B.C.A. SEM-1 (COMPUTER FUNDAMENTALS AND EMERGING TECHNOLOGY)

Sr No.	Topic	Details	Marks	Min Lec.

1	Introduction to computer	• Basics of Computers
		  • What is Computer
		  • Characteristics of Computer
		  • Data Processing Cycle
		• Classification of Computer by Data processed
		• History and Generations of Computers
		• Classification of Computer by processing Capabilities
		• Simple Model of Computer
		  • Input Devices.
		  • CPU (Central Processing Unit)
		• Output Devices
		• Secondary Storage Devices		

	Internal/External parts used with Computer Cabinet	• Introduction to Mother Board
		• Types of Processors
		  – Dual Core, Core 2 Duo, i2, i3, etc….
		• Memory structure and Types of Memory
		  – RAM (SRAM, DRAM, SD, DDR, etc.).
		  – ROM (ROM, PROM, EPROM, EEPROM, etc.)
		• Slots
		  i. ISA Slots / PCI Slots / Memory Slots
		• Sockets
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		  i. Serial Cable / Parallel Cable / USB Cable
		• Ports
		  i. USB / Serial / Parellel / PS2
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2	Input Devices	• Introduction
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		  – Light pen, Touch Screen, Digitizers and Graphic Table, Mic
		  – Camera, POS Terminal
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	Data Storage	• Introduction
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			• [Reading / Writing Data to and from Storage Devices](#)
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			• [Other Storage Devices](#)
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			•		

3	Output Devices		• [Introduction](#)
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			    – [Dot Matrix Printer, Daisy Wheel printer, Chain Printer, Drum Printer, Band printer, etc.](#)
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			    – [SGD (Speech generating Devices)](#)
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4	Numbering System and Codes		• [Introduction to Binary Codes](#)
			  - [Nibble](#) / [Bit](#) / [Byte](#) / [Carry Bit](#) / [Parity Bit](#) / [Sign Bit](#) / [KB](#) / [MB / GB / TB / HB](#) / etc….
			• [Types of Numbering System](#)
			  - [Binary](#) / [Octal](#) / [Decimal](#) / [Hex-Decimal](#)
			• [Conversion](#)
			  • [Binary to Octal, Decimal and Hexa-Decimal](#)
			  • [Decimal to Binary, Octal and Hexa-Decimal](#)
			  • [Octal to Binary, Decimal and Hexa-Decimal](#)
			  • [Hexa-Decimal to Binary, Octal and Decimal](#)
			• [Binary Arithmetic](#)
			  • [Addition](#) / [Substraction(1's Compliment and 2's Compliment)](#) / [Division](#) / [Multiplication](#)		

		• Types of Codes
		   ➔ ASCII / BCD / EBCDIC / UniCode
		• Parity Check
		   ➔ Event Parity System / Odd Parity System		

	Languages, Operating Systems and Software Packages	• Introduction
		- Types of Languages (Assembler / Compiler / Interpretor)
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		• Types of Operating System
		   - Batch Operating System
		   - Multi Processing Operating System
		   - Time Sharing Operating System
		   - Online and Real Time Operating System
		• Types of Software Packages
		   • Word Processing Packages
		   • Spread Sheet Packages
		   • Graphical Packages
		   • Database Packages
		• Presentation Packages
		• Animation / Video / Sound Packages		

5	Emerging Technologies and Virus	• Introduction
		• Different Communication methods
		   - GIS / GPS / CDMA / GSM
		• Communication Devices
		   - Cell Phones / Modem / Infrared / Bluetooth / WiFi
		• Virus
		   • Introduction to Virus and related terms
		   • Origin and History
		   • Types of Virus
		   • Problems and Protection from Virus
		• Cloud Computing
		   a. What is cloud computing?
		   b. Characteristic & service module
		   c. Architecture
		   d. Security & Privacy		

	Important Terms and Acronyms	• ATM • Backup / Restore • Hard Copy / Soft Copy • Bus / Data Bus • Buffer and types / Spooling • Cursor / Pointer / Icon • E-Mail / Attachment • CLI / GUI • Compiler and its types • Drive / Directory (Folder) / File / Path • Menu / Popup Menu / Toolbar • Shutdown / Reboot / Restart • Syntax / Wild Card Characters		

| | | Optical Fiber (Fiber Optic) Net meeting UPS Printing Speed (CPS, CPM, LPM, DPI, PPM) Peripherals | | |

Unit -1(Introduction To Computer & Internal/External parts used with Computer Cabinet)

Definition of Computer

- A computer is an electronic device which reduces the mental efforts to solve the problem.

OR

- It is an automatic electronic device for making calculation or controlling operations those are expressible in numerical or logical terms.
- Computer can operate on various kinds of data.

Data Processing Cycle

- The activities processing of data using a computer is called **Data.**
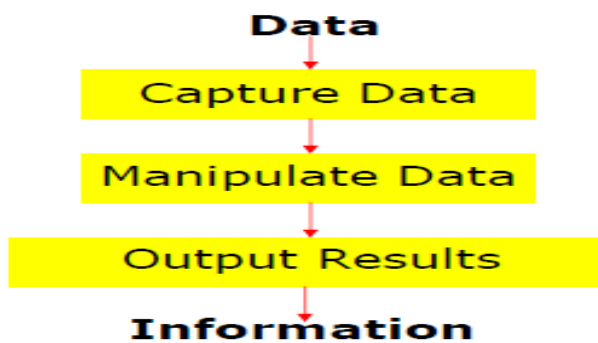
- Data processing consists of three sub activities

  - Capturing the input data
  - Manipulating the data   and
  - Managing the output results.

- *Data* is raw material use as input and *information* processed data obtained as output of data processing.

Characteristics of computer
1. **Automatic:-**
- Computers are automatic machines because once started on a job, they carry on until the job is finished, normally without any human assistance.
- Computers being machines cannot start them selves.
- They cannot go out and find their own problem of coded instructions that specify exactly how a particular job is to be done.
- While the job is in process, the program is stored in the computer, and the parts of the instructions.
2. **Speed:-**
- A computer is a very, fast device.
- It can perform in a few seconds the amount of work that a human being can do in an entire year.
- If he worked day and night and did nothing else.

- To put it in a different manner, a computer does in one minute what would take a man his entire lifetime.
3. **Accuracy:-**
   - The accuracy of a computer is consistently high and the degree of accuracy of a particular computer depends upon this design.
   - But for a particular computer each and every calculation is performed with the same accuracy.
4. **Diligence:-**
   - A computer is free form monotony (variation), tiredness, lack of concentration, etc.
   - computers obviously score over human being in doing routine type of jobs, which require great accuracy.
   - If ten lakhs calculations have to be performed, a computer will perform the ten lakhs calculations with exactly the same accuracy and speed as the first one.
5. **Versatility:-**
   - Versatility is one of the most wonderful things about the computer.
   - It is preparing the results of particular examination, preparing electricity bills.
   - Computer is capable of performing almost any task provided that the task can be reduce to a series of logical steps.

Generation of computers

1. First Generation (1942-55):-
- First generation computers were made up of **vacuum tubes.**
- These computers were of very big sizes, expensive consume lot of power.
- For example,
  - ENIAC – Electronic Numerical Integrator And Calculator (1943-46)
  - EDVAC – Electronic Discrete Variable Automatic Computer (1946-52)
  - EDSAC – Electronic Delay Storage Automatic Calculator (1947-49)
  - UNIVAC – Universal Automatic Computer (1951 - 54)

Limitations
- They were too large in size requiring rooms for installation.
- Thousands of vacuum tubes that were used so it can produce large amount. Hence the air-conditioned required.
- High power consumption and short life span.
- Commercial production of these computers was difficult and costly.
- Limited programming capabilities
- No portable.

2. Second Generation (1955-64):-
- The second generation computers were

manufactured using **transistors** instead of vacuum tubes.
- Compared to vacuum tubes they are in size and having more life.

Advantages
- They were more then 10 times faster than first generation computers.
- They were much smaller in size then first generation computers.
- Requiring smaller space for installation.
- They accept less power than the first generation computers.
- They were much easier to program and use than the first generation computers.

Limitations
- They had more than one transistors to made this type of computers
- It is very difficult and costly.
- Repairing charge is very costly.

3. Third Generation (1964-75):-
- The third generation was based on IC (Integrated Circuits) technology.
- The IC technology was also known as "microelectronics" technology because it made it possible to integrate larger number of circuit components into very small i.e. less than 5 mm square surface of silicon known as "chip".

Advantages
- They were much more powerful than the second-generation computers.
- Smaller in size as compared to second-generation computers.
- Less power than the second-generation computers.
- Commercial production was easier and cheaper.
- They are portable.

Limitation
- Third generation computers were located had to be properly air-conditioned.
- Highly sophisticated technology and expensive setup was required for the manufacture of IC chips.

4. Fourth Generation (1975-89):-
- The fourth generation computers were also made by IC technology.
- It is known as Small Scale Integration (SSI).
- After the advance technology in the production of IC chip it was possible to coordinate 100 components on one chip.
- It is known as Medium Scale Integration (MSI).
- Latest and advance IC technology is Very Large Scale Integration (VLSI) in which more than 10 lakhs components can be coordinate on one chip.
- Fourth generation computers were based on LSI technology.

Advantages
- The PCs were much smaller and cheaper as compared to previous generations.
- They consumed much less power than the third-generation computers.
- They had faster and larger primary memory and secondary storage devices as compared to third-generation computers.
- PCs are used for office and home usage.

- The PCs of the fourth generation made computers affordable even by individuals for their personal use at home.

Limitations
- Highly difficult technology required for the manufacture of LSI chips.

➢ **Fifth Generation (1989 Onwards):-**
- This generation computers use the ULSI (Ultra Large Scale Integration) for making IC chips.
- Size of this computer is reduced and speed is increase.
- These computers are very powerful and compact as compared to fourth generation computers.

Advantages
- In this generation PCs are much smaller and handy the PCs of the fourth generation.
- They consume much less power.
- They have faster and larger primary memory and secondary storage devices as compared to other generation.
- They are totally general purpose machines.
- Commercial production of these systems is easier and cheaper.

Classification of Computer by Data processed
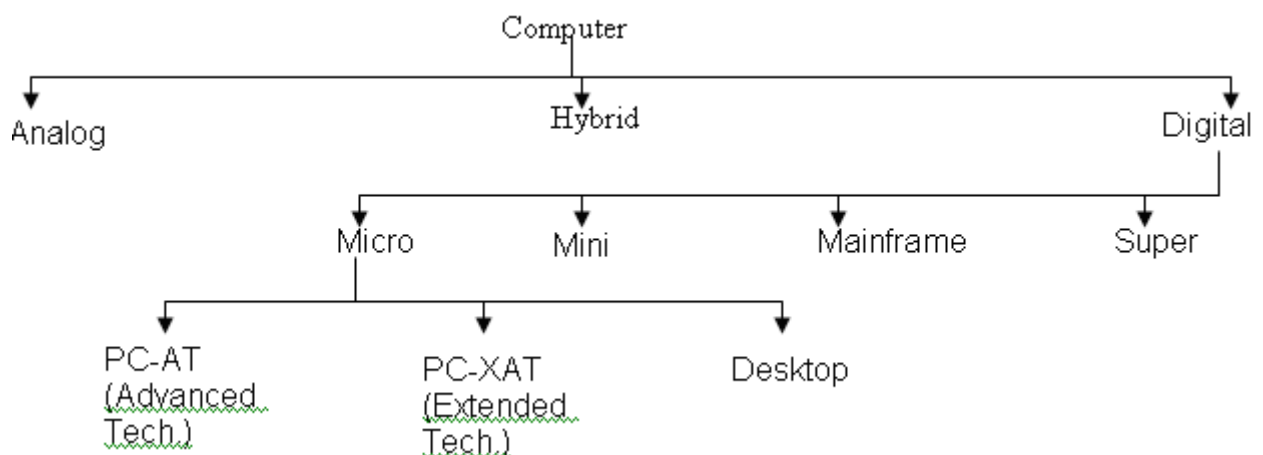
Analog Computer
- Analog is a Greek word meaning to find the equality between two units.
- It is computer that operates on data which is in the form of continuously variable physical quantities such as electrical current, sound waves.
- computer that uses continuous physical phenomena such as electrical, mechanical, or hydraulic quantities to model the problem being solved.

-

Hybrid Computer

- It is a combination of digital and analog computers combining the good qualities of both.
- Hybrid computer has the speed of analog computer and the accuracy and efficiency of digital computer.
- These types of computer are used for the special kind of work. For example, aero plane, radar, submarine.

Digital Computer

- Digital computer is a machine based on digital technology.
- Digital computer gives the output by making necessary calculations from the given data.
- This type of computer cannot do any measurement.
- It is used in various fields. For example, calculator.

Classification of Computer by processing Capabilities

1. Microcomputer

- A micro computer's CPU is a microprocessor, which originated in late 1970's and built around 8 – bit microprocessor chips.
- An improvement on 8 bit chip technology was see in early 1980s when a series of 16 bit chip namely 8086 and 8088 was introduced by Intel Corporation each one with an advancement over the other.
- Currently processor named Pentium-II is available in the market. Like desktop computer, laptop computer, palmtop computer.

- **Mini computers**
  - A minicomputer is a multi-user computer capable of supporting from 10 to hundreds of users simultaneously.
  - Initially microcomputers were 8 bit and 12 bit machines but by 1970s almost all mini computers were 16 bit machines.
  - Mini computers speed, memory, size and other characteristics developed and the minicomputer was then used for various standalone applications.
  - A 32 minicomputer which was called super mini was introduced.
  - It had larger memory and could support more users working simultaneously on the computer in comparison to the previous minicomputers.
  - **A midsized computer. In size and power, minicomputers lie between workstations and mainframes. In the past decade, the distinction between large minicomputers and small mainframes has blurred, however, as has the distinction between small minicomputers and workstations. But in general, a minicomputer is a multiprocessing system capable of supporting from 4 to about 200 users simultaneously.**

3. Mainframe computer

- Mainframe computers are generally 32 bit machines or on the higher side.
- These are suited to big organizations to manage high volume application.
- Few of the popular mainframe series are MEDHA, Sperry, DEC, IBM, HP, HCL, etc.
- Mainframe are also used us central host computers in distributed systems.
- There are several organizations such as banks, insurance companies, hospitals, railways etc, that need to process large number of transactions on-line and require computer systems having data storage and processing capabilities.
- Mainframe systems are computer systems that are mainly used for handling the bulk of data and information processing of such organizations.
- Mainframe systems are much bigger and several time more expensive then workstations.
- A typical mainframe system needs a large room with closely monitored temperature.

