



**Government Polytechnic, Sonapur**

**LECTURE NOTE**

**COMPUTER APPLICATION**

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# First Generation of computers →

1942 - 1954

## Vacuum Tubes →

- A vacuum tube is a device used to control the flow of electronic current using a vacuum in a sealed container.
- The vacuum tube is the predecessor of the modern transistor and was used in similar ways as electronically controlled switches, rectifiers, amplifiers, oscillators and in other ways as electronically may be used today.
- Vacuum tubes are used in radio, television, radar equipment and telephone systems during the first half of the 1900s.

## Features

- 1 - Huge size
- 2 - Highly unreliable
- 3 - Very costly
- 4 - Difficult to use
- 5 - Not for commercial use
- 6 - Consumed a lot of electricity
- 7 - Generated a lot of heat, so AC needed

## Example

- ENIAC → Electronic Numerical Integrator and computer
- EDSAC → Electronic Delay Storage Automatic Calculator
- EDVAC → Electronic Discrete Variable Automatic Calculator
- UNIVAC → Universal Automatic Calculator
- IBM-701
- IBM-650

## Second Generation of computer

1952 - 1964

### Transistor

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminal connections to an external circuit.

- A voltage or current applied to one pair of the transistor terminal controls the current through another pair of terminal. Because the controlled (output) power can be higher than the controlling (input power) a transistor can be amplify a signal.

## Features

1. Smaller size as compared to first generation computers
2. Fast and reliable
3. Still very costly
4. Difficult to use
5. Not for commercial use
6. Consumed less electricity as compared to first generation
7. Still generate heat so AC is required.

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## Example

- 1. IBM-1620
- 2. IBM-7094
- 3. CDC-1604
- 4. CDC-3600
- 5. UNIVAC-1108

## Third Generation of computer

~~Integrated~~ 1964 - 1972

### Integrated circuit

- An integrated circuit (IC) sometimes called a chip or microchip is a semiconductor wafer on which thousands or millions of tiny registers, capacitors and transistors are fabricated.
- An IC can function as an amplifier, oscillator, timer, counter, computer memory or microprocessor.

### Feature of Third

1. Smaller size
2. Faster and more reliable
3. Still costly
4. Lesser maintenance
5. Started for commercial use
6. Consumed less electricity
7. Generates less heat but AC required

## Example

- IBM 360 series
- Honeywell 6000 series
- IBM-370/168
- CDC-316

## Fourth Generation of computer

1972 - 1989

### LSI (Large scale Integrated)

- 1000 - 10,000 transistor/chip on 300-3000 gates/chip (8 bit)

### VLSI (Very large scale Integrated)

- 100,000 - 1,000,000 transistor/chip on more than 3000 gates/chip (16 bit / 32 bit)

Feature

- 1. very small size and portable
- 2. very fast and much more reliable
- 3. very cheap
- 4. very less maintenance
- 5. computer became easily available
- 6. No AC required

Example

- DEC 10
  - STAR 1000
  - PDP 11
  - CRAY-I (super computer)
  - CRAY-X-MP (super computer)
- Fifth Generation of computer  
(1989 - Present)

- VLSI → ultra ~~small~~ large scale Integration  
10 power 6 - 10 power 7 transistor/chip  
smart sensors, VR reality module
- GSI - Giant scale Integration  
greater than 10 power 7 transistor/chip

Feature

- very fast and highly reliable
- Availability of very powerful and computer at cheaper rate
- More user friendly ~~Info~~ Interfaces with multimedia features.
- Advancement in superconductor technology
- Advanced in parallel processing
- Development of artificial intelligence

Example →

- 1. Desktop
- 2. Laptop
- 3. Notebook
- 3. Ultra notebook

19th century computers

First generation  
1942 - 1959

Second generation  
1952 - 1964

Third generation  
1964 - 1972

Fourth generation  
1972 - 1981

Fifth generation  
1981 - present

Year 1942 - 1959

Technology Vacuum Tubes

→ Magnetic core memory

→ Large magnetic tape

Multi processor semiconductor memory

Large scale Microprocessor Semiconductor memory

Memory ~~Electromechanical~~ Electro-mechanical relay memory

→ Magnetic core memory

Larger capacity disk and magnetic tape

Larger capacity disk magnetic tapes & drums

Larger capacity parallel disk optical disk

Storage punched gate

Disk

1. Desktop

Example

1. ENIAC
2. EDSAC
3. EDVAC
4. UNIVAC
5. IAS - 701
6. IAS - 650

1. IAS 1620
2. IAS 7014
3. CDC 1604
4. CDC 3600
5. UNIVAC 1103

1. IAS - 360 series
2. Honeywell 6000 series
3. PDP (Personal Data Processor)
4. IAS - 320 / 168
5. CDC - 3601

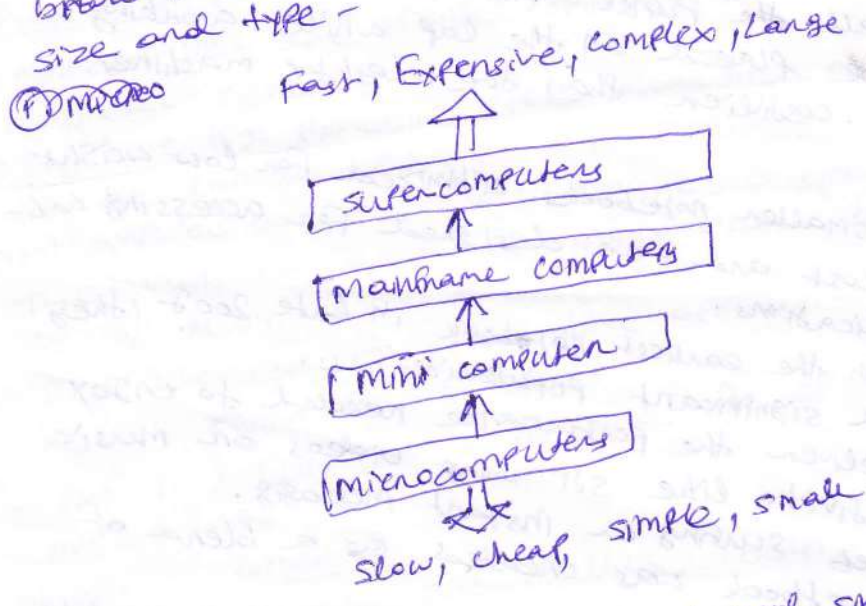
1. DEC 10
2. STAR 100
3. PDP 11
4. CRAY I
5. CRAY - X - MP

2. Laptop
3. Notebook
4. Ultrabook

# Classification of computers

- ① Microcomputer
- ② Mini computer
- ③ Mainframe computer
- ④ Super computer

- The digital computers that are available nowadays vary in their sizes and types. The computers are broadly classified into four categories based on their size and type -



## Microcomputers

Microcomputers are small, low-cost and single-user digital computer.

→ They consist of CPU, input unit, output unit, storage unit and the software. Although microcomputers are stand alone machines, they can be connected together to create a network of computers that can serve more than one user.

→ Micro computer include desktop computer, notebook computers, tablet computer, handheld computer, smart phone and netbook.

## ① Desktop computer → is the most common type of microcomputer

→ It is a stand alone machine that can be placed on the desk.

→ Externally it consists of three units →  
① keyboard ② monitor ③ system unit containing the CPU, memory, hard disk drive etc.

- (a) It is not very expensive and suited to the needs of a single user at home, small business units and organizations.
- Ex- Apple, HP, Dell, Lenovo are some of the PC manufacturers.

### (b) Notebook computer →

- They are portable and have all the features of a desktop computer.
- The advantage of the laptop is that it is small in size, can be carried anywhere, has a battery backup and has all the functionalities of the desktop.
- Laptop can be placed on the lap while working.
- Laptop are costlier than the desktop machines.

### (c) Netbook →

- There are smaller notebooks optimized for low weight and low cost and are designed for accessing web-based applications.

→ Starting with the earliest netbook in late 2007 they have gained significant popularity now.

→ Netbook deliver the performance needed to enjoy popular activities like streaming videos on music emailing, web surfing or instant messaging.

→ The word netbook was created as a blend of Internet and notebook.

→ Tablet computer has features of the notebook computer but it can accept input from a stylus or a pen instead of the keyboard or mouse. It is a portable computer. Tablet computers are the new kind of PCs.

### (d) Handheld computer or personal Digital Assistant (PDA) is a small computer that can be held on the top of the palm.

- It is small in size. Instead of the keyboard, PDA uses a pen or a stylus for input.

- PDA do not have a hard drive. They have a limited memory and are less powerful.

- PDA can be connected to the Internet via a wireless connection.

- Apple's Newton was the first widely sold PDA. Even the year PDA have merged into mobile phone to create a smart phone.

