.

1. System Software.
2. Application Software.



System Software

System software consists of several programs, which are directly responsible for controlling, integrating and managing the individual hardware components of a computer system.

It also provides the interface between the user and component of the computer.

The purpose of system software is to insulate the applications programmer as much as possible from the detail of the particular complex computer being used.

Depending on the functionality, the system software can be further divided into two major categories; system management program and developing software.

1. System Management Program:

It includes an integrated system of programs, which manages the operations of the processor, controls input/output, manages storage resources and provides various support services. Some common examples of system management programs are operating system, device driver and system utilities.

Operating System:

It consists of programs , which controls, which controls, coordinates and supervises the activities of the various components of a computer system. Its function is to provide link between the computer hardware and the user.

It performs all internal management functions (disk access, memory management, task scheduling and user interfacing) and ensures systematic functioning of a computer system. It provides an environment to run the programs. e.g., MS-DOS, windows XP/2000/98, Unix Linux, etc.

The operating system performs the following functions.

1. It recognises input from keyboard, sends output to the display screen.
2. It makes sure that programs running at the same time do not interface with each other.
3. It is also responsible for security, ensuring that unauthorized users do not access the system.

BIOS:

The Basic Input / Output system (BIOS) is commonly known as System Bios. The BIOS controls various electronic components within the main computer system The initial function of the BIOS is to initialize system devices such as the RAM, hard disk, CD/DVD drive, video display card and other hardwares. The BIOS sets the machine hardware into a known state that helps the operating system to configure the hardware components. This process is known as **Booting Up.**

Device Drivers:

A software, which is written with the objective of making a device functional when it is connected to the computer is called device driver. It is a system software that acts like an interface between the device and the user. Every device, whether it is a printer, monitor, mouse or keyboard has

a driver program associated with it for its proper functioning.

- *Device drivers are a set of instructions that introduce our PC to a hardware device.*
- Device drivers are not independent programs, they assists and are assisted by the operating system for the proper functioning.

- **System Utilities:**

These programs perform tasks related to the maintenance of the computer system. These are the packages which are loaded into computer during time of installation of operating system. They are used to support, enhance, expand and secure existing programs and data in the computer system.

System utility mainly consists of the following functions.

1. **Disk Compression** It increases the amount of information that can be stored on a hard disk by compressing all information stored on a hard disk. This utility works automatically and the user does not need to be aware of its existence.
2. **Disk Fragmenters** It detects computer files whose contents are broken across several locations on the hard disk and moves the fragments to one location to increase efficiency. It can be used to rearrange files and unused space on your hard disk.
3. **Backup Utilities** It can make a copy of all information stored on a disk and restore either the entire disk or selected files.
4. **Disk Cleaners** It is used to find files that have not been used for a long time. This utility also serves to increase the speed of a slow computer.
5. **Anti-Virus** It is the utility which is used to scan computer for viruses and prevent the computer system files from being corrupt.

2. Developing Software:

It is a software which provides service required for the development and execution of application software. The programming languages, language translator, loader, linker are required for the application software development.

Programming Languages:

A programming language is a primary interface of a programmer with a computer. A programming language is an artificial language to express computation that can be performed by a computer.

Each language has its own syntax i.e., the set of specific rules and expresses the logical steps of an algorithm. programming languages are divided into two categories; Low Level Language (LLL) and High Level Language (HLL).

1. **Low Level Language (LLL)** Low level language is divided into two parts

1. **Machine Language** It is sometimes, referred to as machine code or object code. It is a collection of binary digits or bits that computer reads and interprets.

2. **Assembly Language** It is used to interface with computer hardware. It uses instructed commands as substitutions for numbers allowing human to read the code more easily than binary. It uses English –like representation to write a program.

Medium Level Language:

It serves as the bridge between raw hardware and programming layer of a computer system. It is designed to improve the translated code before it is executed by the processor.