4. Super Computer

- Super computers are the most powerful and the most expensive computers available at a given time.
- They are primarily used for processing complex scientific applications that require high processing power.
- For example scientists build models of complex processes and stimulate (motivate) the processes on a super computer.
- The super computers are used in petroleum industry, aerospace industry, automobile industry, film and TV industry, etc

Simple Model of Computer

- ❖ **Input Device:-**
  - All i/p devices are electromechanical devices that accept data from outside world & translates them into a form the computer interpret (i.e. binary).
  - There are mainly three type of input devices
    - Standard Input Device
    - Pointing Input Device
    - Special Input device

❖ **CPU (Central Processing Unit):-**

Central Processing Unit (CPU)
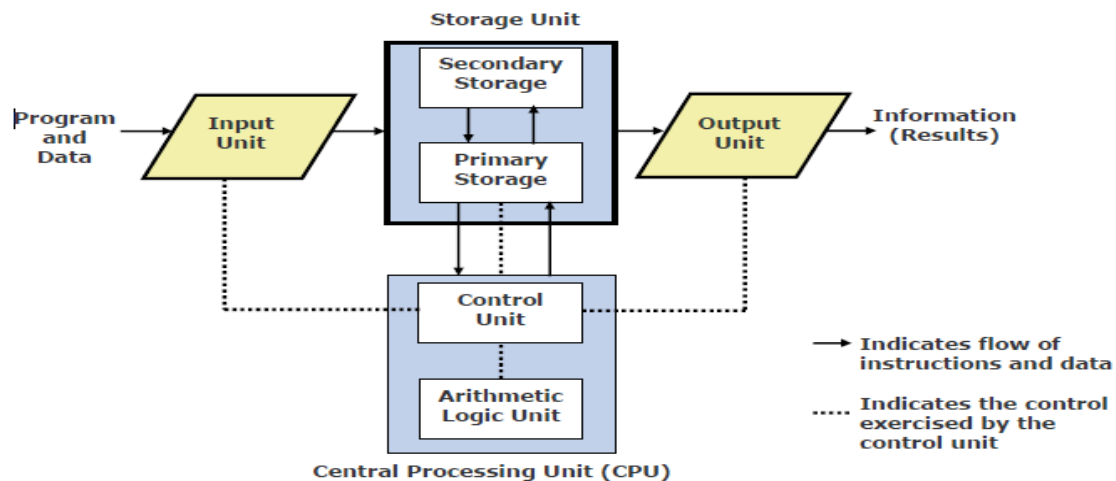
❖ **Input Unit:-**
- An input unit of a Computer system performs the following functions:
    - It accepts (or read) instructions and data from outside word.
    - It converts these instructions and data in computer acceptable form.
    - It supplies the converted instructions and data to the computer system for further processing

❖ **Output Unit:-**
- An output unit of a computer system performs the following functions :
    - It accepts the results produced by the computer, which are in coded form and hence, cannot be easily understood by us.
    - It converts these coded results to human acceptable (readable) form.
    - It supplies the converted results to outside word.

❖ **Storage Device:-**
- The storage unit of a computer system holds (or stores) the following:
    - Data and instructions required for processing (received from input devices)
    - Intermediate results of processing
    - Final result of processing, before they are released to an output device

- There are two types of storage:
    - Primary storage
    - Secondary storage

❖ **Primary storage :-**
    - Used to hold running program instructions
    - Used to hold data, intermediate results, and result of outgoing processing of job(s).
    - Fast in capacity

❖ **Secondary storage :-**
    - Used to hold stored program instructions

- Used to hold data and information of stored jobs
- Slowed than primary storage
- Large capacity
- Lot cheaper that primary storage.
- Retains data even without power

❖ **Arithmetic and Logic Unit (ALU) : -**

- Arithmetic and logic unit of a computer system is the place where the actual executions of instructions take place during processing operation.

❖ **Control Unit (CU):-**
- Control unit of a computer system manages and coordinates the operations of all other components of the computer system.

➢ **Secondary Storage (Auxiliary)**
- Computer systems need to store data on a permanent basis for several days, several months, or even several years.
- So, an additional memory called auxiliary memory or secondary storage is used with most computer systems.
- This section of memory is used to store large volume of data on a permanent basis, which can be partially transferred to the primary storage as and when required for processing.
- Data is stored in secondary storage in the same binary codes as in main storage and is made available to main storage as needed.
- A wide range of devices and media have been developed for use as secondary storage in computer systems.
- The popular item used in today's computer systems are floppy disk, hard disk, CD, DVD, Zip Drive, Pen Drive etc.
- There are three type of secondary devices:: Magnetic Tape, Magnetic Disk, Optical Disk

➢ **Introduction to Mother Board**

The motherboard serves as a single platform to connect all of the parts of a computer together. A motherboard connects CPU, memory, hard drives, optical drives, video card, sound card, and other ports and expansion cards directly or via cables. It can be considered as the backbone of a computer.

Radha Ranpara
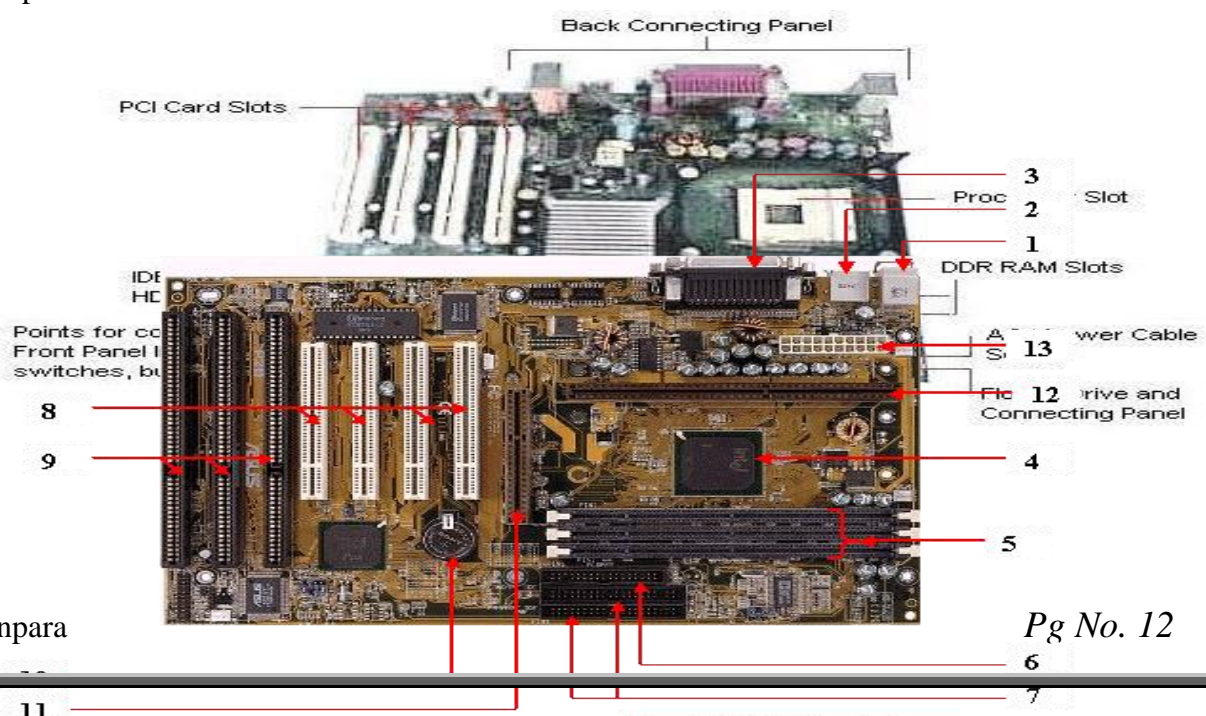
1. Mouse & keyboard:

- Keyboard Connectors are two types basically. All PCs have a Key board port connected directly to the motherboard.
- The oldest, but still quite common type, is a special DIN, and most PCs until recently retained this style connector.
- The AT-style keyboard connector is quickly disappearing, being replaced by the smaller mini DIN PS/2-style keyboard connector.
- You can use an AT-style keyboard with a PS/2-style socket (or the other way around) by using a converter. Although the AT connector is unique in PCs, the PS/2-style mini-DIN is also used in more modern PCs for the mouse.
- Fortunately, most PCs that use the mini-DIN for both the keyboard and mouse clearly mark each mini-DIN socket as to its correct use. Some keyboards have a USB connection, but these are fairly rare compared to the PS/2 connection keyboards.

2. USB (Universal serial bus):

- USB is the General-purpose connection for PC. You can find USB versions of many different devices, such as mice, keyboards, scanners, cameras, and even printers.
- A USB connector's distinctive rectangular shape makes it easily recognizable.
- USB has a number of features that makes it particularly popular on PCs. First, USB devices are hot swappable. You can insert or remove them without restarting your system.

3. Parallel port:
- Most printers use a special connector called a parallel port. Parallel port carries data on more than one wire, as opposed to the serial port, which uses only one wire.
- Parallel ports use a 25-pin female DB connector. Parallel ports are directly supported by the motherboard through a direct connection or through a dangle.

4. CPU Chip :
- The *central processing unit,* also called the *microprocessor* performs all the calculations that take place inside a pc. CPUs come in Variety of shapes and sizes.
- Modern CPUs generate a lot of heat and thus require a cooling fan or heat sink. The cooling device (such as a cooling fan) is removable, although some CPU manufactures sell the CPU with a fan permanently attached.

5. RAM slots:
- Random-Access Memory (RAM) stores programs and data currently being used by the CPU. RAM is measured in units called bytes.
- RAM has been packaged in many different ways. The most current package is called a 168-pin DIMM (Dual Inline Memory module).

6. Floppy controller:
- The floppy drive connects to the computer via a 34-pin *ribbon cable,* which in turn connects to the motherboard. A *floppy controller* is one that is used to control the floppy drive.

7. IDE controller:
- Industry standards define two common types of hard drives: EIDE and SCSI. Majority of the PCs use EIDE drives.
- SCSI drives show up in high end PCs such as network servers or graphical workstations. The EIDE drive connects to the hard drive via a 2-inch-wide, 40-pin ribbon cable, which in turn connects to the motherboard. *IDE controller* is responsible for controlling the hard drive.

8. PCI slot:
- Intel introduced the *Peripheral component interconnect* bus protocol. The PCI bus is used to connect I/O devices (such as NIC or RAID controllers) to the main logic of the computer.
- PCI bus has replaced the ISA bus.

9. ISA slot:
- (Industry Standard Architecture) It is the standard architecture of the Expansion bus. Motherboard may contain some slots to connect ISA compatible cards.

10. CMOS Battery:
- To provide CMOS with the power when the computer is turned off all motherboards comes with a battery.
- These batteries mount on the motherboard in one of three ways: the obsolete external battery, the most common onboard battery, and built-in battery.

11. AGP slot:
- If you have a modern motherboard, you will almost certainly notice a single connector that looks like a PCI slot, but is slightly shorter and usually brown. You also probably have a video card inserted into this slot. This is an *Advanced Graphics Port (AGP)* slot.

12. CPU slot:
- To install the CPU, just slide it straight down into the slot. Special notches in the slot make it impossible to install them incorrectly.
- So remember if it does not go easily, it is probably not correct. Be sure to plug in the CPU fan's power.

13. Power supply plug in:
- The Power supply, as its name implies, provides the necessary electrical power to make the pc operate.
- The power supply takes standard 110-V AC power and converts into 12-Volt, 5-Volt, and 3.3-Volt DC power.

➤ **Features of Motherboard**

A motherboard comes with following features:

- Motherboard varies greatly in supporting various types of components.
- Normally a motherboard supports a single type of CPU and few types of memories.
- Video Cards, Hard disks, Sound Cards have to be compatible with motherboard to function properly
- Motherboards, cases and power supplies must be compatible to work properly together.

   Popular Manufacturers
   - Intel
   - ASUS
   - AOpen
   - ABIT
   - Biostar
   - Gigabyte
   - MSI

- The motherboard is mounted inside the case and is securely attached via small screws through pre-drilled holes.
- Motherboard contains ports to connect all of the internal components. It provides a single socket for CPU whereas for memory, normally one or more slots are available.
- Motherboards provide ports to attach floppy drive, hard drive, and optical drives via ribbon cables. Motherboard carries fans and a special port designed for power supply.
- There is a peripheral card slot in front of the motherboard using which video cards, sound cards and other expansion cards can be connected to motherboard.
- On the left side, motherboards carry a number of ports to connect monitor, printer, mouse, keyboard, speaker, and network cables.
- Motherboards also provide USB ports which allow compatible devices to be connected in plug-in/plug-out fashion for example, pen drive, digital cameras etc.