## ⑤ Smart Phone →

- They may use a stylus or a pen or may have a 7
- Small keyboard.
- They can be connected to the internet wirelessly.
- They are used to access the electronic mail, download music, play games etc.
- Blackberry, Apple, HTC, Nokia and LG are some of the manufacturers of smart phone.

## Mini Computers →

- Mini computer are digital computer generally used in multiuser system.
- They have high processing speed and high storage capacity than the microcomputers.
- Mini computer can support 4-200 users simultaneously. The users can access the mini computer through their PC or terminal.
- They are used for real-time applications in industries, research ~~center~~ center etc.
- PDP 11, IBM (8000 series) are some of the widely used mini computers.

## Mainframe computer

- Mainframe computer are multiuser, multi programming and high performance computer.
- They operate at a ~~high~~ very high speed have very large storage capacity and can handle the workload of many users. Mainframe computers are large and powerful systems generally used in centralized databases.
- The user access the mainframe computer via a terminal that may be a dumb terminal, an intelligent terminal or a PC.
- A dumb terminal can not be store data or do processing of its own. It has the input and output device only.
- An intelligent terminal has the input and output device, can do processing but can not store data of its own. The dumb and the intelligent terminal use the processing power and the storage facility of the mainframe computer.



→ mainframe computers are used in organization like bank or companies where many people require frequent access to the same data. (8)

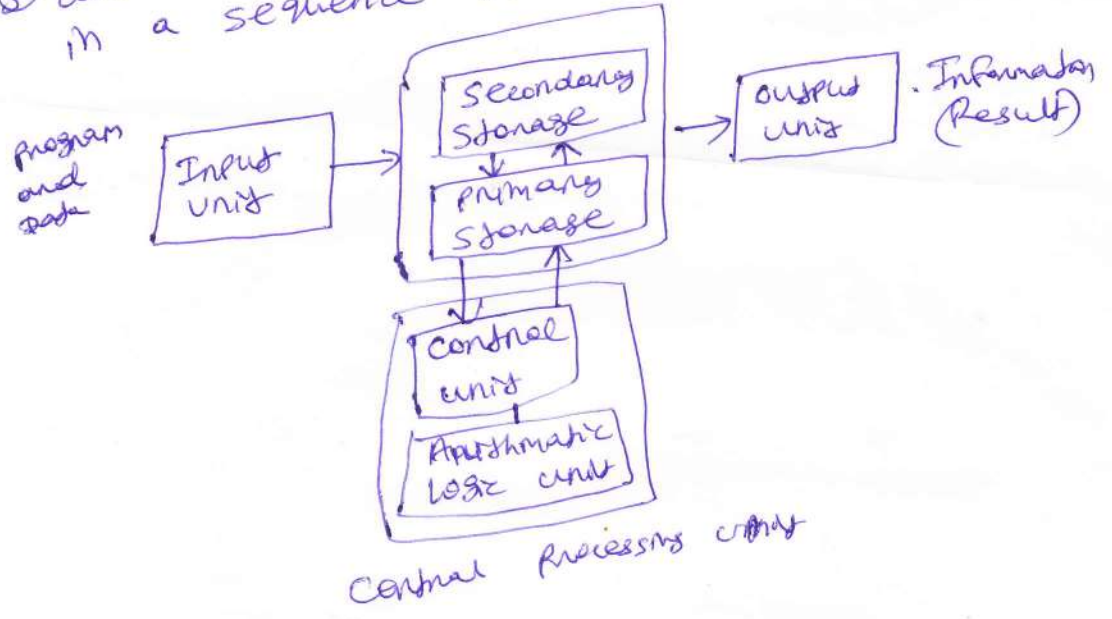
→ CDC 6600 and IBM ES9000 series

### Supercomputers

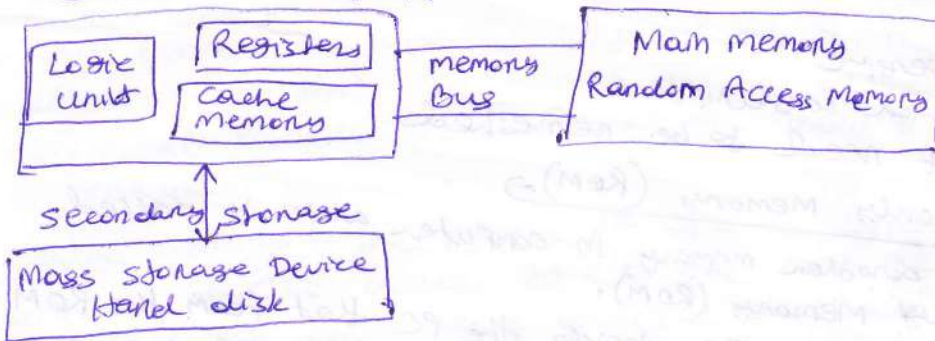
- Supercomputer are the fastest and the most expensive machines.
- They have high processing speed compared to other computers.
  - The speed of a supercomputer is generally measured in FLOPS (floating point operation per second).
  - Some of the faster supercomputers can perform millions of calculations per second.
  - Supercomputer are built by interconnecting thousands of processors that can work in parallel.
  - Supercomputer are used for high calculation-intensive task such as weather forecasting, climate research (global warming), molecular research, biological research, nuclear research and aircraft design. They are also used in major universities, military agencies and scientific research lab.
  - IBM Roadrunner, IBM Blue gene, Intel ASCI Red.
  - PARAM made in India by C-DAC (Centre for development of Advanced computing).

# Von Neumann's architecture

- is a computer architecture based on a 1694 description by the John von Neumann.
- All computer systems perform the following five basic operations →
  - ① **Inputting** - This is the process of entering data and instructions into the computer system.
  - ② **Storing** → saving data and instructions to make them readily available for ~~the future~~ use so that they can be used for processing.
  - ③ **Processing** → performing arithmetic operations on logical operations on data to convert them into useful information.
  - ④ **Outputting** - producing useful information for a user such as printed report on visual display.
  - ⑤ **Controlling** → Directing and coordinating all operation in a sequence inside a computer.



## Central Processing Unit



### Primary memory →

- ~~There are two types~~ Primary memory is also known as Internal memory or main memory.
- As soon as the computer is switched off, the contents of the primary memory is lost.
- We can store and retrieve data much faster with primary memory compared to secondary memory.
- Primary memory is more expensive than secondary memory.
- When the computer is doing any job, the data that have to be processed are stored in the primary memory. This data may come from an input device like keyboard or from a secondary storage device like floppy disk, memory card or pen drive etc.
- The primary memory itself is implemented by two types of memory technologies →

### (a) Random Access Memory (RAM)

- The primary storage is referred to as Random Access memory (RAM) because it is possible to randomly select and use any location of the memory directly to store and retrieve data.
- The storage of data and instructions inside the primary storage is temporary. It disappears from RAM as soon as the power to the computer is switched off. The memories which ~~lose~~ lose their content on failure of power supply, are known as volatile memories. So now we can say that RAM is volatile memory.

There are two types of RAM

### ① DRAM (Dynamic Random Access Memory)

→ Slower

- Less expensive

- Less power consumption

- Needs to be refreshed thousands per second

## ② SRAM (Static Random Access Memory)

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→ Faster

- More expensive

- More power consumption

- Does not need to be refreshed

### → Read only Memory (ROM)

- There is another memory in computer which is called Read only Memory (ROM).

- Again it is the ICs inside the PC that form the ROM.

- The storage of program and data in the ROM is permanent.

The ROM stores some standard processing program supplied by the manufacturer to operate the personal computer.

- The ROM can only be read by the CPU but it can not be changed. The (BIOS) Basic Input/output system

is stored in the ROM that examines and initializes various equipment attached to PC when the switch is turned on.

- The memories which do not lose their content on failure of power supply, are known as non-volatile memories. ROM is non-volatile memory.

### - Programmable Read only memory (PROM)

- There is another type of primary memory in computer which is called Programmable Read only Memory (PROM)

You know that it is not possible to modify or erase programs stored in ROM, but it is possible for you to store your program in PROM chips. Once the

program are written it can not be changed and remain intact even if power is switched off.

Therefore programs or instructions written in PROM or ROM can not be erased or changed.

### - Erasable Programmable Read only memory (EPROM)

- It overcome the problem of PROM and ROM. EPROM chip can be programmed time and again by erasing the

information stored earlier in it. Information stored in EPROM can be erased by exposing it to ultra-

violet light. This memory can be reprogrammed using a special programming facility. When the EPROM is

in the use, information can only be read.