2. **High Level Language (HLL)** It is machine independent language and uses translator. It is also called source code. Some commonly used high level languages are C, BASIC, FORTRAN, PASCAL, etc.

Language Translator:

A language translator helps in converting programming languages to machine language. The translated program is called the object code. There are three different kinds of language translator

1. **Assembler** It is used to convert the assembly language into machine language (i.e.,0 or 1), This language consists of mnemonic codes which are difficult to learn and is machine dependent.
2. **Compiler** It is used to convert the source code (written in high level language) into machine language. Compiler reads whole source code at a time and trap the errors and inform to programmer. For each high level language, the machine requires a separate compiler.
3. **Interpreter** This language processor converts a high level language program into machine language by converting it line-by-line. If there is any error in any line during execution, it will report it at the same time and cannot resume until the error is rectified.

Linker

A linker is a system program that links together several object modules and libraries to form a single and coherent program (executable). The main purpose of linker is to resolve references among files. Linker is used to determine the memory locations that code from each module will occupy and relates its instruction by adjusting absolute references.

Loader

Loader is a kind of system software, which is responsible for loading and relocation of the executable program in the main memory. It is a part of operating system that brings an executable file residing on disk into memory and starts its execution process.

Application Software

Application software is a computer software designed to help the user to perform singular or multiple tasks. It is a set of instructions or program designed for specific uses or applications, that enable the user to interact with a computer . Application software are also called the end-user programs. These programs do the real work for users.

There are two types of application software.

1. General Purpose Software

General purpose software's are designed to perform general tasks.

I. Word Processing Software

A word processor is a software program capable of creating, storing and printing of documents. Word processors have the ability to create a document and make changes anywhere in the document. This document can also be saved for modification later on or be opened on any other computer using the same word processor.

II. Presentation software

Presentation is the practice of showing and explaining the contents of a topic to an audience or learner visually. People , in a variety of settings and situations, use presentation software to make their presentations more interesting and professional. e.g., marketing managers use presentation graphics to present new marketing strategies to their superiors Sales people use this software to demonstrate products and encourage customers to make purchases. Students use it to create high quality class presentations. e.g., Microsoft PowerPoint, Corel presentations, Lotus Freelance Graphics etc.

III. Electronic Spreadsheets

Spreadsheet applications (sometimes referred to simply as spreadsheets) are the computer programs that accepts data in a tabular form and allow you to create and manipulate spreadsheets electronically. In Spreadsheet Applications, each value exists in a cell. You can define what type of data is in each cell and how different cells depend on one another. The relationships between cells are called Formulas and the names of the cells are called Labels. E.g., Microsoft Excel, Corel Quattro Pro, Lotus 1-2-3 etc.

IV. Database Management System (DBMS)

A DBMS (Database Management System) refers to the software that is responsible for sorting, maintaining and utilizing a database. It enables a user to define, create and maintain the database and provide controlled access on it. A database is a collection of integrated data stored together to serve multiple applications.

e.g., Microsoft Access, Corel Paradox, Lotus Approach etc.

V. Desktop Publishing Software

Desktop publishing software is a tool for graphic designers and non-designers to create visual communications for professional or desktop printing as well as for online or on screen electronic publishing.

Complete Desktop Publishing (DTP) involves the combination of type setting (choosing font and the text layout), graphic design, Page layout (how it all fits on the page) and printing the document. e.g., Quark Express, Adobe Page Maker, 3B2, Corel Draw, Corel Ventura Illustrator etc.

VI. Graphics Software

Graphics Software or image editing software is an application program or collection of programs that enables a person to manipulate visual images on a computer system. Most graphics software have the ability to import and export one or more graphics file formats. Typical graphics software enables data to be plotted as line chart, bar chart and pie chart. e.g., Adobe Photoshop, Pizza, Microsoft Publishes etc.