➤ **Processors**

- The brain or engine of the PC is the processor (sometimes called microprocessor), or central processing unit (CPU).
- The CPU performs the system's calculating and processing. The processor is easily the most expensive single component in the system, costing up to four or more times greater than the motherboard it plugs into.
- Intel is generally credited with creating the first microprocessor in 1971 with the introduction of a chip called the 4004.
- Today Intel still has control over the processor market, at least for PC systems. This means that all PC-compatible systems use either Intel processors or Intel-compatible processors from a handful of competitors (such as AMD or Cyrix).
- Processors can be identified by two main parameters: how wide they are and how fast they are.
- The speed of a processor is a fairly simple concept.
- Speed is counted in megahertz (MHz), which means millions of cycles per second—and faster is better! The width of a processor is a little more complicated to discuss because there are three main specifications in a processor that are expressed in width. They are

  - **Internal registers**
  - **Data input and output bus**
  - **Memory address bus**

- ➢ **TYPES OF PROCESSOR**

- Nios embedded processor (redirect from Nios (computer processor))
  - Nios was Altera 's first configurable 16-bit embedded processor for its FPGA product-line. For new designs, Altera recommends the 32-bit ... 598 B (55 words) - 10:24, 1 November 2013

- Ivy Bridge (microarchitecture) (redirect from Ivy Bridge (computer processor))
  - Ivy Bridge is the codename for a line of processors based on the 22 nm ... See also: Computer Science | Electronics List of Intel CPU ... 65 KB (8,501 words) - 22:29, 8 April 2014

- ARM architecture (redirect from ARM processor)
  - ARM is a family of instruction set architecture s for computer processors based on a reduced instruction set computing (RISC) ... 65 KB (8,957 words) - 22:08, 19 April 2014

- Dual processor
  - In computer architecture , dual processor can refer to two different types of multiprocessing : A computer with two central processing ... 289 B (37 words) - 09:13, 5 October 2013

- Processor Technology
  - Processor Technology Corporation was a personal computer company founded in April 1975 by Gary Ingram and Bob Marsh in Berkeley, California ... 7 KB (1,094 words) - 23:42, 26 October 2013

- Instruction set (redirect from Instruction (computer science))
  - (ISA), is the part of the computer architecture related to programming , including ... the native commands implemented by a particular processor. ... 24 KB (3,274 words) - 14:39, 16 April 2014

- Accumulator (computing) (section Notable accumulator-based computers)
  - In a computer 's central processing unit (CPU), an accumulator is a register in ... However, a number of special-purpose processors still ... 10 KB (1,614 words) - 22:07, 3 March 2014

- Coprocessor (redirect from Co-processor)
  - A coprocessor is a computer processor used to supplement the functions of the primary processor (the CPU). signal processing , string ... 11 KB (1,604 words) - 04:16, 11 March 2014

- Mobile processor
  - A mobile processor is found in mobile computer s and cellphone s. A CPU chip is designed for portable computers, it is typically housed in a ...
  - 887 B (112 words) - 05:04, 22 February 2014

- Notebook processor
  - A notebook processor is a CPU optimized for notebook computer s. One of the main characteristics differentiating notebook processors from ...
  - 3 KB (335 words) - 08:07, 28 January 2014

- Scalar processor
  - Scalar processors represent a class of computer processor s. A scalar processor processes only one datum at a time, with typical data ...
  - 1 KB (165 words) - 16:46, 21 November 2013

- Slipstream (computer science)
  - A slipstream processor is an architecture designed to reduce the length of a running program by removing the non-essential instructions. ...
  - 2 KB (274 words) - 21:19, 3 January 2014

- EasyWriter
  - Easy Writer was a word processor first written for the Apple II series computer in 1979, the first word processor for that platform It was ... 5 KB (750 words) - 02:44, 29 March 2014

- Soma super computer
  - The Soma Super Computer is a SGI supercomputer with 64 processors . It is generally installed in Electronics Engineering school of the ... 686 B (65 words) - 17:28, 12 January 2014

- Wait state
  - A wait state is a delay experienced by a computer processor when accessing external memory or another device that is slow to respond. ... 2 KB (300 words) - 14:51, 6 August 2013
- Parity flag (section x86 Processors)
  - In computer processors the parity flag indicates if the number of set bits is odd or even in the binary representation of the result of ... 2 KB (363 words) - 05:04, 28 January 2014

- Idle (CPU)
  - A computer processor is described as idle when it is not being used by any program . Details: On processors that have a halt instruction that ... 2 KB (255 words) - 12:25, 10 February 2014

- Process (computing) (redirect from Computer process)
  - In computing, a process is an instance of a computer program that is being ... processes to share processors (CPU s) and other system resources. ... 13 KB (1,716 words) - 01:54, 9 March 2014

> **Memory structure and Types of Memory**

- Internal Memory also called Main Memory or Primary Memory consist of fully electronic devices that stores data and program instructions.
- Main memory is divided into many separate locations and each location is identified by an address.
- As each memory location can be referenced randomly and immediately by the used of these address, main memory is also know by the terms IAS (Immediate Access Storage) and RAM (Random Access Memory) (Some common terms related to the memory will be discussed later)

➢ **SOME IMPORTANT TERMS RELATED TO MEMORY :**
  - Main Memory can be volatile or Non-Volatile. In Volatile Memory, the data stored is lost when the power is switched off.
  - RAM Chips are volatile. On other hand, Non-Volatile Memory retains its contents even after the power is switched off. ROM chips are non-volatile.
  - RAM and ROM chips are implemented as electronic circuits and are known as semiconductor memory.
  - Semiconductors memories are storage devices where the storage elements are formed as solid state electronic components on an Integrated Circuit chip.
  - The following are some of the more common memory chips :

➢ **RAM(Random Access Memory) :-**
  o **RAM** is the internal memory of the CPU for storing data, program and program result. It is read/write memory which stores data until the machine is working.
  o As soon as the machine is switched off, data is erased. Access time in RAM is independent of the address that is, each storage location inside the memory is as easy to reach as other locations and takes the same amount of time.
  o Data in the RAM can be accessed randomly but it is very expensive. RAM is volatile, i.e. data stored in it is lost when we switch off the computer or if there is a power failure.
  o Hence a backup uninterruptible power system (UPS) is often used with computers. RAM is small, both in terms of its physical size and in the amount of data it can hold. RAM is of two types

Static RAM (SRAM)
Dynamic RAM (DRAM)
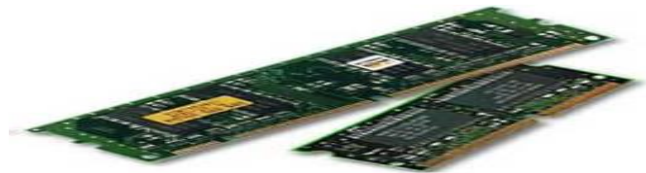
DRAM
  o Dynamic Random Access Memory is a volatile memory that allows fast access to data and is ideal for use as the primary store of computer systems. However, the information is stored as electrical charges and the charges need to be constantly refreshed in order for the data to be maintained.

SRAM
  o Static Random Access Memory is also a volatile memory. Once data is written into the chip, it is maintained as long as power is supplied to it; it does not need refreshing. However, SRAM is slower than DRAM and it is also more expensive.

ROM
  o Read Only Memory is non-volatile. Data is written by the manufacturer and can not be changed. When programs are stored in ROM, it is referred to as "Firm Ware". ROM-BIOS (Basic Input Output System) used in personal computers for booting up the system is a notable example.

PROM
  o Programmable Read Only Memory is a non-volatile memory which allows the user to program the chip with a PROM writer. The chip can be programmed once, thereafter, it cannot be altered.

EPROM & EEPROM

- o Erasable Programmable Read Only Memory and Electrically Erasable Programable Read Only Memory chips can be electrically programmed. Unlike ROM and PROM chips, EPROM chips can be erased and reprogramm

➢ **Slots**
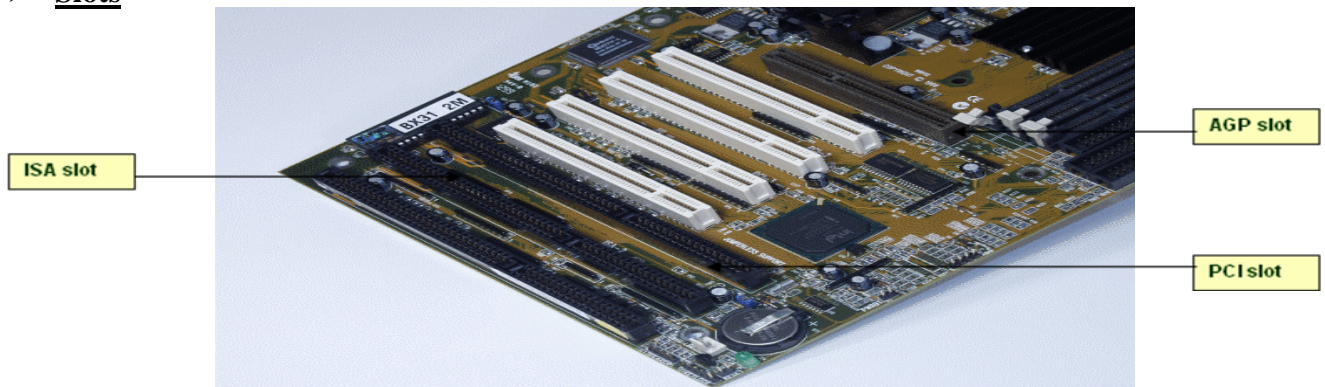
Industry Standard Architecture (ISA)
Peripheral Component Interconnect (PCI)
Advanced Graphic Port (AGP)
Universal serial bus (USB)

➢ **Sockets**

Socket may refer to: In mechanics: Socket wrench , a type of wrench that uses separate, removable sockets to fit different sizes of nuts ...
3 KB (319 words) - 14:42, 21 March 2014

- AC power plugs and sockets
  - o AC power plugs and sockets are devices that allow electrically operated equipment to be connected to the primary alternating current (AC) ...
  - o 96 KB (14,851 words) - 09:36, 20 April 2014
- Network socket
  - o A network socket is an endpoint of an inter-process communication flow across a computer network . most network sockets are Internet sockets. ...
  - o 11 KB (1,469 words) - 18:53, 26 March 2014
- CPU socket
  - o A CPU socket or CPU slot is a mechanical component(s) that provides mechanical and electrical connections between a microprocessor and a ...
  - o 15 KB (1,479 words) - 04:54, 9 March 2014
- Berkeley sockets (section socket())
  - o Berkeley sockets (or BSD sockets) is a computing library with an application programming interface (API) for internet socket s and Unix ...
  - o 30 KB (4,002 words) - 16:38, 7 April 2014

- Socket wrench
  - A socket wrench is a type of wrench that has a socket attached at one end, usually used to turn a fastener. the ratcheting socket wrench, ...
  - 27 KB (4,431 words) - 20:09, 9 April 2014
- Unix domain socket
  - A Unix domain socket or IPC socket (inter-process communication socket) is a data communications endpoint for exchanging data between ...
  - 2 KB (294 words) - 15:59, 7 February 2014
- Tube socket
  - Tube sockets are electrical sockets into which vacuum tube s (also known as valves) can be plugged, holding them in place and providing ...
  - 32 KB (5,011 words) - 21:22, 10 April 2014
- Orbit (anatomy) (redirect from Eye socket)
  - In anatomy , the orbit is the cavity or socket of the skull in which the eye and its appendages are situated. " the bony socket or it can ...
  - 9 KB (1,140 words) - 16:16, 18 February 2014

➢ **Cables**

FIGURE 2-27	Personal Computer Cables and Connectors		
	Connector	Description	Devices
	Serial DB-9	Connects to serial port, which sends data over a single data line one bit at a time at speeds of 56 Kbps.	Mouse or modem
	Parallel DB-25M	Connects to parallel port, which sends data simultaneously over 8 data lines at speeds of 12,000 Kbps.	Printer, external CD-ROM drive, Zip drive, external hard disk drive, or tape backup device
	USB	Connects to universal serial bus (USB), which sends data over a single data line and can support up to 127 devices. USB-1 carries data at speeds up to 12,000 Kbps; USB-2 at 480,000 Kbps.	Modem, keyboard, joystick, scanner, mouse, external hard disk drive, MP3 player
	SCSI C-50F	Connects to SCSI ("scuzzy") port, which sends data simultaneously over 8 or 16 data lines at speeds between 40,000 Kbps and 640,000 Kbps; supports up to 16 devices.	Internal or external hard disk drive, scanner, CD-ROM drive, tape backup device
	IEEE 1394	Connects to the "FireWire" port, which sends data at 400,000 Kbps.	Video camera, DVD player
	VGA HDB-15	Connects to the video port.	Monitor

> **Ports**
>   - A port is a physical docking point using which an external device can be connected to the computer.
>   - A port can also be programmatic docking point through which information flows from a program to computer or over the internet.

- **Characteristics :-**

A port has the following characteristics:
- External devices are connected to a computer using cables and ports.
- Ports are slots on the motherboard into which a cable of external device is plugged in.
- Examples of external devices attached via ports are mouse, keyboard, monitor, microphone, speakers etc.

Following are few important types of ports:

Serial Port

- Used for external modems and older computer mouse
- Two versions : 9 pin, 25 pin model
- Data travels at 115 kilobits per second

Parallel Port

- Used for scanners and printers
- Also called printer port
- 25 pin model
- Also known as IEEE 1284-compliant Centronics port

PS/2 Port

- Used for old computer keyboard and mouse
- Also called mouse port
- Most of the old computers provide two PS/2 port, each for mouse and keyboard
- Also known as IEEE 1284-compliant Centronics port

Universal Serial Bus (or USB) Port

- It can connect all kinds of external USB devices such as external hard disk, printer, scanner, mouse, keyboard etc.
- It was introduced in 1997.
- Most of the computers provide two USB ports as minimum.
- Data travels at 12 megabits per seconds
- USB compliant devices can get power from a USB port

VGA Port

- Connects monitor to a computer's video card.
- Has 15 holes.
- Similar to serial port connector but serial port connector has pins, it has holes.
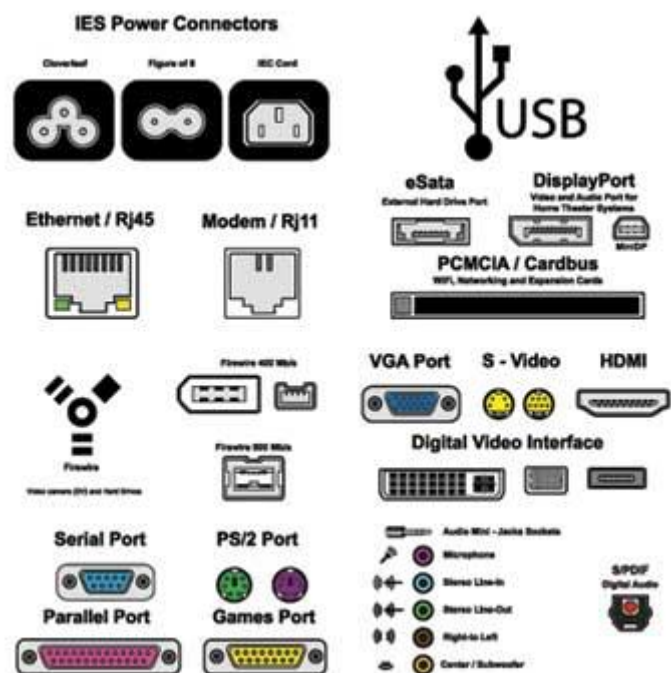
<div align="center">**Power Connector**</div>

- Three-pronged plug
- Connects to the computer's power cable that plugs into a power bar or wall socket

<div align="center">**Firewire Port**</div>

- Transfers large amount of data at very fast speed.
- Connects camcorders and video equipment to the computer
- Data travels at 400 to 800 megabits per seconds
- Invented by Apple
- Three variants : 4-Pin FireWire 400 connector, 6-Pin FireWire 400 connector and 9-Pin FireWire 800 connector

<div align="center">**Modem Port**</div>

- Connects a PC's modem to the telephone network

<div align="center">**Ethernet Port**</div>

- Connects to a network and high speed Internet.
- Connect network cable to a computer.
- This port resides on an Ethernet Card.
- Data travels at 10 megabits to 1000 megabits per seconds depending upon the network bandwidth.