## - EEPROM (Electrically erasable Programmable Read only memory)

(12)

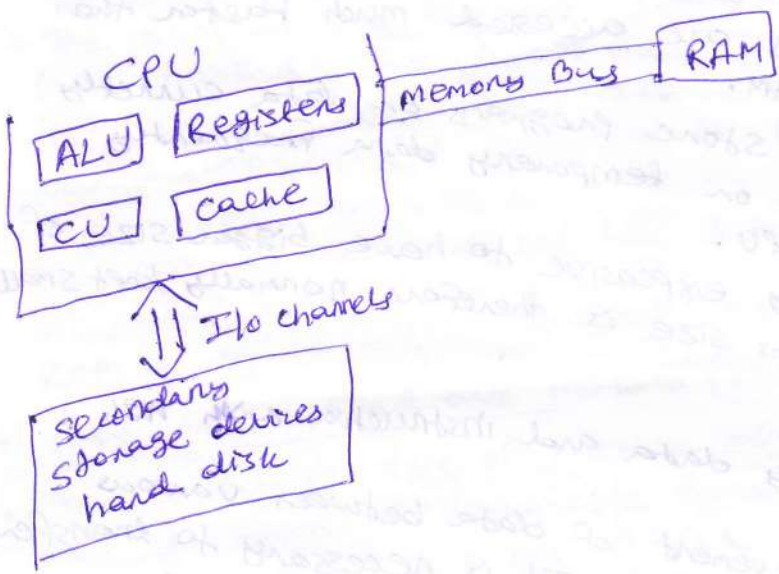
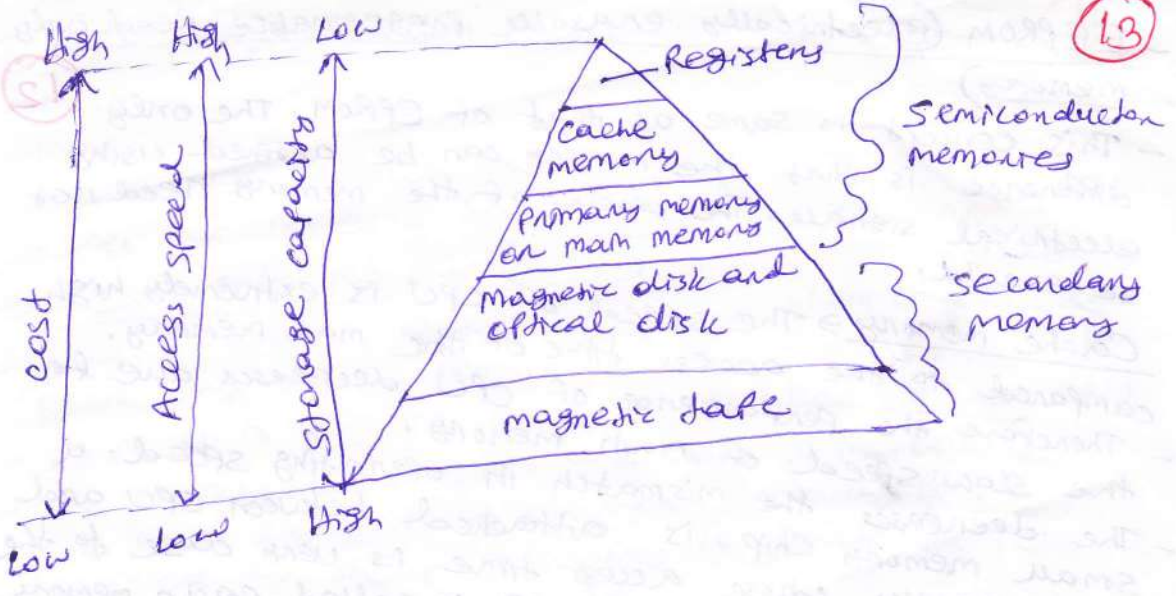
- This concept is same as that of EPROM. The only difference is that the memory can be altered using electrical signals. The whole of the memory need not be erased.

Cache memory  $\Rightarrow$  The speed of CPU is extremely high compared to the access time of the main memory.

- Therefore the performance of CPU decreases due to the slow speed of main memory.
- The decreases the mismatch in operating speed, a small memory chip is attached between CPU and main memory whose access time is very close to the processing speed of CPU. It is called cache memory.
- Cache memories are accessed much faster than conventional RAM.
- It is used to store programs or data currently being executed on temporary data frequently used by the CPU.
- It is also very expensive to have bigger size of cache memory. Its size is therefore normally kept small.

## Registers $\Rightarrow$

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



## Secondary Memory

- The secondary memory is also called ~~a~~ auxiliary memory on external memory.
- The data and instructions stored in secondary memory must be fetched into RAM before processing is done by CPU.
- Magnetic tape drives, magnetic disk drives, optical disk drive are the different types of storage devices.

### Access types of storage devices

- The information stored in storage devices can be accessed in two ways -

① Sequential access

② Direct access

① Sequential Access Devices →

- sequential access means that computer must run through the data in sequence starting from the beginning, in order to locate a particular piece of data.

- Magnetic tape is an example of sequential access device.

- Let us suppose that magnetic tape consists of 80 records. To access the 25th record, the computer starts from first record, then reaches second, third etc until it reaches the 25th record.

Sequential access devices are generally slow devices.

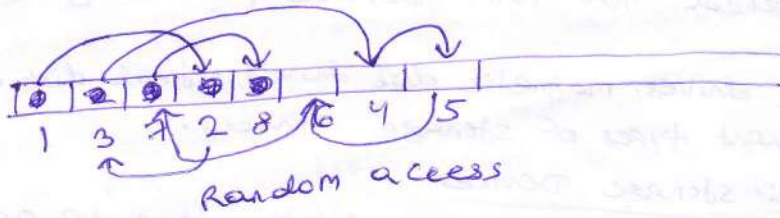
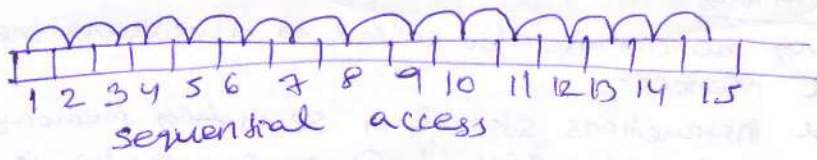
② Direct Access Devices →

- Direct access devices are the ones in which any piece of data can be retrieved in a non-sequential manner by locating it using the data address. It accesses the data directly from a desired location.

- Magnetic disk and optical disk are example of direct access device.

- There is no predefined order in which one can read and write data from a direct access device. In a magnetic disk consisting of 80 records, to access 25th record, the computer can directly access the 25th record without going the first 24 records. Based on access magnetic tape are sequential access devices and magnetic disks, optical disk and ~~m~~ are direct access devices.

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### Magnetic Tape

- Magnetic tape is a plastic tape with magnetic coating. It is a storage medium on a large open reel or in a smaller cartridge or cassette (like a music cassette).
- Magnetic tapes are cheaper storage media. They are durable, can be written, erased and re-written. Magnetic tape are sequential access devices which mean that the tape needs to rewind or move forward to the location where the requested data is positioned in the magnetic tape. Due to their sequential nature, magnetic tape are not suitable for data files that need to be revised or updated often.
- ⇒ They are generally used to store back up data that is not frequently used or to transfer data from one system to other.

### Feature

- ① Inexpensive storage device
- ② can store a large amount of data
- ③ Easy to carry or transport
- ④ Not suitable for random access data
- ⑤ slow access device
- ⑥ Needs dust prevention as dust can harm the tape.
- ⑦ suitable for back up storage or archiving.

### Magnetic Disk

- magnetic disk is a direct access secondary storage device. It is a thin plastic or metallic circular plate coated with magnetic oxide and encased in a protective cover. Data is stored on magnetic disk as magnetized spots. The presence of a magnetic spot represents

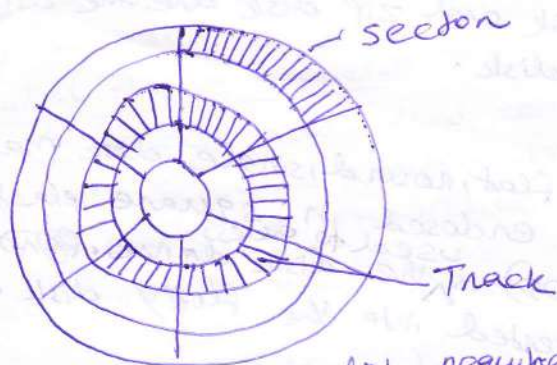


the bit 1 and its absence represents the bit 0. (16)

- The working of magnetic disk is explained as follows -

→ The surface of disk is divided into concentric circles known as tracks. The outermost track is numbered 0 and the innermost track is the last track.

→ Tracks are further divided into sectors. A sector is a pie slice that cuts across all tracks. The data on disk is stored in sectors. Sector is the smallest unit that can be read or written on a disk. A disk has eight or more sectors per track.