VII. Multimedia Software

Multimedia includes a combination of text, audio, still images, animation, video or interactivity content forms. The term is used in contrast to media which uses only rudimentary computer display such as text only or traditional forms of printed or hand produced material.

2. Specific Purpose Software

Specific purpose software are designed to perform specific tasks. This type of application software generally has one purpose to execute.

Some of the specific purpose application software's are described below.

I. Inventory Management System and Purchasing System.

It is an attempt to balance inventory needs and requirement to minimize total cost, resulting from obtaining and holding an inventory. Inventory is a list of goods and materials available in a stock. Inventory management system is generally used in departmental stores or in an organization to keep the records of the stock of all the physical resources.

II. Payroll Management System.

Payroll management system is used by all modern organisations to encompass every employee of the organisation who receives a regular wage or other compensation. All different payment methods are calculated by the payroll software and the appropriate Pay checks are issued.

III. Hotel Management System

Hotel management system refers to the management techniques used in the hotel sector. These can include hotel administration, accounts, billing, marketing, housekeeping, front office or front desk.

IV. Reservation System

A reservation system or central reservation system (CRS) is a computerized system used to store and retrieve information and conduct transactions related to air travel, hotels, car rental, or other activities. It is an application software which is commonly seen at railway reservation offices, this software helps the concerned department to automatically check the availability of the seats or berths of any train and any particular data with incomparable speed.

V. Report Card Generator

It is an application software which is commonly used in schools by the examination department to prepare and generate the report cards of the students. It performs all possible mathematical calculations and checks whether a student can be promoted to the next class or not. It can also be used to calculate the class wise ranking of a student.

VI. Accounting software

Accounting software is an application software that records and processes accounting transactions within functional modules such as accounts payable, accounts receivable, payroll and trial balance. It works as an accounting information system.

There are several types of accounting software's as follows

(a) Accounts payable Software.

(b) Bank Reconciliation Software.

(c) Budget Management Software, etc.

VII. HR Management System

It refers to the systems and processes at the intersection between human resource management (HRM) and information technology. The function of HR department is generally administrative and common to all organisations. e.g., Effective Staff, Cezanne HR etc.

VIII. Attendance System

Attendance system is an application software designed to track and optimize the presence of a person/ student in an organisation or school. Now-a-days, attendance system can be integrated with customer's existing time/attendance recording devices like Biometrics/ Access cards. Attendance management can be done in two ways

(a) Biometric Integration

(b) Manually Attendance Integration

IX. Billing System

It refers to the software that is used to perform the billing process. It handles the tracking of ladled products and services delivered to a customer or set of customers. e.g., Billing Tracker, Killing etc.

Internet

The Internet, sometimes called simply "the Net," is a worldwide system of computer networks a network of networks in which users at any one computer can, if they have permission, get information from any other computer (and sometimes talk directly to users at other computers). It was conceived by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was first known as the ARPANet. The original aim was to create a network that would allow users of a research computer at one university to "talk to" research computers at other universities. A side benefit of ARPANet's design was that, because messages could be routed or rerouted in more than one direction, the network could continue to function even if parts of it were destroyed in the event of a military attack or other disaster.

Today, the Internet is a public, cooperative and self-sustaining facility accessible to hundreds of millions of people worldwide. Physically, the Internet uses a portion of the total resources of the currently existing public telecommunication networks. Technically, what distinguishes the Internet is its use of a set of protocols called TCP/IP (for Transmission Control Protocol/Internet Protocol). Two recent adaptations of Internet technology, the intranet and the extranet, also make use of the TCP/IP protocol.

The most widely used part of the Internet is the World Wide Web (often abbreviated "WWW" or called "the Web"). Its outstanding feature is hypertext, a method of instant cross-referencing. In most Web sites, certain words or phrases appear in text of a different color than the rest; often this text is also underlined. When you select one of these words or phrases, you will be transferred to the site or page that is relevant to this word or phrase. Sometimes there are buttons, images, or portions of images that are "clickable." If you move the pointer over a spot on a Web site and the pointer changes into a hand, this indicates that you can click and be transferred to another site.