<div align="center">**Game Port**</div>

- Connect a joystick to a PC
- Now replaced by USB.

<div align="center">**Digital Video Interface, DVI port**</div>

- Connects Flat panel LCD monitor to the computer's high end video graphic cards.
- Very popular among video card manufacturers.

<div align="center">**Sockets**</div>

- Connect microphone, speakers to sound card of the computer

➤ **Graphic Cards:-**
  - A video card (also called a video adapter, display card, graphics card, graphics board, display adapter or graphics adapter and sometimes preceded by the word discrete or dedicated to emphasize the distinction between this implementation and integrated graphics) is an expansion card which generates a feed of output images to a display (such as a computer monitor).
  - Within the industry, video cards are sometimes called graphics add-in-boards, abbreviated as AIBs, with the word "graphics" usually omitted.
  - Virtually all current video cards are built with either AMD-sourced or Nvidia-sourced graphics chips.
  - Most video cards offer various functions such as accelerated rendering of 3D scenes and 2D graphics, MPEG-2/MPEG-4 decoding, TV output, or the ability to connect multiple monitors (multi-monitor).

➢ **Network interface controller**

- A network interface controller (NIC, also known as a network interface card, network adapter, LAN adapter or physical network interface and by similar terms) is a computer hardware component that connects a computer to a computer network.
- Early network interface controllers were commonly implemented on expansion cards that plugged into a computer bus. The low cost and ubiquity of the Ethernet standard means that most newer computers have a network interface built into the motherboard.
- Modern network interface controllers offer advanced features such as interrupt and DMA interfaces to the host processors, support for multiple receive and transmit queues, partitioning into multiple logical interfaces, and on-controller network traffic processing such as the TCP offload engine.
- The NIC allows computers to communicate over a computer network, either by using cables or wirelessly.
- The NIC is both a physical layer and data link layer device, as it provides physical access to a networking medium and, for IEEE 802 and similar networks, provides a low-level addressing system through the use of MAC addresses that are uniquely assigned to network interfaces.

➤ **Sound Cards**

- A sound card (also known as an audio card) is an internal computer expansion card that facilitates economical input and output of audio signals to and from a computer under control of computer programs.
- The term *sound card* is also applied to external audio interfaces that use software to generate sound, as opposed to using hardware inside the PC. Typical uses of sound cards include providing the audio component for multimedia applications such as music composition, editing video or audio, presentation, education and entertainment (games) and video projection.
- Sound functionality can also be integrated onto the motherboard, using components similar to plug-in cards.
- The best plug-in cards, which use better and more expensive components, can achieve higher quality than integrated sound.
- The integrated sound system is often still referred to as a "sound card". Sound processing hardware is also present on modern video cards with HDMI to output sound along with the video using that connector; previously they used a SPDIF connection to the motherboard or sound card.

Unit -2(Input devices and Data storage)

Introduction to Input Devices

- All i/p device is an electromechanical devices that accept data from outside world & translates them into a form the computer interpret (i.e.binary)

Input devices

```
Standard                Pointing Device          Special Input
  • keybord               • Mouse                  Device
                          • Joy Stick              • Scanners
                          • light pen              • Microphone
                          • track ball
                          • touch screen
```
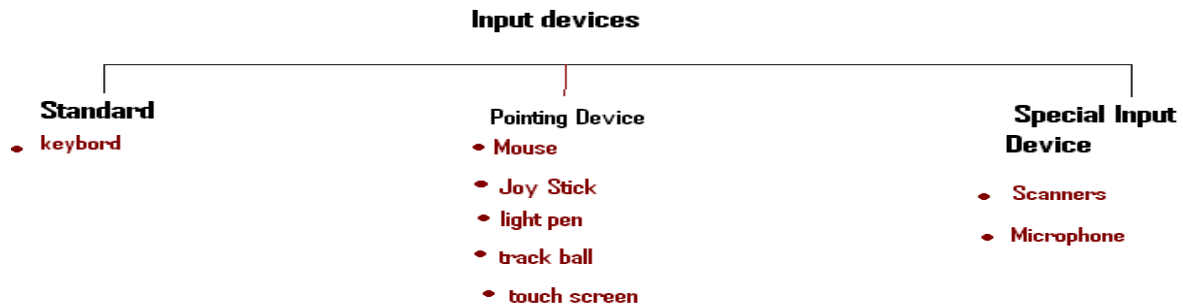
- A wide range of input devices is available today that can be broadly classified into the following

➢ Standard input devices

- Keyboard is the most commonly used input devices.
- They allows data entry into a computer system by pressing a set of keys.
- Keyboard devices can be broadly classified into two types::
  1) General Purpose .
  2) Special Purpose.

➢ General purpose keyboard

- General purpose keyboards are standard keyboards used with most computer systems.
- They are called general purpose because they have enough keys to make them useful for any type of application.
- They are design to meet the data entry requirements of a very wide range of computer users.
- The most popular general – purpose keyboards used today are the 101 – keys QWERTY keyboard.
- It was introduced and promoted by IBM for use with IBM PCs.
- The keys of a QWERTY keyboard are grouped into the following functional groups to make the keyboard easier and more comfortable to use ::

➢ **Key-Board**
  • **Alphanumeric keys:-** The alphanumeric keys contain the
    number 0-9 and several special characters like ?,/,$,&,@,etc.
    Numeric keys:- The numeric keypad is a set of keys that
    looks like an adding machine with its ten digits (0-9) and
    mathematical operators (+,-,*,.,/).
    • It is usually located on the right side of the keyboard.
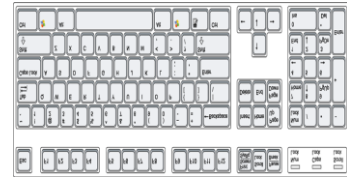
    Arrow keys:- Arrow keys are a set of four keys up, down, left and right.
    • They are also called "cursor – control" or "cursor – movement" keys.

    Special function key:- The keyboard also has a set of special function keys.
    • Some of the most important keys are Enter, Shift, Ctrl, Alt, Backspace, Tab, Caps Lock , Num
      Lock, Home, End, Delete, Page Up , Page Down, Insert, Escape, Spacebar, Print screen, etc.

    Other function key:- The other function keys are known as user – programmable function keys
    they are contains F1, F2, F3 and so on.

➢ **Special purpose keyboard**

• Special purpose keyboard have special function for faster data
  entry & rapid interaction with computer.
• For example, instead of typing the name and price of a
  purchased item.

  • Like Veg. Pizza, the operator need only press the key labeled "Veg. Pizza" and the system
    automatically prints the name and price of the item from an internally store database.
  • This application requires a special purpose keyboard for rapid data entry and faster operation.

Advantages
  • Reliable for data input of text and numbers.
  • Usually supplied with a computer so no additional cost.
  • Specialized keyboards are available.

Dis-Advantage
  • Users may be slow for not very accurate typists.
  • Slow for accessing menus etc. and difficult to use if you want to move objects around the
    screen.
  • Difficult for people unable to use keyboards through paralysis or muscular disorder.

<u>**Pointing Devices:**</u>

Mouse:-
- It is a small hand held device which fit into the user palm.
- It rolls on small bearing and has one or more button on top.
- When a user rolls the mouse across a flat surface such as on top of the table cursor moves on the side where mouse moves.
  - Cursor has variety of symbols such as an arrow, pointing finger, etc.

Techniques of mouse

1. Point:-
- To point the menu item on top of the menu for selecting it using left mouse button.

2. Click:-
- To press and release mouse once to select the menu item using left key of mouse.
- To press and release once to call the pop up option menu using right key of mouse
- Usually depends on the software where the right click is used.

3. Double – click:-
- Using left key of mouse to press and release left button 2 times rapid to execute the selected icon.
- Using right key it depend on the software where the double right click is used.

4. Simultaneous – click:-
- To simultaneous – click means to press and release both the left and right mouse buttons simultaneously.
- It is used by some software packages to give added functionality to the mouse.

5. Drag:-
- Press and hold the left button. For example,
    1) To change the location or position of the icon.
    2) To draw object in some software such as Paint.
    3) To select the paragraph to copy or for selection to change style of font or size.

Types of Mouse
- There are 4 type of different categories of mouse
**1. Mechanical and Optical Mouse:-**

Mechanical mouse:-
- A mechanical mouse has a ball inside it.
- The ball rolls due to surface when the mouse is moved on a flat surface.
- On both sides of the ball at a 90-degree angle from each other there are two small wheels that spin to match the speed of the ball.
  - Each wheel of the mouse is connected to a sensor.
  - The mouse ball rolls when the mouse is moved, the sensors detect how much each wheel spins and send this information to the computer in the form of changes to the current position of the graphics cursor on the screen.
  - The mouse ball rolls when the mouse is moved, the sensors detect how much each wheel spins and send this information to the computer in the form of changes to the current position of the graphics cursor on the screen.

Optical mouse:-
- An optical mouse has no mechanical parts like the ball and wheels.
- It has a built-in photo-detector. This type of mouse comes with a special pad with gridlines printed on it.
- For moving the graphics cursor on the screen the mouse has to be moved on the special pad.
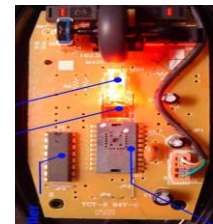
2. One, Two and Three Buttons Mouse:-
- A mouse can have one, two or three buttons.
- Programs are designed to use only a single button.
- In two or three button mouse, the leftmost button is the main button that allows most mouse operations because most people are right-handed and use their right-index finger to click the main button.

3. Serial and Bus mouse:-
- A serial mouse is one, which is designed to plug into a serial port.
- This type of mouse does not require a special electronic card for connecting the mouse to the computer system.
- A bus mouse is one that requires a special electronic card that provides a special port just for the mouse for connecting to the computer system.
- The special electronic card is fitted into one of the expansion slot inside the computer.
- A bus mouse occupies one of the expansion slot where a serial mouse does not need any expansion slot.

4. Wired and Cordless Mouse:-
- A wired mouse connected to the computer system with a small card.
- On the other hand, a cordless mouse is not connected to the computer system.
- It communicates with the computer system with the help of a special controller that operates by transmitting a low-intensity radio or infrared signal.
- A cordless mouse is more expensive than a wired mouse, it allows easier movements of the mouse

Uses:
- Movement - controlling a screen pointer
- Buttons - selecting items / menus etc.

Advantages:
- Ideal for use with desktop computers.

- Usually supplied with a computer so no additional cost.
- All computer users tend to be familiar with using them.

Disadvantages:
- They need a flat space close to the computer.
- The mouse cannot easily be used with laptop, notebook or palmtop computers. (These need a tracker ball or a touch sensitive pad called a **touch pad**).

Track Ball
- It is another pointing device.
- It uses the spherical ball which is rolled by the palm of the hand.
- The spherical ball is moved on top from thumb or finger and relative the cursor moves in screen.
- It does not require much space to use it and it can be placed on any type of surface.

Advantages:
- Ideal for use where flat space close to the computer is limited.
- Can be useful with laptops as they can be built into the computer keyboard or clipped on.

Disadvantages:
- Not supplied as standard so an additional cost and users have to learn how to use them.

Glide Pad
- A touch-sensitive pad about 2 x 2 that will track the touch of a finger.
- It is not a pressure sensor, so there is no need to press down, only to touch.
- This device acts like a mouse for pointing, and you can tap quickly on the pad to mimic a click

Joystick
- A lever that moves in all directions and controls the movement of a pointer or some other display symbol.
- A joystick is similar to a mouse, except that with a mouse the cursor stops moving as soon as you stop moving the mouse.
- With a joystick, the pointer continues moving in the direction the joystick is pointing.
    - To stop the pointer, you must return the joystick to its upright position.
    - Most joysticks include two buttons called triggers.

Light Pen
- It is called light pen, because its construction is similar to a pen and senses light.
- Construction of light pen is very simple. It has a photo cell which senses light of screen and converts into electrical signal.
- Using of light pen screen is refreshed every time which sense the change in light i.e. change in brightness of the screen.

    - When the light is sensed the corresponding information is generated and the position of the light pen is located. It can be used to draw object , point ,etc
    - Light pen does not have any tracking hardware to make use of light pen as a 'position' device a tracking program must be loaded in computer.

Touch Screen

- A touch screen is an input device that allows users to operate a PC by simply touching the display screen.
- Touch screen is designed by different technologies

1) **By use of the optical sensor:-** optical sensor can sense the touch of the user when input is made with the finger.
2) **Pressure sensitive monitors:-** which has sensor to measure the weight of monitor when user touches the screen the weight and force information is transferred to sensor and the sensor allow the device to detect the touch location. Some time user need to supply force on the screen to select the menu.
3) **The display screen:-** It has a sensitive glass overlay placed on it and we could give the desired input by touching it.
    - A touch screen is based on CRT (Cathode Ray Tube) technology, that accepts direct onscreen input.
    - The ability for direct onscreen input is facilitated by an external (light pen) or an internal device (touch overlay and controller)

Main touch screen components:
- ➢ Touch sensor
- ➢ Controller
- ➢ Software driver

TOUCH SENSOR
- A touch screen sensor is a clear glass panel with a touch responsive surface which is placed over a display screen so that the responsive area of the panel covers the viewable area of the display screen.
- The sensor generally has an electrical current or signal going through it and touching the screen causes a voltage or signal change. This voltage change is used to determine the location of the touch to the screen

CONTROLLER
- The controller is a small PC card that connects between the touch sensor and the PC. It takes information from the touch sensor and translates it into information that PC can understand.