- Accessing data on the disk requires the following -

- ① The read/write head is positioned to the desired track where the data is to be read from or written to. The time taken to move the read/write head to the desired track is called the seek time.
- ② Once the read/write head is at the right track, then the head waits for right sector to come under it (disk is moving at high speed). The time taken for desired sector of the track to come under read/write head is called the Latency time.
- ③ Once the read/write head is positioned at the right track and sector, the data has to be written to disk or read from disk is called data transfer rate.
- ④ The sum of seek time, latency time and time for data transfer is the access time of the disk.
- ⑤ Large disk storage is created by stacking together multiple disk. A set of same ~~same~~ track on all disk forms a cylinder. Each disk has its own read/write head which work in coordination.
- ⑥ A disk can also have tracks and sectors on both sides. Such a disk is called double sided disk.

- The features of magnetic disk are ->

- ① cheap storage device
- ② can store a large amount of data
- ③ Easy to carry on transport
- ④ suitable for frequently read/write data
- ⑤ Fast access device
- ⑥ More reliable storage device
- ⑦ To be prevented from dust as the read/write head files over the disk. Any dust particle in between can corrupt the disk.

Example ->

- Floppy disk, hard disk and ZIP disk are the different type of magnetic disk.

Floppy Disk ->

- Floppy disk (FD) is a flat, round, single disk made of <sup>moving layer of</sup> plastic and enclosed in square plastic jacket. <sup>used to access</sup>
- Floppy disk drive (FDD) is the disk drive. ~~the floppy disk~~
- The floppy disk is inserted into the floppy disk drive to read or write data to it.
- Floppy disk has a write-protect slide tab that prevents a user from writing to it.
- A floppy disk may be single sided or double sided disk i.e. data can be read or written on one and both sides of floppy disk respectively.
- They are portable. They can be removed from the disk drive, carried or stored separately.
- They are small and inexpensive.
- Floppy disks are slower to access than hard disk. They have less storage capacity and are less expensive than hard disk.
- They come in two basic sizes -  $5\frac{1}{4}$  inch or  $3\frac{1}{2}$  inch.
- The  $5\frac{1}{4}$  inch disk came around 1987. It can store 360 KB to 1.2 MB of data.
- The  $3\frac{1}{2}$  inch disk has capacity of 400 KB to 1.44 MB - It usually contains 40 tracks and 18 sectors per track and can store 512 bytes per sector.

## Hand Disk -

- A hand disk (HD) consists of one or more platters (18) divided into concentric tracks and sectors. It is mounted on a central spindle like a stack. It can be read by a read/write head that pivots across the rotating disk. The data is stored on the platters covered with magnetic coating.
- Hand disk is the key secondary storage device of computer. The operating system is stored on the hand disk. The performance of computer like speed of computer boot up, loading of programs to primary memory, loading of large files like images, video, audio etc is also dependent on the hand disk.

## Optical Disk

- Optical disk is a flat and circular disk which is coated with reflective plastic material that can be altered by laser light. Optical disk does not use magnetism. The bits 1 and 0 are stored as spots that are relatively bright and light respectively.
- An optical disk consists of a single spiral track that starts from the edge to the centre of disk. Due to its spiral shape, it can access large amount of data sequentially. For example music and video. The random access on optical disk is slower than that of magnetic disk, due to its spiral shape.
- The tracks on optical disk are further divided into sectors which are of same length. Thus the sectors near the centre of disk wrap around the disk longer than the sectors on the edges of disk. Reading the disk thus require spinning the disk faster when reading near the centre and slower when reading near the edge of disk. Optical disk are generally slower than hard disk.
- Optical disk can store large amount of data upto 6 GB in a small space. Commonly used optical disk store 600-700 MB of data. 200 mg.
- The access time for an optical disk ranges from 100 to 200 ms.
- There are two most common categories of optical disk
  - (a) Read only optical disk
  - (b) Recondable optical disk

## CD-ROM →

- Originally, compact disk (CD) was a popular medium for storing music. Now it is used in computers to store data and is called Compact Disk Read Only Memory (CD-ROM)
- As the name suggests CD-ROM is an optical disk that can only be read and not written on. CD-ROM is written on by the manufacturer of the CD-ROM using the laser light.
- As CD-ROM is read only, no changes can be made into the data contained in it.
- Since there is no head touching the disk but a laser light CD-ROM does not wear out easily.
- The storage density of CD-ROM is very high and cost is low as compared to floppy disk and hard disk.
- Access time of CD-ROM is less. CD-ROM drives can read data at 150 kbps. They come in multiple of the speed like 2X, 4X, 52X, 75X, etc.
- It is a commonly used medium for distributing software and large data.

## DVD-ROM

- Digital Video Disk Read Only Memory (DVD-ROM) is an optical storage device used to store digital video or computer data.
- DVDs look like CDs in shape and physical size.
- It improves on CD technology.
- It is a high density medium with increased track and bit density.
- DVD-ROM uses both sides of the disk and special data compression technologies. The tracks for storing data are extremely small.
- A full length movie can be stored on a single disk.
- Each side of DVD-ROM can store 4.7 GB of data, so a single DVD can store 9.4 GB of data.
- New DVD-ROM use layers of data track to double its capacity. Such ~~two~~ dual layer disks can store 17 GB of data.

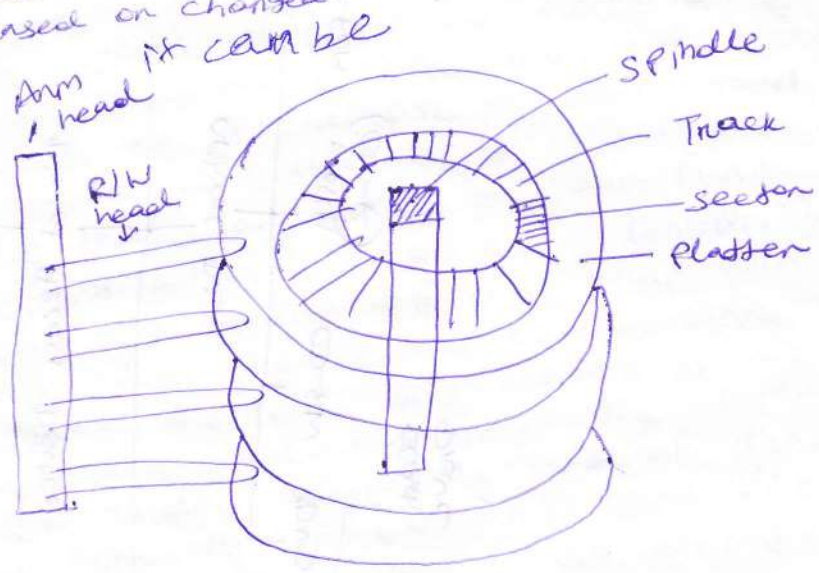
# Reordable optical Disk

- In addition to the read only CDs and DVDs, reordable optical disk are also available. Users can record music, vides, audio and data on it.
- The Reordable optical disk are -

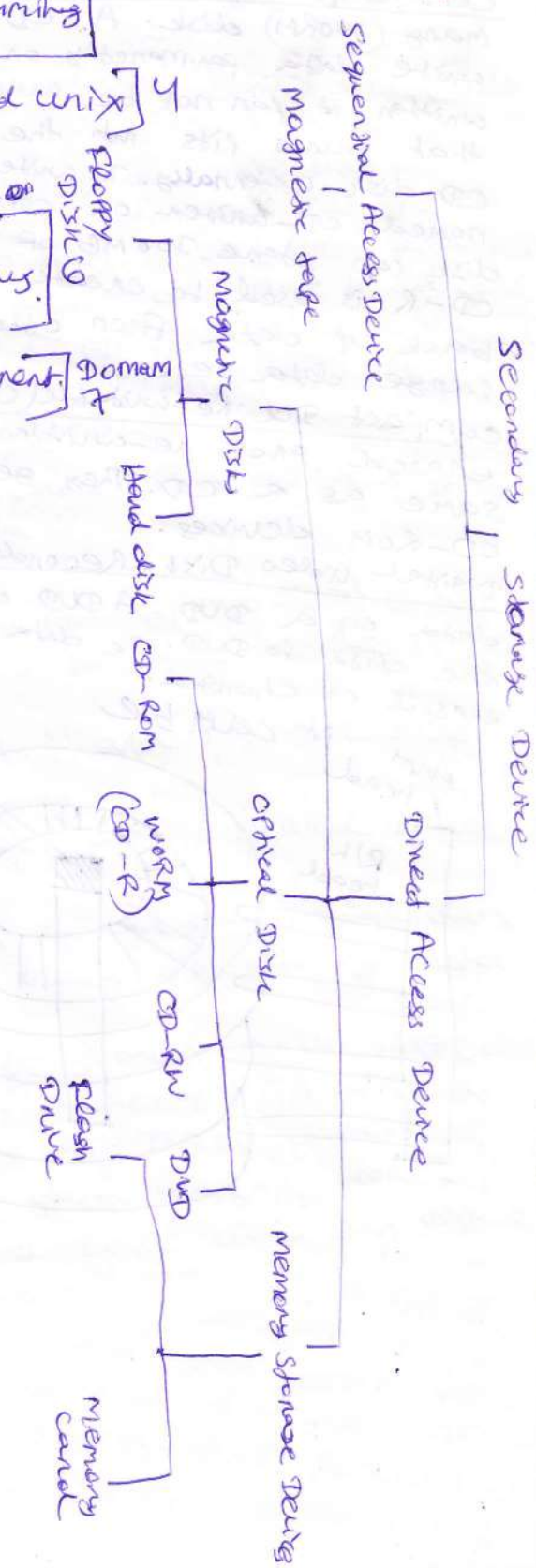
Compact Disk Reordable (CD-R) is a write once Read many (WORM) disk. A CD-R disk allows the user to write data permanently on to the disk. Once the data is written it can not be erased. CD-R disk uses a laser that burns pits into the disk surface. It looks like a CD disk externally. To write to a CD-R disk a device named CD-writer or CD-burner is required. A CD-R disk can store 700MB of data that can run for 80 min. CD-R is used to create music CDs in home computer back up data from other storage devices, archives a large data etc.