Using the Web, you have access to billions of pages of information. Web browsing is done with a Web browser, the most popular of which are Chrome, Firefox and Internet Explorer. The appearance of a particular Web site may vary slightly depending on the browser you use. Also, later versions of a particular browser are able to render more "bells and whistles" such as animation, virtual reality, sound, and music files, than earlier versions.

The Internet has continued to grow and evolve over the years of its existence. IPv6, for example, was designed to anticipate enormous future expansion in the number of available IP addresses. In a related development, the Internet of Things (IoT) is the burgeoning environment in which almost any entity or object can be provided with a unique identifier and the ability to transfer data automatically over the Internet.

E-mail

Short for **electronic mail**, **e-mail** or **email** is information stored on a computer that is exchanged between two users over telecommunications. More plainly, e-mail is a message that may contain text, files, images, or other attachments sent through a network to a specified individual or group of individuals.

The first e-mail was sent by Ray Tomlinson in 1971. Tomlinson sent the e-mail to himself as a test e-mail message, containing the text "something like QWERTYUIOP." However, despite sending the e-mail to himself, the e-mail message was still transmitted through ARPANET.

By 1996, more electronic mail was being sent than postal mail.

Some early email systems required the author and the recipient to both be online at the same time, in common with instant messaging. Today's email systems are based on a store-and-forward model. Email servers accept, forward, deliver, and store messages. Neither the users nor their computers are required to be online simultaneously; they need to connect only briefly, typically to a mail server or a webmail interface, for as long as it takes to send or receive messages.

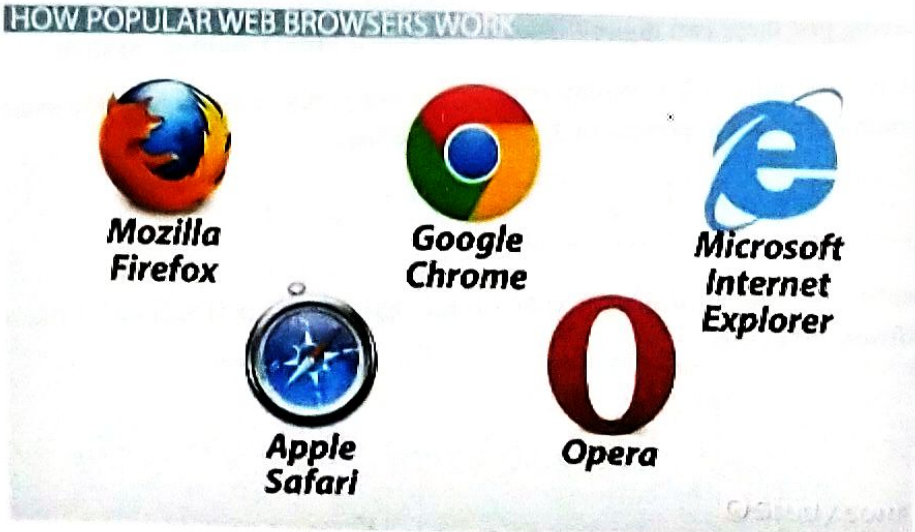
BROWSER:

Definition - What does Web Browser mean?

A web browser is a software program that allows a user to locate, access, and display web pages. In common usage, a web browser is usually shortened to "browser." Browsers are used primarily for displaying and accessing websites on the internet, as well as other content created using languages such as Hypertext Markup Language (HTML) and Extensible Markup Language (XML).

Browsers translate web pages and websites delivered using Hypertext Transfer Protocol (HTTP) into human-readable content. They also have the ability to display other protocols and prefixes, such as secure HTTP (HTTPS), File Transfer Protocol (FTP), email handling (mailto:), and files (file:). In addition, most browsers also support external plug-ins required to display active content, such as in-page video, audio and game content.