SOFTWARE DRIVER
- The driver is software that allows the touch screen and computer to work together. It tells the operating system how to interpret the touch event information that is sent from the controller.
- Most touch screen drivers today are a mouse-emulation type driver. This makes touching the screen the same as clicking your mouse at the same location on the screen.

Use of Touch Screen
- **Public Information Displays:::**
Tourism displays, Trade show display
- **Customer Self-Services:::**
Stores, Restaurants, ATMs, Airline ticket terminals and Transportation hubs.
- **More uses...**
Computerized gaming, Student Registration systems, Multimedia softwares, scientific applications etc.
- **Information counters:**

For public counter such as in bus stands, railways station, some museums, airport, departmental store, malls for the location of goods, rest room, to show way to customer and for attraction in shopping mall

Other Touch screen Technology

- Resistive touch screen
- Capacitive touch screen
- Infrared touch screen
- Surface acoustic wave (SAW) touch screen

1. Resistive Touch screen

- Resistive Touch screens consist of a glass or acrylic panel that is coated with electrically conductive and resistive layers made with Indium Tin Oxide (ITO).
- The thin layers are separated by invisible spacers.

➢ Characteristics of Resistive Touch screen
1. Cost effective solutions
2. Activated by a stylus, a finger or gloved hand
3. Not affected by dirt, dust, water, or light
4. 75%~85% clarify
5. resistive layers can be damaged by a very sharp object

2. Capacitive Touch screen

- Capacitive touch screen describe a two parts
    1. Projected – capacitive touch screen
    2. Surface – capacitive touch screen

❖ Projected – capacitive touch screen:-
- Projected capacitive touch screens have front and back protective glass providing optical and strength enhancement options.
- Its middle layer consists of a laminated sensor grid of micro-fine wires, and optical enhancement options.
- During a touch, capacitance forms between the finger and the sensor grid. The embedded serial controller in the touch screen calculates touch location coordinates and transmits them to the computer for processing.

❖ Surface – capacitive touch screen:-
- Surface capacitive technology consists of a conductive coating on a glass panel.
- Electrical rays around the panel's edge evenly distribute a low voltage across the conductive layer, creating a uniform electric field.
- A human body is an electric conductor, so when you touch the screen with a finger, a slight amount of current is drawn, creating a voltage drop.

➢ Characteristics of Capacitive touch screen
1. Faster and more responsive.
2. Superior optical clarity, brighter display and less surface reflection.
3. Must be touched by finger, will not work with any non-conductive input

3. Infrared touch screen

- Infrared (IR) technology relies on the interruption of an IR light grid in front of the display screen.
- The touch frame contains a row of IR-light emitting diode (LEDs) and photo transistors, each mounted on two opposite sides to create a grid of invisible infrared light.

- The IR controller sequentially pulses the LEDs to create a grid of IR light beams.
- When a stylus, such as a finger, enters the grid, it obstructs the beams.
- One or more photo transistors from each axis detect the absence of light and transmit a signal that identifies the x and y coordinates.

  ➢ **Characteristics of Infrared touch screen**
  1. Clear as glass, improves reading ability.
  2. Most durable surface.

4. **Surface Acoustic Wave (SAW) Touch Screen**
   - Surface waves are readily absorbed when a soft object such as a fingertip touches the substrate.
   - The touch screen controller sends an electrical signal to the transmitting transducer, which converts the signal into ultrasonic waves within the glass.
   - When you touch the screen, you absorb a portion of the wave traveling across it.
   - The received signal is then compared to the stored digital map, the change recognized, and a coordinate calculate.

   ➢ **Characteristics of SAW touch screen**
   1. Durable glass construction
   2. High optical clarity
   3. Activated by a finger, gloved hand or soft tip
   4. Not completely sealable, can be affected by large amounts of dirt, dust, and / or water in the environment.

   - Finally though the touch screen technology contains some limitations it's very user friendly, fast, accurate, easy for the use & fun.
   - It has been widely accepted and now by just modifying a little it can replace the mouse and key board completely in near future.

➕ **Graphics tablet**
   - A graphics tablet (also digitizer, digitizing tablet, graphics pad, drawing tablet or pen tablet) is a computer input device that enables a user to hand-draw images and graphics, similar to the way a person draws images with a pencil and paper.
   - These tablets may also be used to capture data or handwritten signatures.
   - It can also be used to trace an image from a piece of paper which is taped or otherwise secured to the surface.
   - Capturing data in this way, either by tracing or entering the corners of linear poly-lines or shapes is called digitizing.
   - A graphics tablet (also called pen pad or digitizer) consists of a flat surface upon which the user may "draw" or trace an image using an attached stylus, a pen-like drawing apparatus.
   - The image generally does not appear on the tablet itself but, rather, is displayed on the computer monitor.
   - Some tablets, however, come as a functioning secondary computer screen that you can interact with images directly by using the stylus.

➕ **Digitizer**

- A digitizer is an input device, which is used for converting (digitizing) pictures, maps and drawings into digital form for storage -in computers.
- For example, the x and y coordinates of points in a drawing mat be stored in digital form.
- This enables re-creation of the drawing from the stored information, and easy incorporation of changes in the drawing, as and when required.
    - A digitizer consists of a digitizing tablet (also known as graphics tablet) associated with a stylus.
    - The digitizing tablet is a flat surface, which contains hundreds of fine copper wires forming a grid.
    - Each copper wire receives electric pulses. The digitizing tablet can be spread over a working table, and is connected to a computer.
    - The stylus is like a pen, or a lens-like cursor with a cross hair and button.
    - The stylus is connected to the tablet, and can be pressed down at a point on the tablet to input the (x, y) coordinates of the point.
    - When the stylus is moved on the tablet, the cursor on the computer's screen moves simultaneously to a corresponding position on the screen to provide visual feedback to the operator.
    - Digitizers are commonly used in the area of Computer Aided Design (CAD) by architects and engineers to design cars, buildings, medical devices, robots, mechanical parts, etc.
    - They are also used in the area of Geographical Information System (GIS) for digitizing of maps, which are available in paper form.
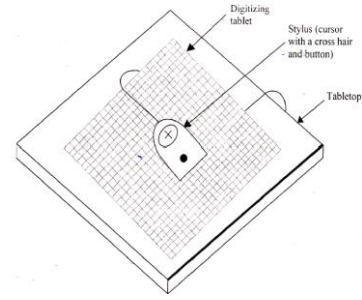
Microphone
- This is used for the input of sound which is then digitized by the computer.
- The digital audio can be saved for playback later on.
- The digital audio can also be used with voice-recognition software to control hardware, navigate a menu or input text into a word processor.
- Voice recognition can also be used in security systems.

Advantages:
- Voice recognition software can be used to convert your voice into text or to control menu options on a phone system.

Disadvantages:
- Stored audio files can take up a lot of memory.
- Voice commands can be difficult to recognize by the software.

Digital camera
- These are used to take photographs like a normal camera but produce digital images instead of using film.
- The light passing through the lens is digitized by special light sensitive sensors.
- The image is stored on memory chips in the camera and can then be transferred to a computer.
- The resolution of such cameras is increasing rapidly and professional models have become standard in photo-journalism.
- Images are usually compressed as jpeg's to save memory.
- Removable memory card Advanced models have removable memory cards to increase the camera's storage capacity.
- Images can be transferred to a computer by cables or memory card readers.

POS (Point Of Sale)
- A point-of-sale display (POS) is a specialized form of sales promotion that is found near, on, or next to a checkout counter (the "point of sale").
- They are intended to draw the customers' attention to products, which may be new products, or on special offer, and are also used to promote special events, e.g. seasonal or holiday-time sales.
- POS displays can include shelf edging, dummy packs, display packs, display stands, mobiles, posters, and banners.
- POS can also refer to systems used to record transactions between the customer and the commerce.

Computer terminal
- A computer terminal is an electronic or electromechanical hardware device that is used for entering data into, and displaying data from, a computer or a computing system.
- Early terminals were inexpensive devices but very slow compared to punched cards or paper tape for input, but as the technology improved and video displays were introduced, terminals pushed these older forms of interaction from the industry.
- A related development was timesharing systems, which evolved in parallel and made up for any inefficiencies of the user's typing ability with the ability to support multiple users on the same machine, each at their own terminal.
- The function of a terminal is confined to display and input of data; a device with significant local programmable data processing capability may be called a "smart terminal" or fat client.
- A terminal that depends on the host computer for its processing power is called a dumb terminal or thin client.
- A personal computer can run software that emulates the function of a terminal, sometimes allowing concurrent use of local programs and access to a distant terminal host system.

Special input devices :

Scanner:
- A scanner is an input device that translates paper documents into an electronic format that can be stored in a computer.
- The input documents may be typed text, pictures, graphics or even handwritten material.

- The scanner treats the document as if it is drawn on graph sheet.
- An intersection of horizontal & vertical line of a graph is called grid point.
- If there is dark spot at the grid point it is represented by '1' otherwise '0'
- This representation is called bit map representation of image.
- Each bit in the representation of image is called "Pixel".
- Scanner having 300 to 600 grid points per inch is common.
- Scanners come in various shapes and sizes.

The types of scanners are:
1. Flat Bed Scanner
2. Hand Held scanner
3. Optical Scanner
   i. Optical Mark Reader
   ii. Optical Char Reader
   iii. Optical Barcode Reader
   iv. Magnetic Ink Character Recognition

1. Flat Bed Scanners
- A Flatbed scanner is usually composed of glass plate which you can lid documents to be scanned.
- Flatbed scanners are effectively useful to scan documents.
- The document to be scanned is placed upside down.
- The light source is situated below the glass plate and move horizontally from left to right when activated.
  - After scanning one line it moves to the next line to scan and this process continue.
  - It takes about 20 seconds to scan a document of size 21 cm X 28 cm.

2. Hand-held Scanner
- Hand-held scanner scan a document at a time a scanner is slowly dragged from one end of the document to its other end with its light on.
  - The scanner has to be dragged very steadily and carefully over the document; otherwise the conversion of the document into its equivalent bit map will not be correct.
  - They are usually used to read the barcodes & text in libraries and departmental stores.
  - It contains the set of LED. It is cheaper than flatbed scanner.

3. Optical Scanner

I) Optical Mark Readers (OMR)
- These scanners are capable of recognizing a pre specified type of mark made by pencil or pen.
- The use of OMR is not limited to the grading of objective tests.
- But it is useful to any input data that is of a choice or selection nature can be recorded for OMR input.
- OMR Software is a computer software application that makes OMR possible using a desktop computer.

Advantages:
  - Very cheap
  - Checking of papers made fast, accurate and without corruption.

Disadvantages:
  - Can't read character
  - Erasing or cancellation not possible
  - The main disadvantage is need for good quality expensive paper.

II) Optical Character Readers (OCR)
- These devices are capable of detecting alphabetic and numeric characters printed on paper.
- An OCR device will transform the hand written text into the text in the computer.
- Some advanced OCR systems have the ability to recognize graphics and charts.
- If the characters are typewritten, they must be typed using a special type font called an OCR font.
- The standard fonts used are OCR-A (American standard) and OCR- B (European standard).
- Some OCR devices can also accept computer print-out and complete pages of typed text.

Advantages:
- Speed up data input.
- OCR devices can now accept a wide range of fonts, using ordinary (simple) inks.

Disadvantages:
- OCR devices are expensive and so used only for large- volume processing applications.
- Characters can be scanned properly only if they are standard size.
- Roughly handled and dusty papers cannot be scanned with accuracy.

III) Optical Barcode Reader (OBR)
- As the name suggests, an Optical Barcode Reader is used to read printed barcodes.
- Bar codes represent alphanumeric data by a combination of adjacent vertical lines by varying their width and the spacing between them.
- A barcode reader is uses a laser – beam scanning technology.
- Different barcodes having different patterns of bars reflect the beam in different ways, which is sensed by a light – sensitive detector.
- It a type of hand held scanners.

IV) Magnetic Ink Character Recognition (MICR)
- It is a character recognition technology mainly used in banking sector.
- It allows the computers to read information like account numbers from printed documents.
- In MICR, the characters are printed on documents using special magnetic ink.
- These characters when passed through the MICR device are identified by their magnetic field.

Advantages:
- Even roughly handled, folded, smeared can still be read with a high degree of accuracy.
- Speed up data input for the banking industry because check can be directly fed into the input device.

Disadvantages:
- No alphabets can be used.
- Special ink is required, hence expensive.

DATA STORAGE

➢ Introduction
- Also referred as Secondary Memory consists of devices that allow more permanent storage of data; i.e. they are non-volatile.
- It is usually much higher in capacity than main memory. However, they are much slower than main memory.
- Magnetic Disk (Hard Disk), Floppy Disk, Optical Disks are the examples of secondary storage devices. (will be discussed later) Secondary Storage Devices are also called as Secondary Memory, Auxiliary Devices.
- They are used to store the data permanent on the media which is used to store the data.

(1) Magnetic Disk Storage
- Magnetic disk drives are comprise of one or more circular rotating disks coated with magnetic material that is used for the recording of data.
- Data is stored and retrieved from the disk using a conducting coil called the Head. During a read / write, the head is stationary while the platter rotates beneath it.
- Data are recorded into concentric rings know as Tracks. A track is sub-divided into blocks called Sectors.

- Tracks on each surface of the disk are numbered. In a disk pack, all the similarly numbered tracks of each surface of each disk is known as a Cylinder.
- A block is the smallest unit of data that is transferred from the disk to the memory and vice versa. The first track (0 Track) of magnetic disk is called as FAT (File Allocation Table) which stores information about files.
- When accessing data from the magnetic disks, the read / write heads attached to the access arms will move to the correct track. The time taken to move the head to correct track is known as the Seek Time.