Compact Disk Re-writable (CD-RW) allows data to be written, erased and re-written on. The capacity of CD-RW is same as a CD. These generally do not played on all CD-ROM devices.

Digital Video Disk-Reordable (DVD-R) allows recording of data on a DVD. A DVD writer device is required to write the data to DVD. The data once written on a DVD can not be erased or changed.



- 1) Software concept  
System software  
Application software
- 2) Overview of operating system  
Objectives, functions of OS
- 3) Types of operating system  
Batch processing, Multiprogramming
- 4) Time sharing OS  
Feature of DOS, windows and unix
- 5) Programming languages  
compiler, Interpreter, ~~assembler~~
- Computer virus  
Different types of computer virus  
Detection and prevention of virus  
Applications of computer in different ~~domains~~



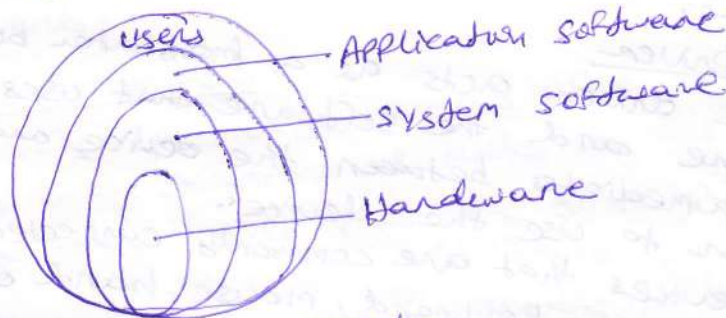
## Computer Software

- A computer system consists of hardware and software. The computer hardware can not perform any task on its own. It needs to be instructed about the tasks to be performed. Software is a set of program that instructs the computer about the tasks to be performed.

### Types of software

- software can be broadly classified in two categories -

- ① System software provides the basic functions that are performed by the computer. It is necessary for the functioning of a computer.
- ② Application software is used by the users to perform specific tasks. The user may choose the appropriate application software for performing a specific task, which provide the desired functionality.



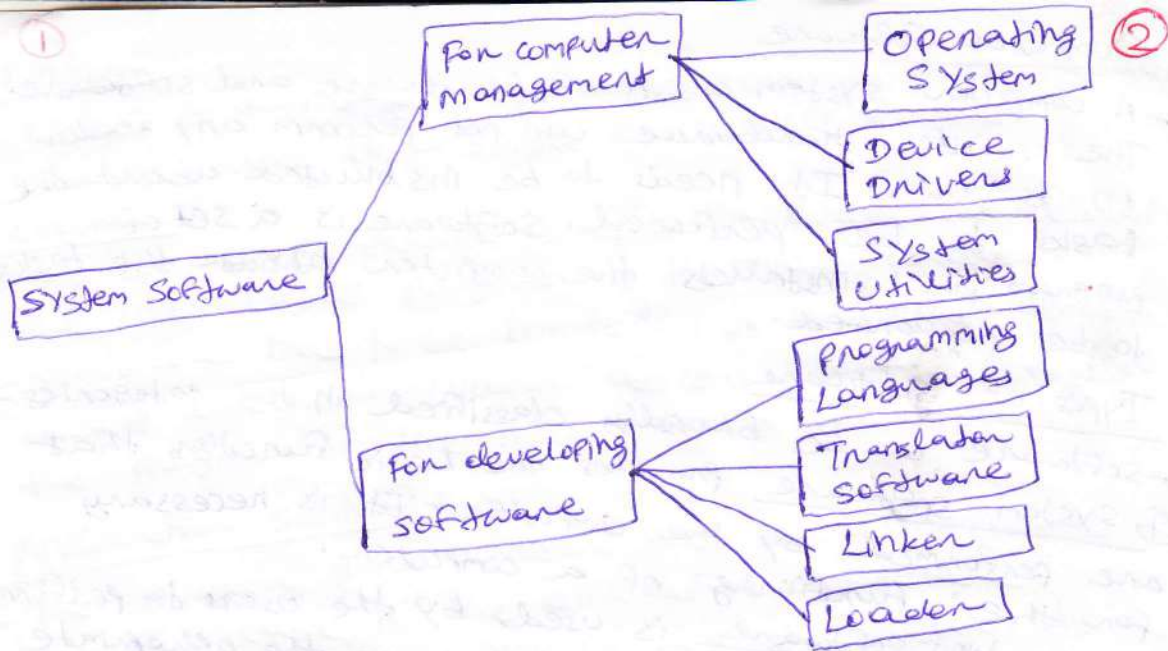
Software hierarchy

### System software

- System software provides basic functionality to the computer. System software is required for the working of computer itself. The user of computer does not need to be aware about the functioning of system software, while using the computer.

- The purpose of system software are:

- ① To provide basic ~~performance~~ functionality to computer.
- ② To ~~provide~~ control computer hardware
- ③ To act as an Interface between user, application software and computer hardware.



### Operating System (OS)

- OS is an important part of a computer. OS intermediates between the user of a computer and computer hardware.

### Device Driver

- A device driver acts as a translator between the hardware and the software that uses the device. It intermediates between the device and the software in order to use the device.

- Some devices that are commonly connected to the computer are - keyboard, mouse, hard disk, printer, speakers, microphone, Joystick, webcam, scanner, digital camera and monitor.

### System Utilities

- System utility software is required for the maintenance of computer system. Utilities are used for supporting and enhancing the programs and the data in computer. Some system utilities may come embedded with OS and others may be added later on.

### Example

- ① Anti-virus utility → To scan computer for viruses.
- ② Data compression utility → To compress the files
- ③ Cryptographic utility → To encrypt and decrypt files.
- ④ Disk compression utility - To compress contents of a



disk for increasing the capacity of a disk. (3)

⑤ Disk partitioning → To divide a single drive into multiple logical drive. Each drive is then treated as an individual drive.

⑥ Disk cleaners → To find files that have not been used for a long time. It helps the user to decide what to delete when the hard disk is full.

⑦ Backup utility → To make a copy of all information stored on the disk. It also restores the backed up contents in case of disk failure.

⑧ System profiling → Utility provides detailed information about the software installed on the computer and the hardware attached to it.

⑨ Network Managers → To check the computer network and to log events.

### Programming Languages

- A programming language consists of a set of vocabulary and grammatical rules, to express the computations and tasks that the computer has to perform.

- programming language usually refers to high-level languages like COBOL, BASIC, FORTRAN, C, C++, Java

### Translator Software →

- Translator software is used to convert a program written in high level language and assembly language to a form that the computer can understand. Translator software converts a program written in assembly language, and high-level language to a machine-level language program.

- The translated program is called the object code.

- There are three different kind of translator software

- ① Assembler
- ② compiler
- ③ Interpreter

## Linker

- Linker is a program that links several object modules and libraries to a single executable program.

## Loader

- The loader software is used to load and relocate the executable program in the main memory.
- Software has to be loaded into the main memory during execution. Loader assigns storage space to the program in the main memory for execution.