Common browsers include Internet Explorer from Microsoft, Firefox from Mozilla, Google Chrome, Safari from Apple, and Opera. All major browsers have mobile versions that are lightweight versions for accessing the web on mobile devices.



Number system:

The technique to represent and work with numbers is called number system. Decimal number system is the most common number system. Other popular number systems include binary number system, octal number system, hexadecimal number system, etc.

Decimal Number System:

Decimal number system is a **base 10** number system having 10 digits from 0 to 9. This means that any numerical quantity can be represented using these 10 digits. Decimal number system is also a **positional value system**. This means that the value of digits will depend on its position. Let us take an example to understand this.

Say we have three numbers – 734, 971 and 207. The value of 7 in all three numbers is different–

- In 734, value of 7 is 7 hundreds or 700 or 7×100 or 7×10^2
- In 971, value of 7 is 7 tens or 70 or 7×10 or 7×10^1
- In 207, value 0f 7 is 7 units or 7 or 7×1 or 7×10^0

The weightage of each position can be represented as follows –

10^5	10^4	10^3	10^2	10^1	10^0

In digital systems, instructions are given through electric signals; variation is done by varying the voltage of the signal. Having 10 different voltages to implement decimal number system in digital equipment is difficult. So, many number systems that are easier to implement digitally have been developed. Let's look at them in detail.

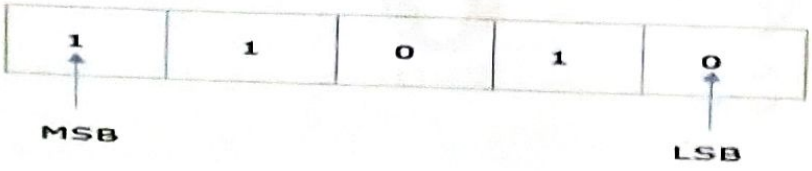
Binary Number System:

The easiest way to vary instructions through electric signals is two-state system – on and off. On is represented as 1 and off as 0, though 0 is not actually no signal but signal at a lower voltage. The number system having just these two digits – 0 and 1 – is called **binary number system**.

Each binary digit is also called a **bit**. Binary number system is also positional value system, where each digit has a value expressed in powers of 2, as displayed here.

2^5	2^4	2^3	2^2	2^1	2^0

In any binary number, the rightmost digit is called **least significant bit (LSB)** and leftmost digit is called **most significant bit (MSB)**.



And decimal equivalent of this number is sum of product of each digit with its positional value.

$110102 = 1\times2^4 + 1\times2^3 + 0\times2^2 + 1\times2^1 + 0\times2^0$

$= 16 + 8 + 0 + 2 + 0$

$= 2610$

Octal Number System:

Octal number system has eight digits – 0, 1, 2, 3, 4, 5, 6 and 7. Octal number system is also a positional value system with where each digit has its value expressed in powers of 8, as shown here –

8^5	8^4	8^3	8^2	8^1	8^0

Decimal equivalent of any octal number is sum of product of each digit with its positional value.

$7268 = 7\times8^2 + 2\times8^1 + 6\times8^0$

$= 448 + 16 + 6$

$= 47010$

Hexadecimal Number System:

Octal number system has 16 symbols – 0 to 9 and A to F where A is equal to 10, B is equal to 11 and so on till F. Hexadecimal number system is also a positional value system with where each digit has its value expressed in powers of 16, as shown here –

16^5	16^4	16^3	16^2	16^1	16^0

Decimal equivalent of any hexadecimal number is sum of product of each digit with its positional value.

$27FB16 = 2\times16^3 + 7\times16^2 + 15\times16^1 + 10\times16^0$

$= 8192 + 1792 + 240 + 10$

$= 1023410$

Number System Relationship:

The following table depicts the relationship between decimal, binary, octal and hexadecimal number systems.