  - Seek Time : Time taken by head to reach at desired track.
  - Rotational Delay or Latency : Time taken by head to reach at desired data (sector) after reaching at particular track.

  FAT (File Allocation Table) Track **Sector**
  - Access Time : Seek Time + Rotational Delay.
  - Response Time : Access Time + Data Transfer Time
  Two common types of magnetic disks are Floppy disks and Hard disks :

(2) FLOPPY DISKS
- There are two types of floppy disks available :
  1) 3.5" (1.44 MB)
  2) 5.25" (1.2 MB)
- The most common floppy disk now in used is the 3.5" disk, also known as 1.44 MB floppy and microfloppy.
- 8" and 5.25" floppy disks were popular in the past but are superseded by the 3.5" disks.
- Floppies are made of plastic coated with magnetic oxide. The long lit is provided for the read / writes head to access the disk.
- A hub in the center is used for mounting the disk drive. A hole is used to sense index marking.
  External Label Write Protect Notch Spindle Hole Index Hole
  Read/Write Notch
  Recording Windows with
  Sliding Cover
  5.25" (1.2 MB) 3.5" (1.44 MB)

(3) HARD DISKS
- Comprises at least one rigid disk protected by a strong, and usually air-tight, casing.
- The hard disk is usually a self-contained unit containing the disks, read / write head, access arms and servo motor enclosed within the casing, and the electronic circuit board controlling the disk operations attached to the external of the casing.
- The hard disk drive has become the most indispensable secondary storage device in micro-computers.
- It is fast and speeds of less than 10 (ms) milliseconds are achievable.
- Storage capacity is large and it is not uncommon for micro-computers.

(4) Magnetic Tape
- Magnetic tape allows large volumes of data to be stored economically.
- Magnetic tapes used to be available in large reels normally used with mainframe computers; however, magnetic tape cartridges are now available and is even used in micro-computer systems as backup devices.
- The tape is made of a plastic coated iron oxide. When the tape passes the tape device's write head, data is recorded by magnetizing the iron oxide in different directions.

- When reading data, the iron oxide causes a current in the read head.
- **Access Arm Read / Write Head Cylinder Non-Recordable Surface Spindle**

Advantage
- Inexpensive
- Large storage capacity
- Data can be stored permanently
- Direct recording
- Reusable
- Used in Batch Processing Jobs

Disadvantage
- Serial Access
- Updated can not be automatically written back at their original place.
- On-line updation is time consuming

- Data can be recorded onto the tape as records. Gaps are found between records and are know as IRG (Inter Record Gaps).
- These gaps exist to allow the tape device to accelerate to the correct speed before data is accessed.
- Records are normally 'blocked' together and are separated by IBG (Inter Block Gaps), 'Factor' refers to the number of records per block.
- Data stored in IRG make data transfer slow and inefficient use of tape

.
Other Storage Disk

- In this form of storage, a light source, usually laser, is used to etch data patterns onto the surface of the disk.
- Normally, two laser light sources are used : a week laser used to read data while a stronger laser is used to record data by burning pits under the surface of the disk.CD-ROM (Compact Disk – Read Only Memory) is a non-erasable backing store which can hold large amounts of data.
- Large volume production is achieved by automated processes similar to that of audio compact disks.
- Many of today's micro-computers comes with CD-ROM readers and as a result, CDROM is popularly used for distribution of software, digitized graphic images as well as Multi-Media material.
- WORM (Write Once Read Many) disk technology is inexpensive allows and users to store large amounts of data.
- The data can be read time and again but, once the data is stored, it cannot be erased or changed.
- Some WORM drives only allow one write operation (i.e. additional data cannot be recorded subsequently even if the disk capacity is not fully utilized). Other types of WORM drives allow data to be incrementally recorded.

➢ **DVD (Digital Video Disc)**
- DVD, also known as Digital Video Disc or Digital Versatile Disc, is an optical disc storage media format, and was invented and developed by Philips, Sony, Toshiba, and Time Warner in 1995.
- Its main uses are video and data storage. DVDs are of the same dimensions as compact discs (CDs), but are capable of storing more than six times as much data.

- Variations of the term *DVD* often indicate the way data is stored on the discs: DVD-ROM (read only memory) has data that can only be read and not written; DVD-R and DVD+R (recordable) can record data only once, and then function as a DVD-ROM; DVD-RW (re-writable), DVD+RW, and DVD-RAM (random access memory) can all record and erase data multiple times DVD-Video and DVD-Audio discs refer to properly formatted and structured video and audio content, respectively. Other types of DVDs, including those with video content, may be referred to as DVD Data discs.

- ➢ **Blu-ray disk**
  - The industry is set for yet another revolution with the introduction of Blu-ray Discs (BD) in 2006.
  - With their high storage capacity, Blu-ray discs can hold and play back large quantities of high-definition video and audio, as well as photos, data and other digital content.
  - A current, single-sided, standard DVD can hold 4.7 GB (gigabytes) of information.
  - That's about the size of an average two-hour, standard-definition movie with a few extra features. But a high-definition movie, which has a much clearer image.
  - Blu-ray is the next-generation digital video disc. It can record, store and play back high-definition video and digital audio, as well as computer data. The advantage to Blu-ray is the sheer amount of information it can hold:
    - o A single-layer Blu-ray disc, which is roughly the same size as a DVD, can hold up to 27 GB of data -- that's more than two hours of high-definition video or about 13 hours of standard video.
    - o A double-layer Blu-ray disc can store up to 50 GB, enough to hold about 4.5 hours of high definition video **or** more than 20 hours of standard video. And there are even plans in the works to develop a disc with twice that amount of storage.

- ➢ **zip drive**
  - A zip drive is a type of removal disk storage capable of holding a moderate amount of computer information.
  - Although the zip drive was embraced by many computer users when it was introduced in 1994, it never replaced the 3.5-inch floppy disk. Rather, items such as rewritable digital versatile discs (DVDs), rewritable compact discs (CDs), and flash drives gained popularity and have virtually replaced the floppy disk. These storage devices have proven to be convenient and capable of holding large amounts of data. For this reason, the zip drive was never a popular device for data storage.
  - The first zip drive system, introduced by Iomega, was capable of holding only 100 megabytes of information. This made the zip drive, which cost just under 200 US dollars (USD), an instant success, as people used it to store files that were too large to be placed on a floppy disk.
  - The zip drive was later beefed up to hold 250 megabytes, and ultimately 750 megabytes of information. At the same time, Iomega improved upon the zip drive's ability to transfer data.
  - The price for the 100 megabyte zip drive steadily fell as competition increased when other companies began offering their own versions. From 1999 to 2003, however, zip drive sales began to plummet.
  - This was largely due to the decreasing costs of DVD±RW and CD-R. In addition, Universal Serial Bus (USB) flash drives with much larger capacities were introduced. Nonetheless, some computer users still prefer the zip drive because it is durable, reliable, and capable of transferring data quickly

> **Pen drive**
>   - A USB flash drive is an consists of a flash memory data storage device integrated with a USB (Universal Serial Bus). USB flash drives are typically removable and rewritable, and physically much smaller than a floppy disk. Most weigh less than 30 g.
>   - Storage capacities in 2010 can be as large as 256 GB with steady improvements in size and price per capacity expected.
>   - Some allow 1 million write or erase cycles and have a 10-year data retention cycle. USB flash drives are often used for the same purposes as floppy disks were.
>   - They are smaller, faster, have thousands of times more capacity, and are more durable and reliable because of their lack of moving parts.
>   - A flash drive consists of a small printed circuit board carrying the circuit elements and a USB connector, insulated electrically and protected inside a plastic, metal, or rubberized case which can be carried in a pocket or on a key chain, for example.
>   - The USB connector may be protected by a removable cap or by retracting into the body of the drive, although it is not likely to be damaged if unprotected.
>   - **1** USB connector
>   - **2** USB mass storage controller device
>   - **3** Test points
>   - **4** Flash memory chip
>   - **5** Crystal oscillator
>   - **6** LED
>   - **7** Write-protect switch (Optional)
>   - **8** Space for second flash memory chip

Storage Mechanism of Magnetic Storage Devices
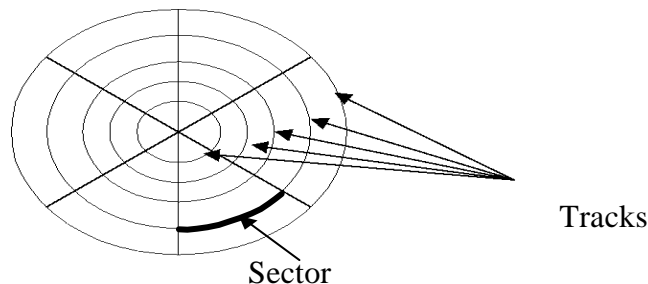
Tracks

Sector

Disk contains concentric Tracks
Tracks divided into Sectors A Sector is the smallest addressable unit in a disk

> **Flash memory**

- Flash memory is an electronic (solid-state) non-volatile computer storage medium that can be electrically erased and reprogrammed.
- Toshiba developed flash memory from EEPROM (electrically erasable programmable read-only memory) in the early 1980s and introduced it to the market in 1984. The two main types of flash memory are named after the NAND and NOR logic gates.
- The individual flash memory cells exhibit internal characteristics similar to those of the corresponding gates.
- Whereas EPROMs had to be completely erased before being rewritten, NAND-type flash memory may be written and read in blocks (or pages) which are generally much smaller than the entire device.

- NOR-type flash allows a single machine word (byte) to be written—to an erased location—or read independently.

- The NAND type operates primarily in memory cards, USB flash drives, solid-state drives (those produced in 2009 or later), and similar products, for general storage and transfer of data.

- NAND or NOR flash memory is also often used to store configuration data in numerous digital products, a task previously made possible by EEPROM or battery-powered static RAM. One key disadvantage of flash memory is that it can only endure a relatively small number of write cycles in a specific block

A USB flash drive. The chip on the left is the flash memory. The controller is on the right.
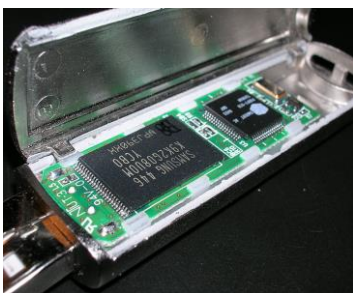
➢ **Cloud Storage**

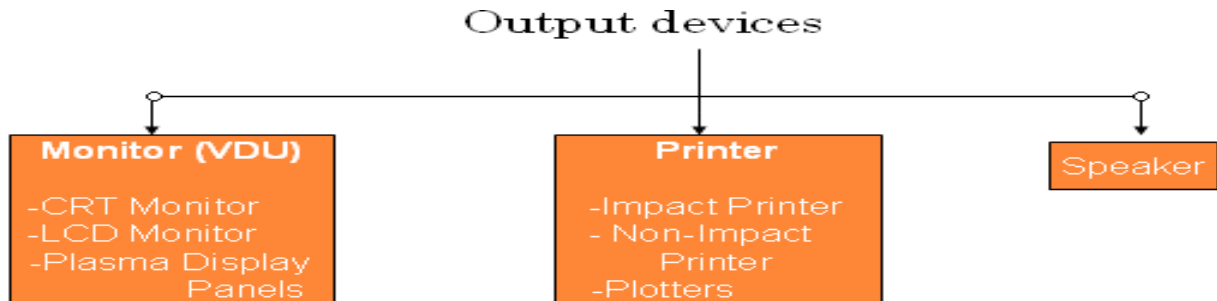- Cloud storage is a model of data storage in which the digital data is stored in logical pools, the physical storage spans multiple servers (and often locations), and the physical environment is typically owned and managed by a hosting company.
- These cloud storage providers are responsible for keeping the data available and accessible, and the physical environment protected and running.
- People and organizations buy or lease storage capacity from the providers to store user, organization, or application data.
- Cloud storage services may be accessed through a co-located cloud computer service, a web service application programming interface (API) or by applications that utilize the API, such as cloud desktop storage, a cloud storage gateway or Web-based content management systems.
- Cloud computing is believed to have been invented by Joseph Carl Robnett Licklider in the 1960s with his work on ARPANET to connect people and data from anywhere at any time.
- In 1983, CompuServe offered its consumer users 128k of disk space that could be used to store any files they chose to upload.
- In 1994, AT&T launched PersonaLink Services, an online platform for personal and business communication and entrepreneurship. The storage was one of the first to be all web-based, and referenced in their commercials as, "you can think of our electronic meeting place as the cloud." Amazon Web Services introduced their cloud storage service AWS S3 in 2006, and has gained widespread recognition and adoption as the storage supplier to popular services such as Smugmug, Dropbox, Synaptop and Pinterest.

- In 2005, Box (company) launched an online file sharing and personal cloud content management service for businesses.

Unit -3(Output Devices)

Output Device::

- An output device is an electromechanical device that accepts data from a computer and translates them into a form suitable for use by the outside world.
- A wide range of output devices is available today that can be broadly classified into the following categories:

Output devices

Monitor (VDU)	Printer	Speaker
-CRT Monitor -LCD Monitor -Plasma Display Panels	-Impact Printer - Non-Impact Printer -Plotters	

- **MONITOR (VDU):-**
    - Monitors are by far the most popular output devices used today for producing softcopy output.
    - They display the generated output in on the screen.
    - Monitor is known as VDU (Video Display Unit) or screen.
    - Monitors are available in various size like 14, 17 and 21 each, etc.
    - They are two basic types of monitors used today
        - **1)** CRT (Cathode – Ray – Tube) and
        - **2)** Flat – Panel display
    - The CRT monitors look like a television and are used with non-portable computer systems.
    - The Flat – panel monitors are thinner and lighter and commonly used with portable computer systems like notebooks, LCD computers.