## Application Software

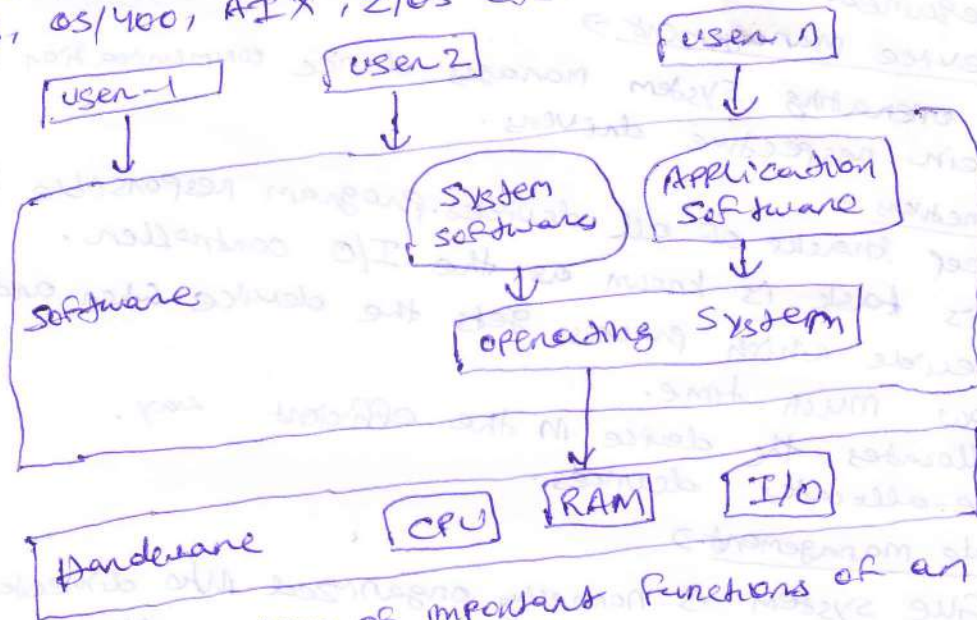
- The software that a user uses for accomplishing a specific task is the application software.
- Application software may be a single program or a set of programs. A set of programs that are written for a specific purpose and provide the required functionality is called software package.

## Example

- ① Word processing software → For writing letters, reports, documents etc (e.g. MS-WORD)
- ② Image processing software → For assisting in drawing and manipulating graphics (e.g. Adobe Photoshop)
- ③ Accounting software → For assisting in accounting, information, salary, tax returns (Tally software)
- ④ Spreadsheet software → used for creating budget, table etc (e.g. MS-Excel)
- ⑤ Presentation software → To make presentations, slide shows (e.g. MS - Powerpoint)
- ⑥ CAD/CAM software → To assist in architectural design (e.g. AutoCAD, Autodesk)
- ⑦ Web browsing software → To ~~visit~~ <sup>access</sup> the world wide web to search, documents, sound, images etc  
e.g. Internet explorer, ~~Net scape~~ ~~compu link~~, @mozilla, chrome

## Operating System (OS)

- OS is an interface between a computer user and computer hardware.
- An operating system is a software which performs all the basic tasks like file management, memory management, process management, handling input and output and controlling peripheral devices such as disk drives and printers.
- Some popular operating systems are Linux, Windows, OS X, VMS, OS/400, AIX, z/os etc.



- Following are some of important functions of an operating system →

① Memory Management → refers to management of primary memory or main memory. Main memory is a large array of words or bytes where each word or byte has its own address.

- Main memory provides a fast storage that can be accessed directly by the CPU. For a program to be executed, it must be in the main memory.

Functions

- keep tracks of primary memory, i.e. what part of it are in use by whom, what part are not in use.
- In multiprogramming, OS decides which process will get memory when and how much.
- Allocates the memory when a process requests it to do so.

② Process Management → In multiprogramming environment, ⑥  
the OS decides which process gets the processor  
when and for how much time. This function is  
called process scheduling.

• Functions

- keep track of processor and status of process.
- Allocates the processor (CPU) to a process.
- De-allocates processor when a process is no longer required.

③ Device Management →

- An operating system manages device communication via their respective drivers.

Functions -

- keep track of all devices. Program responsible for this task is known as the I/O controller.
- Decide which process gets the device when and for how much time.
- Allocates the device in the efficient way.
- De-allocates devices.

④ File Management →

- A file system is normally organized like directories for easy navigation and usage. These directories may contain files and other directories.

Functions

- keeps track of information, location, uses, status etc. The collective facilities are often known as file system.
- Decides who get the resources.
- Allocates the resources.
- De-allocates the resources.

⑤ Security →

- By means of password and similar other techniques, it prevents unauthorized access to programs and data.

⑥ Control over system performance → Reducing delays between request for a service and response from the system.

- ⑦ Job accounting - keeping track of time and resources used by various jobs and users.
- ⑧ Error detecting aids → production of dumps, traces, error messages and other debugging and error detecting aids.
- ⑨ Co-ordination between other softwares and users → co-ordination and assignment of compilers, interpreters, assemblers and other software to the various users of the computer systems.

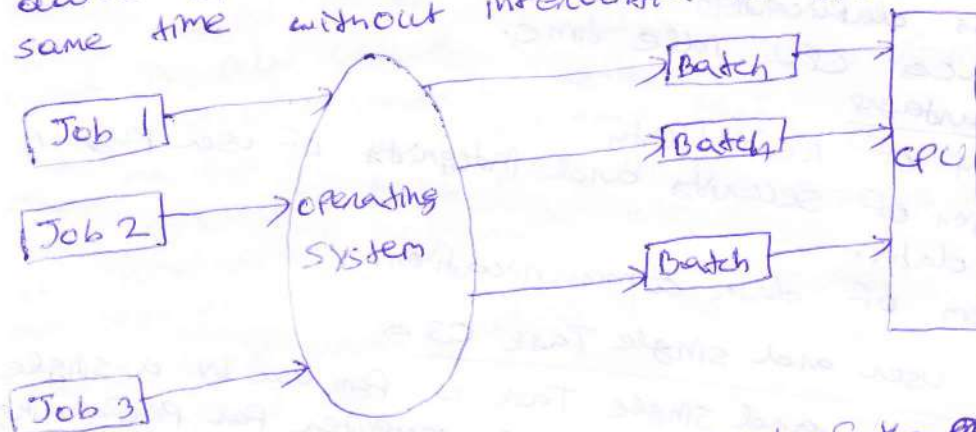
## Type of operating System ⇒

- Operating systems are there from the very first computer generation and they keep evolving with time.
- Following are some of the important types of operating system which are most commonly used.

- ① Batch processing system
- ② Time sharing operating system
- ③ single user and single task
- ④ Multi Tasking system
- ⑤ Multi processing system
- ⑥ Multi programming system
- ⑦ Networking operating system
- ⑧ Real Time operating system (RTOS)

### ① Batch operating System ⇒

- This is oldest operating system.
- In this operating system technique the jobs which had similar requirements were ~~batch~~ batched together for execution. These jobs were ~~batched~~ finally handed over to the system where the operating system of computer transferred them from one job to another.
- The computer automatically processed program and data of each user one after the other at the same time without intervention of operator and user.



### Advantages

- Batch processing takes much of the work of the ~~operator~~ operator to the computer.
- Increased performance as a new job get started as soon as the previous job is finished, without any manual intervention.

## Disadvantages

- Difficult to debug program
- A Job could enter an infinite loop
- Due to lack of protection scheme, one batch Job can affect pending Jobs.

## ② Time sharing operating systems →

- Time-sharing is a technique which enables many people, located at various terminals, to use a particular computer system at the same time.
- Processor time which is shared among multiple users simultaneously is termed as time sharing.
- Time sharing system, the objective is to minimize response time.
- Multiple Jobs are executed by the CPU by switching between them, but the switches occur so frequently, that the user can receive an immediate response.
- Thus the user can receive an immediate response.
- The operating system uses CPU scheduling and multiprogramming to provide each user with a small portion of a time.

## Advantages

- Provides the advantage of quick response.
- Avoids duplication of software.
- Reduces CPU idle time.

## Disadvantages

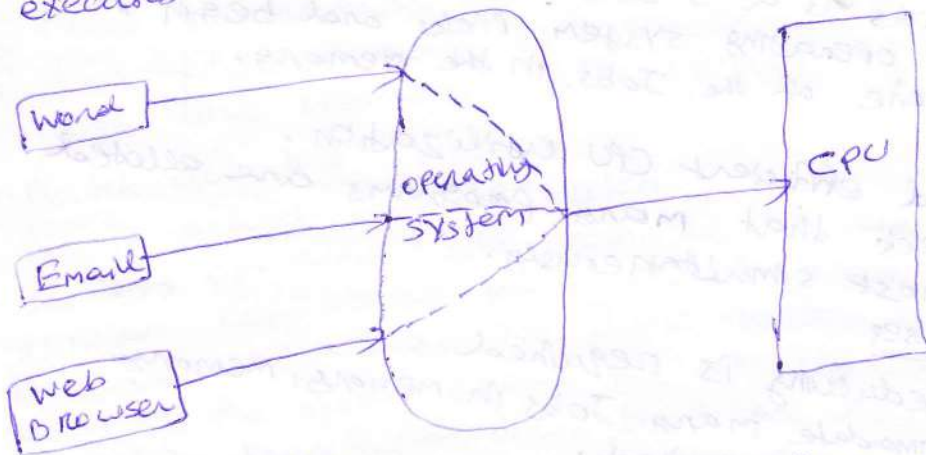
- Problem of reliability
- Question of security and integrity of user program and data.
- Problem of data communication.

## ③ Single user and single task OS →

- Single user and single task is for use by a single user for a standalone single computer for performing a single task. operating system for personal computer (PC) are single user OS.
- For example - If the user is editing a document, then a document can not be printed on the printer simultaneously. single user OS are one simple OS designed to manage one task at a time.
- MS-DOS is an example of single user OS.