BINARY	DECIMAL	OCTAL	HEXADECIMAL
0000	0	0	0
0001	1	1	1

BINARY	DECIMAL	OCTAL	HEXADECIMAL
0000	0	0	0
0001	1	1	1
0010	2	2	2
0011	3	3	3
0100	4	4	4
0101	5	5	5
0110	6	6	6
0111	7	7	7
1000	8	10	8
1001	9	11	9
1010	10	12	A
1011	11	13	B
1100	12	14	C
1101	13	15	D
1110	14	16	E
1111	15	17	F

As you know decimal, binary, octal and hexadecimal number systems are positional value number systems. To convert binary, octal and hexadecimal to decimal number, we just need to add the product of each digit with its positional value. Here we are going to learn other conversion among these number systems.

Decimal to Binary conversion:

Decimal numbers can be converted to binary by repeated division of the number by 2 while recording the remainder. Let's take an example to see how this happens.

		Remainder	
2	43		
2	21	1	MSB
2	10	1	↑
2	5	0	
2	2	1	
2	1	0	
	0	1	LSB

The remainders are to be read from bottom to top to obtain the binary equivalent.

$4310 = 1010112$

Decimal to Octal conversion:

Decimal numbers can be converted to octal by repeated division of the number by 8 while recording the remainder. Let's take an example to see how this happens.

		Remainder	
8	473		
8	59	1	MSD
8	7	3	↑
	0	7	LSD

Reading the remainders from bottom to top,

$47310 = 7318$

Decimal to Hexadecimal conversion:

Decimal numbers can be converted to octal by repeated division of the number by 16 while recording the remainder. Let's take an example to see how this happens.

		Remainder	
16	423		
16	26	7	
16	1	A	↑
	0	1	

Reading the remainders from bottom to top we get,

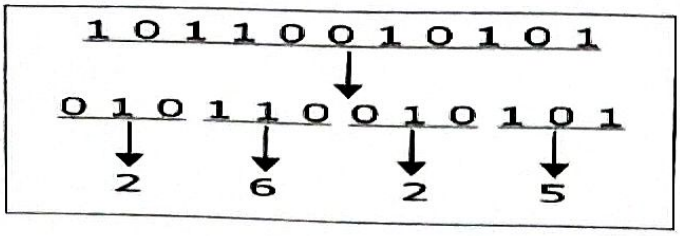
$42310 = 1A716$

Binary to Octal conversion and Vice Versa

To convert a binary number to octal number, these steps are followed –

- Starting from the least significant bit, make groups of three bits.
- If there are one or two bits less in making the groups, 0s can be added after the most significant bit
- Convert each group into its equivalent octal number

Let's take an example to understand this.



101100101012 = 26258

To convert an octal number to binary, each octal digit is converted to its 3-bit binary equivalent according to this table.

Octal Digit	0	1	2	3	4	5	6	7
Binary Equivalent	000	001	010	011	100	101	110	111

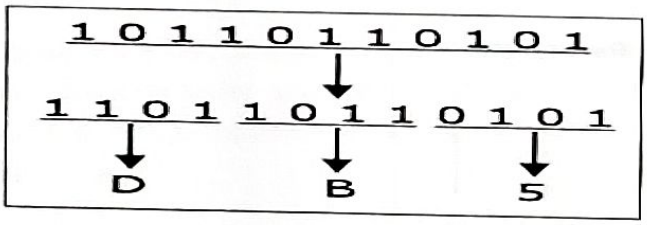
546738 = 1011001101110112

Binary to Hexadecimal conversion:

To convert a binary number to hexadecimal number, these steps are followed –

- Starting from the least significant bit, make groups of four bits.
- If there are one or two bits less in making the groups, 0s can be added after the most significant bit.
- Convert each group into its equivalent octal number.

Let's take an example to understand this.



101101101012 = DB516

To convert an octal number to binary, each octal digit is converted to its 3-bit binary equivalent.

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