- **CATHODE – RAY – TUBE (CRT) MONITORS**
    - CRT display is the most common type of computer displays.
    - The main component inside a monitor is a picture tube or CRT.
    - CRT is one type of glass tube enclosing a source of electrons, an electrode, focusing system, a horizontal and vertical deflection system, and a phosphor coated screen which glows when an electron beam strikes it.
    - The screen's phosphor coating is organized into a grid of dots called "Pixels".
    - CRT based on the resolution and number of colors supported, several standards for color monitors have evolved.
    - The four most popular standards are::
        1. **CGA – Color Graphics Adapter:-** It has a low resolution of 320 by 200 and supports up to 16 colours.
        2. **EGA – Extended Graphics Array:-** It has a resolution of 640 by 350 and supports up to 16 colours.
        3. **VGA – Video Graphics Array:-** It has a resolution of 640 by 480 and supports up to 256 colours.
        4. **Super VGA :-** It provides resolution from 800 by 600 to 1280 by 1024 and supports 256 or more colours.
    - Now a days all modern personal computers used VGA and SVGA adapter.

- **FLAT – PANEL MONITOR (LCD, PLASMA DISPLAY PANELS)**

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- Flat – panel monitors are work same like a CRT monitors but they look very different of them.
- Mainly flat- panel monitors are contains two parts::
    1. LCD Monitors
    2. Plasma Display Panels (PDPs)

1. LCD Monitors:-
- A flat panel monitor (LCD) is only about one inch thick, is light in weight and consumes less electricity as compared to a CRT monitors.
- These features make a flat panel monitor most suitable for use with portable computer system such as a laptop computer and notebook computers.
- A portable computer must be compact in size, light in weight and should consume less power so that it can be operated for longer durations with battery at places where there is no power point in a traveling.
- This requirements make a CRT monitor unsuitable for these systems because of its large size, heavy weight and more power requirement.
- The display technologies used by flat panel monitors include Liquid Crystal Display (LCD), Electro Luminescent Display (ELD) and Gas Plasma Display (GPD).
- LCD monitors use a special kind of liquid crystals to display images on the screen.
- One problem with these monitors is that they are hard to read under certain lighting condition.
- This is because unlike the phosphors used in CRT monitors, the liquid crystals do not glow when charged, so there is not enough contrast between the images and their background to make them clearly readable under all lighting conditions.
- To take care of this problem some LCD put a light source behind the screen.
- One problem with these monitors are hard to read under certain lighting condition because unlike phosphors used in CRT monitors, liquid crystals do not glow when charged .so it is not readable in all lighting condition.

2. Plasma Display Panel (PDP):-
- A plasma display panel is a type of flat panel display used for large TV display.
- Many tiny cells located between two plates of glass hold an mixture of neon and xenon gases.
- The gas in the cells is electrically turned into a plasma which then excites phosphors to emit light.
- The xenon and neon gas in plasma television is contained in hundreds of tiny cells positioned between two plates of glass.
- Long electrodes are also sandwiched between the glass plates, in front of and behind the cells.
- Control circuitry charges the electrodes that cross paths at a cell, creating a voltage difference between front and back and causing the gas to ionize and form plasma.
- In color panel the back of each cell is coated with a phosphor.
- Every pixel is made up of separate sub pixel cells, each with different colored phosphors.
- One sub pixel has a red light phosphor, one has green light phosphor, and one has blue light phosphor.
- These colors blend together to create the overall color of pixel.

Characteristics of PDP:-
- Plasma have wide colour of range, and can be produced in fairly large sizes up to 103 inches.
- Display panel is only about 2.5 inches thick, while the total thickness is less than 4 inches.
- The lifetime of plasma is estimated 60,000 hours.

3. Light - Emitting Diode (LED) :-
- An LED display is a flat panel display, which uses light-emitting diodes as a video display.
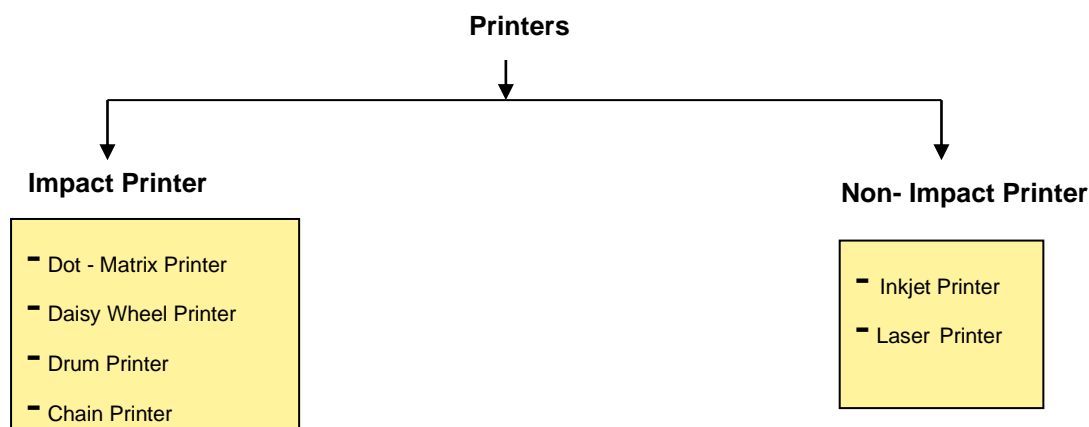- An LED panel is a small display, or a component of a larger display.

- They are typically used outdoors in store signs and billboards, and in recent years have also become commonly used in destination signs on public transport vehicles or even as part of transparent glass area.
- LED panels are sometimes used as form of lighting, for the purpose of general illumination, task lighting, or even stage lighting rather than display.
- There are two types of LED panels: conventional (using discrete LEDs) and surface-mounted device (SMD) panels.
- Most outdoor screens and some indoor screens are built around discrete LEDs, also known as individually mounted LEDs.
- A cluster of red, green, and blue diodes is driven together to form a full-color pixel, usually square in shape.
- These pixels are spaced evenly apart and are measured from center to center for absolute pixel resolution.
- The largest LED television in the world is the Center Hung Video Display at Cowboys Stadium, which is 160×72 ft (49×22 m), 11,520 square feet (1,070 m2).
- The first true all-LED flat panel television screen was possibly developed, demonstrated and documented by James P. Mitchell in 1977.
- The 2011 UEFA Champions League Final match between Manchester United and Barcelona was broadcast live in 3D format in Gothenburg (Sweden), on an EKTA screen.
- LED text displays refer to types that are specialized and limited to display of alpha-numeric characters.
- Most types display either one character or a group of characters.
- One character is generally displayed by a matrix of LEDs, or by a matrix of segments.

Printers:-
- Printers are the most commonly used output devices that can be found in almost all computer centers.
- They are the primary output devices used to prepare permanent documents in human readable form.
- There is different type of printer. It is depending on speed and printing approach.
- Printers are classified as character printer, line printer and page printer.

Types of Printers
- The various types of printers are used today. Mainly the printers had two types.

Printers

Impact Printer

- Dot - Matrix Printer
- Daisy Wheel Printer
- Drum Printer
- Chain Printer

Non- Impact Printer

- Inkjet Printer
- Laser Printer

Impact Printer:-

1) Dot – Matrix Printer:-

- Dot – Matrix printer is a one type of impact printer because they print by hammering the pins on the inked ribbon to leave ink impressions on the paper.
- They are character printers that from characters and all kinds of images as a pattern of dots.
- A dot – matrix printer has a print head that can move horizontally across the paper.
- The print head contains an array of pins, which can be activated independent of each other to extend and strike against an inked ribbon to form a pattern of dots on the paper.
- For faster printing, many dot matrix printers are designed to print both while the print head moves from left to right and while it moves from right to left an return.
- All characters are formed by 5 horizontal and 7 vertical dots. So a pattern is called 5 by 7 matrixes.
- It having a printing speed is between 30 to 600 characters per second..
- The quality of the printed output is directly proportional to density of the dots on the matrix.
- This type of printers are very cheaper then other printers.
- Dot – matrix printers are noisy as compared to non-impact printers.
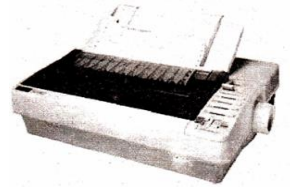
2) **Daisy – Wheel Printer:-**
- It is a one type of Impact printer.
- When the desired character moves to the correct position, a print hammer strikes to produce the output.
- This type of printer's print quality is good.
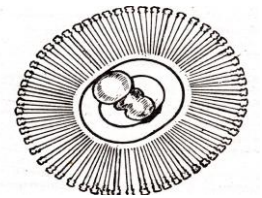
3) Drum Printer:-

- A drum printer is a part of Impact printer.
- It is consists of a solid, cylindrical drum that has raise characters in band on its surface.
- There are many bands as there are printing positions. Each band contains all the possible characters.
- The drum rotates at a rapid speed. For each possible print position there is a print hammer located behind the paper.
- These hammers strike the paper along with the inked ribbon against the proper character on the drum.
- These means that all characters on the line are not printed at exactly the same time but the time required to print the entire line is fast so we can call this type of printer as a **Line printer** too
- The speeds of drum printers are in the range of 300 to 2000 lines per minute.
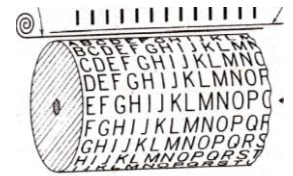
4) Chain Printer:-

- It is an Impact Printer and they use a rapidly moving chain called a print chain.
- Each link of the chain is a character font. There is a print hammer located behind the paper.
- As the print chain rotates, the properly timed print hammers strike the paper, along with the ink ribbon, against the proper character on the chain.
- Speed of chain printers ranges from 400 to 2500 characters per minute.
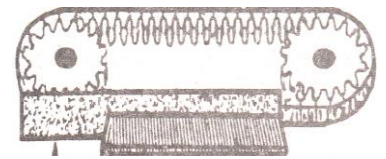
Non - Impact Printer:-

1) Inkjet Printer:-

- Inkjet printer is a one type of non-impact printer.
- Inkjet printers are character printers that from characters and all kinds of images by spraying small drops of ink on to the paper.
- The print head of an inkjet printer contains up to 64 tiny nozzles, which can be selectively heated up in a few microsecond by an integrated circuit register.
- It is produce a high quality output than dot-matrix printer because they from characters by very tiny ink dots.
- A high- resolution inject printer has 64 nozzles within height of 7mm providing print resolution of around 360 dots per inch.
- Inkjet printers produce printed output as patterns of tiny dots, they can print any shape of character that a programmer can describe.
- Inkjet printers are slower then dot-matrix printers with speeds usually ranging between 40 to 300 characters per second.
- Inkjet printer is more expensive that a dot-matrix printer
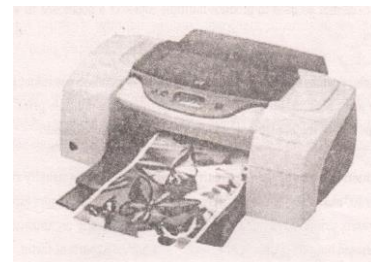
2) **Laser Printer:-**
- Laser printer is a one type of Non-impact printer.
- Laser printers are page printers that print one page at a time.
- The main components of a laser printer are a laser beam source, a multi-side mirror, a photoconductive drum and toner.
- To print a page of output the laser beam is focused on the electro statically charged drum by the spinning multisided mirror.
- The mirror focused on the laser beam on the surface of the drum in such a manner that it created the patterns of characters/ images to be printed on the page.
- As the drum is photoconductive, a difference in electric charge is created on those parts of the drum surface that are exposing to the laser beam.
- The toner is then permanently fused on the paper with heat and pressure to generate the printed output.
- The drum is then rotated ad cleaned with a rubber blade to remove the toner sticking to its surface to prepare the drum for the next page printing.
- Laser printers produce very high quality output because they from characters by very tiny ink particles.
- The most common laser printers have resolutions of 600 dpi (dots per inch) where as some high-end laser have resolutions of 1200 dpi.
- Laser printers are faster then other printers.
- Low speed laser printers can print 4 to 12 pages per minute.
- Very high-speed laser printers are also available which can print 500 to 1000 pages per minute.
- That is fast enough to print this entire book in about one minute.
- Because of their better print quality and printing speed, Laser printers are more expensive than other printers.
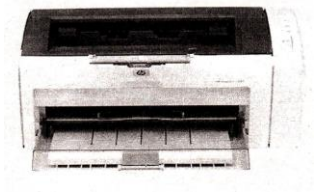
Difference between Impact and Non- Impact Printer

Impact Printer	Non-Impact Printer
It is a noisy printer	It is a silent printer.
It prints a document by hammering on a paper.	It prints a document by spring on a paper.
This type of printers is very cheap.	The types of printers are very costly.
Dot-matrix, Drum, Chain, Daisy wheel printers are known as impact printers.	Inkjet and Laser printers are known as non – impact printers.
In this type of printers are used ink ribbons.	This type of printers are doesn't use any ribbon.