#### ④ Multitasking →

- Multitasking is when multiple jobs are executed by the CPU simultaneously by switching between them. switches occur so frequently that the user may interact with each program while it is running.
- The user ~~gives~~ gives instructions to the operating system or to a program directly, and receives an immediate response. The OS handles multitasking in the way that it can handle multiple operations/ executes multiple program at a time.



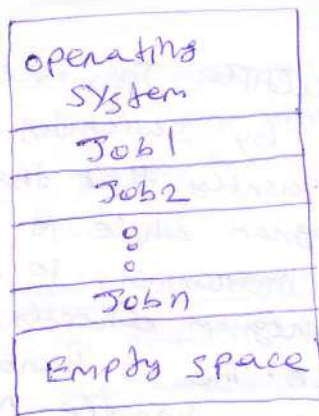
#### ⑤ Multiprocessing →

- Multiprocessing OS have two or more processors for a single running process. processing take place in parallel and is also called parallel processing.
- Each processor works on different parts of the same task or two or more different task.
- since execution takes place in parallel, they are used for high speed execution and to increase the power of computer.
- Linux, Unix and windows 7 are example of multiprocessing OS.

#### ⑥ Multiprogramming

- Sharing the processor, when two or more program reside in memory at the same time, is referred as multiprogramming. Multiprogramming increases CPU utilization by organizing jobs so that the CPU always has one to execute.





- The OS keeps several jobs in memory at a time. This set of jobs is a subset of the jobs kept in the job pool. The operating system picks and begins to execute one of the jobs in the memory.

#### Advantages

- High and efficient CPU utilization.
- User feels that many programs are executed CPU almost simultaneously.

#### Disadvantages

- CPU scheduling is required.
- To accommodate many jobs in memory, memory management is required.

### ⑦ Network operating system

- A network operating system runs on a server and provides the server the capability to manage data, users, groups, security, applications and other networking functions.

- The primary purpose of the network operating system is to allow shared file and printer access among multiple computers in a network.

- Example of network operating system include Microsoft windows server 2003, Microsoft windows server 2008, UNIX, LINUX, mac OS X, Novell Netware, and BSD.

#### Advantages

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

## Disadvantages →

(12)

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

## ⑧ Real Time operating system → (RTOS)

- A real time operating system is an operating system (OS) intended to serve real-time application which process data as it comes in typically without ~~any~~ buffering delays.

- A real time operating system must have well-defined fixed time constraints, otherwise the system will fail.

- Example → scientific experiments, medical imaging system, industrial control system, weapon system, robots, air traffic control system, etc.

Disk Operating Systems → (DOS)

- DOS, refer to operating system software used in most computers that provides the abstraction and management of secondary storage devices and the information on them. Such software is referred to as a disk operating system when the storage devices it manages are made of hard disk or floppy disk.

Features of Dos

- ① It is the primary system where the user will get an environment about the input and output devices e.g. Monitor, keyboard, printer etc.
- ② It is helpful in performing file management e.g. creating, editing, deleting files etc.
- ③ It is a single user operating system.
- ④ It is character based interface system. we can type letters or character in this operating system.

Internal command →

- A command that is stored in the system memory and loaded from the command.com are called Internal command.

Directory command

- MD - create Directory
- CD - changes Directory
- RD - Removes a Directory

File command

- COPY - copies the source file contents to the Target file
- DEL - Erases the files
- TYPE - show the contents of a file
- Rename - Rename the existing file

External Command →

External command are the commands stored separately .com files.

- ① Format.com → This is used to format a floppy disk
- ② CHKDSK.COM → This is used to check for used space, total no of bytes remaining, sectors, tracks and if any bad sectors/tracks.
- ③ DISKCOPY.COM → To copy the contents of one disk to another floppy disk.
- ④ SYS.COM → Transfer system files to Disk Drive.
- ⑤ Label.com → change the label of a disk drive

### Unix →

- The unix operating system is a set of programs that act as a link between the computer and the user.
- The computer program that allocate the system resources and co-ordinate all the details of the computer internal is called the operating system or the kernel.
- User communicates with the kernel through a program known as the shell. The shell is a command line interpreter. It translates commands entered by the user and converts them into a language that is understood by the kernel.

### Unix Architecture →



① Kernel → The kernel is the heart of the operating system. It interacts with the hardware and most of the task like memory ~~memory~~ management, task scheduling and file management. (15)

② Shell → The shell is the utility that processes your requests. When you type in a command at your terminal, the shell interprets the command and calls the program that you want. The shell uses standard syntax for all commands.

③ Commands and utilities → There are various commands and utilities which you can make use of in your day to day activities. cp, mv, cat and grep etc.

④ Files and Directories → All the data of unix is organized into files. All the files are then organized into directories. These directories are further organized into a tree-like structure called the file system.

### Windows operating system →

- Windows is a series of computer ~~system~~ software released by Microsoft, beginning with Windows 1.0 in 1985.
- Windows 1.0, 2.0, 3.0 and 3.1 were simply graphical shells that ran on top of MS-DOS.
- Windows 95 was the first windows version to be distributed as a complete OS, windows 98 and ME were based on windows 95.
- Windows NT was the first windows version to be built completely from scratch as a new separate OS. NT-based versions of windows include windows 2000, XP, vista, 7, 8, 8.1 and 10.

### Windows NT

- Windows New Technology

- Introduced in 1993
- Advanced 32 bit flat virtual OS
- Works with intel x86 and Alpha CPUs.
- ~~Supports for power PC too~~ Does not use DOS

Windows 95

- Released in August 1995.
- 32-bit self contained operating system
- includes a built in and enhanced version of DOS.
- Introduces start button, taskbar.
- plug-play capabilities.
- Memory limitations were expanded.

Windows 98

- Released in June 1998.
- Graphical user interface.
- Types of icons (i) Application icons  
(ii) Document icons  
(iii) Program icons

- Start Button
- Taskbar
- Windows Explorer
- Right mouse Button
- Long file name
- Multitasking
- Shortcuts
- Easy Internet Access
- Help

Windows 2000

- Released on Feb 2000.
- It is use on personal computers, business desktop, laptop and server.
- It is designed for business.

Windows Me

- windows millenium Edition.
- It is released on sep 2000.
- It ~~was~~ is designed for home users.
- It included Internet Explorer, windows media player and the new windows movie maker software.
- Faster boot times
- Include drivers for USB mass storage device.

Windows XP

- It is release in October 2001.
- Microsoft merged its two windows operating system lines for consumer and business.
- Windows XP stands for experience symbolizing the innovative experience that windows can offer to personal computer users.
- With windows XP, home users can work with and enjoy music, movies, messaging and photos with their computers.

Windows Vista

- Released on Jan 2007.
- It included several new features with an emphasis on security.

Windows 7

- Released on Oct 2009.
- It is used on personal computers, including home and business desktop, laptops, net books, tablet PC and media center PC.

Windows 8

- Released on Oct 2012.
- Windows 8 introduces major changes to the operating system platform and user interface to improve its user experience on tablets.

Windows 8.1

- An update to windows 8, called windows 8.1 was released on Oct 2013.
- It include features such as new live tile sizes, and many other revisions.
- It faces some criticism, such as removal of the start menu.

Windows 10

- It was released on July 2015.
- It included the return of the start menu, a virtual desktop system and the ability to run windows store apps within windows on the desktop rather than in full screen mode.

## Programming Languages

- Computer programming languages allow us to give instructions to a computer in a language the computer understands. Just as many human based languages exist, there are an array of computer programming languages that programmers can use to communicate with a computer.
- Usually, programming languages have a vocabulary of syntax and semantics for instructing a computer to perform specific tasks.
- such instructions can be executed directly when they are in the computer manufacturer - specific numerical form known as machine language, after a simple substitution process when expressed in a corresponding assembly language or after translation from some high-level language.
- Thus all the computer language fall in the following three categories →

- (i) Machine level language
- (ii) Assembly language
- (iii) High level language

### (i) Machine level language →

- Machine level language is the lowest-level programming language. Machine languages are the only languages understood by computers. Machine languages are almost impossible for humans to use because they consist entirely of numbers.

#### Advantage:

- ① Machine language makes fast and efficient use of computer, since it is directly executed by the CPU.
- ② It requires no translator to translate the code. It is directly understood by the computer.

#### Disadvantages:-

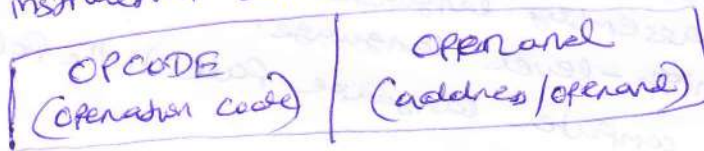
- ① All operation codes have to be remembered.
- ② All memory address have to be remembered.
- ③ It is hard to find errors in a program written in machine language.



④ Machine language is machine dependent i.e. a program written for a particular machine/computer can not be executed by other computers. (19)

## ② Assembly Language →

- Assembly language was developed to overcome some of the many inconveniences of machine language. This is another low-level but very important language in which operation codes and operands are given in the form of alphanumeric ~~and~~ symbols instead of 0's & 1's.
- These alphanumeric symbols are known as mnemonic codes and can combine in a maximum of five letter combination e.g. ADD for addition, SUB for subtraction.
- Each instruction consist of two parts i.e. opcode & operand.



ADD AX, BX

Add the contents of AX and BX registers. Store the result in AX register.

- The instructions of the Assembly language are converted to machine codes by a language translator ~~and then~~ ~~known~~ known as assembler and then they are executed by the computer.

### Advantages →

- It is easier to understand and use.
- It is easy to locate and correct errors.
- It is easily modified.

### Disadvantages →

- It is also machine dependent/specific.
- Since it is machine dependent, the programmer also needs to understand the hardware.

### ③ High level language →

- High level computer languages use formats that are similar to English. The purpose of developing high level languages was to enable people to write program easily, in their own native language (English).
- High level language are basically symbolic language that use English words and mathematical symbol rather than mnemonic codes.
- Each instruction in the high-level language is translated into many machine language instructions that the computer can understand. Such a translator is known as a compiler or Interpreter.

#### Advantages

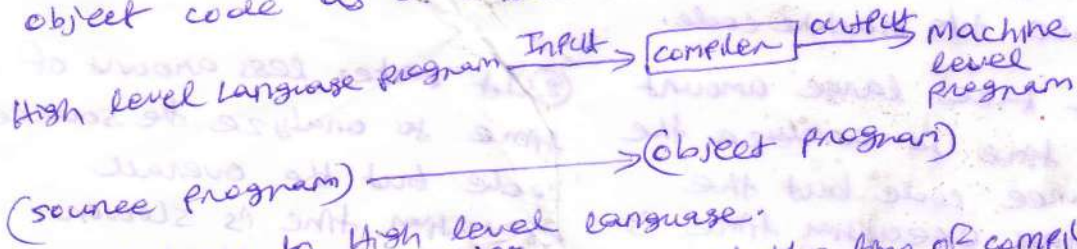
- ① High level languages are user friendly.
- ② They are easier to learn.
- ③ They are easier to maintain.
- ④ This language is independent of the machine.
- ⑤ A program written in a high level language can be translated into many machine languages and can run on any computer for which there exist an appropriate translator.

#### Disadvantage

- ① A high level language has to be translated into the machine language by a translator, which takes up time.
- ② The object code generated by a translator might be inefficient compared to an equivalent assembly language program.

## Compiler

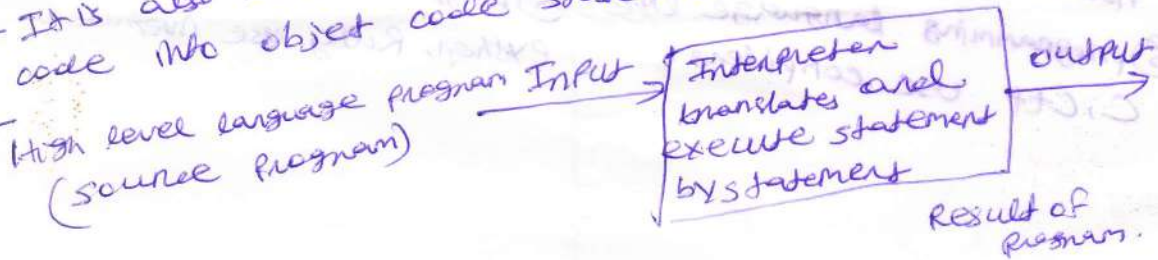
- It is a software that translate source code into object code as a whole one at a time.



- It belongs to high level language.
- compiler detects ~~error~~ <sup>SYNTAX</sup> errors at the time of compilation.
- It also helps the user/programmer to locate the line containing error.
- It is difficult for compiler to detect error.
- When an error occurs in the program, it stops its translation and after removing error whole program is translated again.
- It produces object code.

## Interpreter

- It is also language translator that translates source code into object code statement by statement.



- It is slower than compiler.
- It belongs to high level language.
- It detects syntax errors at the time of compilation.
- It is easy for the interpreter to detect error as compared to compiler.
- When an error occurs, interpreter stops its translation and after removing error, translation resumes.
- It also produces object code.

## Compiler

- ① Scans the entire program and translate it as a whole into machine code.
- ② It takes large amount of time to analyze the source code but the overall execution time is comparatively faster.
- ③ Generate intermediate object code which further requires linker, hence requires more memory.
- ④ It generate the error message only after scanning the whole program. Hence debugging is comparatively hard.
- ⑤ programming language like C, C++ use compilers.

## Interpreter

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- ① Translate program one statement at a time.
- ② It takes less amount of time to analyze the source code but the overall execution time is slower.
- ③ No intermediate object code is generated, hence are memory efficient.
- ④ continues translating the program until the first error is met in which case it stop. Hence debugging is easy.
- ⑤ programming language like Python, Ruby use interpreter.

## Computer virus →

- It is a computer program that can copy itself and infect a computer without permission or knowledge of the user. It is a piece of code that is secretly introduced into a system in order to corrupt it or destroy data. A program which can be transmitted between computers via networks or removable storage such as CDs, USB drives, floppy disk etc.

### Types of Computer Virus →

① Boot virus → These virus infect ~~boot~~ disk boot records in hard disk. They replace the boot record program which is responsible for loading the operating system in memory, copying it elsewhere on the disk or overwrite it. Boot virus load into memory if the computer tries to read the disk while it booting.

Example: - Form, Disk killer, Michael Angelo and Stone viruses.

② Program virus → These infects executable program files such as those with extensions like .BIN, .COM, .EXE, .OVL, .DRV and .SYS. These program are loaded in memory during execution, taking virus with them. The virus becomes active in memory, making copies of itself and infecting files on disk.

Example: - Sunday, Cascade

③ Multipurpose virus → A hybrid of Boot and Program viruses. They infect program files and when the infected program is executed these viruses infect the boot record. When you boot the computer next time, the virus from the boot record loads in memory and then starts infecting other program files on disk.

Example: - Invader, File and Tequila

④ Stealth virus → These virus use certain techniques to avoid detection. They may either redirect the disk head to ~~read~~ read another sector instead of the one in which they reside or they may alter the reading of the infected file size shown in the directory listing.

e.g. Frodo, Joshi, whale

⑤ Polymorphic virus → A virus that can encrypt its code in different ways so that it appears differently in each infection. These viruses are difficult to detect.  
Example: - Involuntary, stimulate, cascade, phoenix, Earth, proud, virus 101.

⑥ Macro virus → A macro virus is a new type of computer virus that infects the macro within a document or template. When you open a word processing or spreadsheet document, the macro virus is activated and it infects the normal template, a general purpose file that stores default document formatting settings. Every document you open refers to the Normal template and hence gets infected with the macro virus. Since the virus attaches itself to documents, the infection can spread if such documents are opened on other computers.

Example - DMV, Nuclear, word concept

How computer viruses work →

- virus begin to work on spread when you start up the program or application of which the virus is present.
- The virus may be programmed to attach to other application, disk or folder. It may infect a network if given the opportunity.
- A virus can be attached to any file that you copy to your computer. If you download files from the internet or copy program or files from friends on <sup>pen drive</sup> ~~pen drive~~, you are very susceptible to viruses.
- Many viruses are spread through e-mail. Just opening the email itself can release the dangerous virus.

What viruses may do to a computer →

- ① Delete files
- ② Various messages in files or on programs
- ③ A directory may be displayed as garbage.
- ④ Cause the system to run slow
- ⑤ Randomly overwrite section on the hard disk

- 1) ⑥ Logical partition created, partitions decrease in size  
⑦ Erratic computer behavior  
⑧ Frequent computer crashes.  
⑨ unexplained data loss  
⑩ Distribution of confidential information

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### Typical Methods of Infection

- ① Removable media on drives
- ② Downloading internet files
- ③ E-mail attachments
- ④ Unpatched software and services
- ⑤ Poor Administrator passwords
- ⑥ Unsecured computer network setup

### Virus Prevention

- ① Update the operating system regularly.
- ② Use a good antivirus software and Firewall
- ③ Always keep your ~~antivirus~~ antivirus software up-to-date.
- ④ Get a anti-spyware software
- ⑤ Do not use pendrive on memory card or external hard disk without scanning with your antivirus software.
- ⑥ Increase your browser security settings.
- ⑦ Avoid questionable web sites
- ⑧ Only download software from sites you trust.
- ⑨ Do not open e-mail from unknown senders
- ⑩ Immediately delete messages you suspect to be spam.