♣ Plotters

- Many Engineers design applications, like architectural plan of a building, design mechanical components of an aircraft or a car etc.
- They require high-quality, perfectly-proportioned graphic output on large sheers.
- The various types of printers are not suitable for meeting this output requirement of such applications.
- A special type of output device, called plotters, is used for this purpose.
- Plotters are ideal output device for architects, engineers, city planners, and others who need to routinely generate high-precision, hard – copy, graphic output of widely varying sizes.
- Mainly plotters are two types::
1.Drum Plotter
2.Flatbed Plotter

1) Drum Plotter:-
- In a drum plotter the paper, on which the design has to be made is placed over a. drum, which can rotate in both clockwise and anti-clockwise directions to produce vertical motion.
- The mechanism also consists of one or more penholders mounted perpendicular to the drum's surface.
- The pen (s) clamped in the holder (s) can move left to right or right to left to produce horizontal motion.
- The movement, of the drum and the pen (s) are controlled by the graph-plotting program.
- That is, under computer control, the drum and the pen (s) move simultaneously to draw the designs and graphs on the sheet placed on the drum.
- The plotter can-also annotate the designs and graphs so drawn by using the pen to draw characters of various sizes.
- Since each pen is program selectable, pens having ink of different colors can be mounted in different holders to produce multi-colored designs.
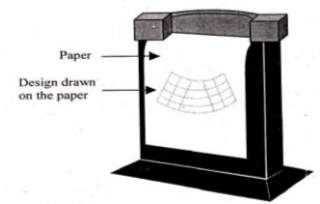
2) Flatbed Plotter:-
- A flatbed plotter plots a design or graph on a sheet of paper, which that is spread and fixed over a rectangular flatbed table.
- In this type of plotter, normally the paper does not move, and the pen holding mechanism is designed to provide all types of motions necessary to draw complex designs and graphs.
- That is, under computer control, the pen (s) move in the required manner to draw the designs and graphs on the sheet placed on the flatbed table.
- The plotter can also annotate the designs and graphs so drawn by using the pen to draw characters of various sizes.
- Each pen is program selectable, pen, having ink of different colors can be mounted in different holders to multi-colored designs.
- The plot size is restricted by the area of the bed. Some may be as small as 44 size (8"*11" page), while some very large beds used in tire design of cars, ships, aircrafts, buildings, highways, etc. can be up to 20 ft. by 50 ft.
- Some plotters are also designed to etch plastic or metal plates.
- In this case, the plastic or metal sheet is spread on the bed, and the drawing pen has a sharp-edged needle.
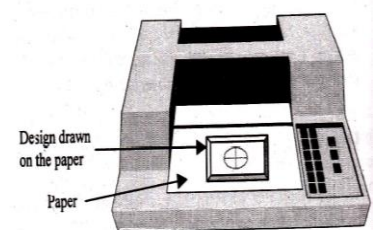
↓ Speaker

- An electro-acoustic transducer that converts electrical signals into sounds loud enough to be heard at a distance.
- Computer speakers, or multimedia speakers, are external speakers and are usually equipped with a male-end phone plug for computer sound cards; however, there are some speaker that have female RCA (phono) plug ports, and some people link computer sound cards to nearby stereo systems.
- Computer speakers are usually a simplified stereo system without a radio or other media sources built in.
- The simplest computer speakers come with computers.
- There are advanced forms of computer speakers that have graphic equalization features (bass, treble, etc.) for dynamic audio flexibility.

Other Output Devices

1. LCD Projectors:-

- An LCD projector is a type of video projector for displaying video, images or computer data on a screen or other flat surface.
- It is a modern equivalent of the slide projector or overhead projector.

- To display images, LCD (liquid-crystal display) projectors typically send light from a metal-halide lamp through a prism or series of dichroic filters that separates light to three polysilicon panels – one each for the red, green and blue components of the video signal.
- As polarized light passes through the panels (combination of polarizer, LCD panel and analyzer), individual pixels can be opened to allow light to pass or closed to block the light.
- The combination of open and closed pixels can produce a wide range of colors and shades in the projected image.
- Metal-halide lamps are used because they output an ideal color temperature and a broad spectrum of color.
- These lamps also have the ability to produce an extremely large amount of light within a small area.

2. **OHP Projectors:-**
   - The full form of OHP is Overhead Projector in Educational Technology.
   - The overhead projector still is in use in many classrooms.
   - Although it is the grandfather of educational technology, the overhead projector is still a viable medium for delivering information.
   - It works in tandem with much of the digital media available.
   - An overhead projector is a metal box with mirrors, lenses and a bright light.
   - The bright light from a bulb reflects on the Fresnel lens inside the overhead.
   - The light then bounces to a reflecting mirror under a stage where you set the overhead transparency. This image is in reverse form.
   - Overhead projectors are familiar features in many classrooms and conference rooms.
   - While the LCD projector is becoming more common, many public speaking venues still offer overhead projectors to illustrate key points in presentations.
   - Because this form of technology is readily available, overhead projectors are quite inexpensive to operate.
   - Many educational institutions have overheads in each classroom because of the low cost and the adaptability of overheads to any discipline.
   - The three types of overhead projectors are the transmissive, reflective and opaque.
   - An overhead projector should have an on/off switch.
   - This switch should automatically allow the cooling fan to continue running even when the switch is off so that the bulb can cool properly.

Other Devices : -

1. **Fax (Facsimile) : -**
   - Fax (short for facsimile), sometimes called telecopying or telefax (the latter short for telefacsimile), is the telephonic transmission of scanned printed material (both text and images), normally to a telephone number connected to a printer or other output device.
   - The original document is scanned with a fax machine (or a telecopier), which processes the contents (text or images) as a single fixed graphic image, converting it into a bitmap, and then transmitting it through the telephone system in the form of audio-frequency tones.

   - The receiving fax machine interprets the tones and reconstructs the image, printing a paper copy. Early systems used direct conversions of image darkness to audio tone in a continuous or analog manner.
   - Since the 1980s, most machines modulate the transmitted audio frequencies using a digital representation of the page which is compressed to quickly transmit areas which are all-white or all-black.

2. **OLED : -**
   - An organic light-emitting diode (OLED) is a light-emitting diode (LED) in which the emissive electroluminescent layer is a film of organic compound that emits light in response to an electric current.
   - This layer of organic semiconductor is situated between two electrodes; typically, at least one of these electrodes is transparent.
   - OLEDs are used to create digital displays in devices such as television screens, computer monitors, portable systems such as mobile phones, handheld game consoles and PDAs.
   - A major area of research is the development of white OLED devices for use in solid-state lighting applications.

- There are two main families of OLED: those based on small molecules and those employing polymers.
- Adding mobile ions to an OLED creates a light-emitting electrochemical cell (LEC) which has a slightly different mode of operation. OLED displays can use either passive-matrix (PMOLED) or active-matrix (AMOLED) addressing schemes. Active-matrix OLEDs (AMOLED) require a thin-film transistor back plane to switch each individual pixel on or off, but allow for higher resolution and larger display sizes.
- An OLED display works without a backlight; thus, it can display deep black levels and can be thinner and lighter than a liquid crystal display (LCD).
- In low ambient light conditions (such as a dark room), an OLED screen can achieve a higher contrast ratio than an LCD, regardless of whether the LCD uses cold cathode fluorescent lamps or an LED backlight.

3. Headphones : -

- Headphones (or head-phones in the early days of telephony and radio) are a pair of small listening devices that are designed to be worn on or around the head over a user's ears.
- They are electroacoustic transducers, which convert an electrical signal to a corresponding sound in the user's ear.
- Headphones are designed to allow a single user to listen to an audio source privately, in contrast to a loudspeaker, which emits sound into the open air, for anyone nearby to hear.
- Headphones are also known as earspeakers , earphones.
- Headphones either connect directly to a signal source such as an audio amplifier, radio, CD player, portable media player, mobile phone, video game consoles, electronic musical instrument, or use wireless technology such as Bluetooth or FM radio.
- Early headphones were first used by radio pioneers (crystal sets) and also by radio telephone and telegraph operators allowing a better audio reception without disturbing others around. Initially the audio quality was mediocre and a step forward was the invention of high fidelity headphones.

4. SGD(Speech Generating Device) : -
- A speech generating device (SGD), also referred to as voice-output communication aids (VOCA), are electronic devices that allow the user to select messages to be spoken aloud, thereby assisting people who are unable to use natural speech to meet the majority of their communication needs.
- SGD technology ranges from simple to complex.
- Dedicated devices are intended for communication purposes only, while others are integrated into portable computer systems.
- Additional components may include but are not limited to environmental controls, switch access, rate enhancement programs, and appointment schedules and reminders.
- Letters, words, phrases and sentences can be selected, alone or in combination, from static or dynamic overlays in order to have information spoken aloud by the device to generate language. Voices may be recorded or computer-generated.
- While low-tech tools provide the intimacy of co-constructing messages with a communication partner, high-tech SGDs provide auditory information that gives receptive feedback to the device user and familiar output to the partner.
- The auditory feedback provides reinforces selections made by the user, models language, provides extra speech input for children who with significant delays who will eventually develop functional speech.

- Auditory output is also especially helpful for communicating with unfamiliar partners who may not know how to respond to more subtle communication strategies.

5. **COM(Computer Output Microfilm) : -**
   - Computer Output Microfilm is a system that converts stored data directly to microfilm or microfiche.
   - Around ten people who used to sell Bell & Howell Computer Output Microfilm systems as far back as the 1960s to the 1980s.
   - It almost seems to be a prerequisite for sales people in the micrographics industry from that era.
   - Computer Output Microfilm systems are still used today, mostly by organizations who need to store payroll, accounting, insurance, inventory, or employee data.
   - A more feasible option is to convert Computer Output Microfilm to digital image via Generation Imaging's microfiche scanning services.
   - Using high quality/high production microfiche scanners, we convert the COM microfiche to digital.
   - Generation Imaging provides this COM fiche scanning service to end users as well as other service bureau's. Clients can choose from Adobe PDF format, Group 4 TIFF (tagged image file format), or greyscale JPEGs. PDFs and TIFFs can be wrapped in a multi-page file.

6. **Google Glass**
   - Google Glass is an optical head-mounted display, that is designed in the shape of a pair of eyeglasses. It was developed with the mission of producing a ubiquitous computer.
   - Google Glass displayed information in a smartphone-like hands-free format. Wearers communicated with the Internet via natural language voice commands.
   - Google started selling a prototype of Google Glass to qualified "Glass Explorers" in the US on April 15, 2013, for a limited period for $1,500, before it became available to the public on May 15, 2014, for the same price.
   - The headset has received massive criticism and legislative action due to privacy and safety concerns.
   - On January 15, 2015, Google announced that it would stop producing the Google Glass prototype but remained committed to the development of the product. According to Google, Project Glass was ready to "graduate" from Google X, the experimental phase of the project.
   - On December 28, 2015, Google filed a new application with the Federal Communications Commission for a new version of the Google Glass.

UNIT-4(Numbering System and Codes & Languages, Operating Systems and Software Packages)

Introduction

Bit

A 'bit' (short for Binary Digit) is the smallest unit of data that can be stored by a computer. Each 'bit' is represented as a binary number, either 1 (true) or 0 (false).

Byte

A 'byte' contains 8 bits, so for example, it could be stored as 11101001.

A single keyboard character that you type, such as the letter A or the letter T takes up one byte of storage.

Nibble

This is not a very commonly used term compared to bit and byte. It is the term given to a group of four bits. Therefore two nibbles make a byte.

The reason it is not very common is because most microprocessors use groups of 8 bits and higher i.e. They use one or more bytes to process data. Not many devices make use of a nibble.

Carry bit

An arithmetic operation that occurs in the course of addition when the sum of the digits in a given position equals or exceeds the base of the number system; a multiple *m* of the base is subtracted from this sum so that the remainder is less than the base, and the number *m* is then added to the next-higher order digit.

This bit is known as carry bit.

Parity Bit

A bit that is used in an error detection procedure in which a 0 or 1 is added to each group of bits so that it will have either an odd number of 1's or an even number of 1's; e.g., if the parity is odd then any group of bits that arrives with an even number of 1's must contain an error.

Sign Bit

In computer science the **sign bit** is the bit in a computer numbering format which indicates the sign of the number. Typically the bit is the most significant bit in the format. Typically if the sign bit is **1** the number is negative (in the case of two's complement integers) or non-positive (for the case of ones' complement integers, sign-magnitude integers, and floating point numbers). Typically if the sign bit is **0** the number is positive.

Word

The computer's internal storage unit. Word "size" refers to the amount of data a processor's internal data registers can hold and process at one time. Business computers generally have word sizes of 32 or 64 bits. Computers embedded in appliances and consumer products typically have word sizes of 8, 16 or 32 bits. The larger the word and the faster the computer calculates and compares.

Double word

A unit of computer memory storage, usually four or eight bytes, used in many high-level programming languages.

Twice the length of a single computer word. A double word is typically 32 bits long.

- Byte (B)
- Kilobyte (KB)
- Megabyte (MB)

- Gigabyte (GB)
- Terabyte (TB)
- Petabyte (PB)
- Exabyte (EB)
- Zettabyte (ZB)
- Yottabyte (YB)

- A byte is a sequence of 8 bits (enough to represent one alphanumeric character) processed as a single unit of information. A single letter or character would use one byte of memory (8 bits), two characters would use two bytes (16 bits).
- An alphanumeric character (e.g. a letter or number such as 'A', 'B' or '7') is stored as 1 byte. For example, to store the letter 'R' uses 1 byte, which is stored by the computer as 8 bits, '01010010'.
- A document containing 100 characters would use 100 bytes (800 bits) - assuming the file didn't have any overhead (additional data about the file which forms part of the file). Note, many non-alphanumeric characters such as symbols and foreign language characters use multiple bytes.
- A kilobyte (KB) is 1024 bytes, a megabyte (MB) is 1024 kilobytes and so on as these tables demonstrate.

1024 bytes	=	1 KB
1024 KB	=	1 MB
1024 MB	=	1 GB
1024 GB	=	1 TB
1024 TB	=	1 PB

KB	=	Kilobyte
MB	=	Megabyte
GB	=	Gigabyte
TB	=	Terabyte
PB	=	Petabyte
EB	=	Exabyte 1024 PB
ZB	=	Zettabyte 1024 EB
YB	=	Yottabyte 1024 ZB

Types of Numbering System

➢ **Decimal Number System**
- The number system that we use in our day-to-day life is the decimal number system. Decimal number system has base 10 as it uses 10 digits from 0 to 9. In decimal number system, the successive positions to the left of the decimal point represent units, tens, hundreds, thousands and so on.
- Each position represents a specific power of the base (10). For example, the decimal number 1234 consists of the digit 4 in the units position, 3 in the tens position, 2 in the hundreds position, and 1 in the thousands position, and its value can be written as

$(1 \times 1000) + (2 \times 100) + (3 \times 10) + (4 \times l)$

$(1 \times 10^3) + (2 \times 10^2) + (3 \times 10^1) + (4 \times l0^0)$

$1000 + 200 + 30 + 1$

1234

- As a computer programmer or an IT professional, you should understand the following number systems which are frequently used in computers.

S.N.	Number System & Description
1	**Binary Number System** Base 2. Digits used: 0, 1
2	**Octal Number System** Base 8. Digits used: 0 to 7
4	**Hexa Decimal Number System** Base 16. Digits used: 0 to 9, Letters used: A- F

➢ **Binary Number System**
Characteristics
- Uses two digits, 0 and 1.
- Also called base 2 number system
- Each position in a binary number represents a 0 power of the base (2). Example 2^0
- Last position in a binary number represents a x power of the base (2). Example 2^x where x represents the last position - 1.

Example

Binary Number: 10101_2
Calculating Decimal Equivalent:

STEP	BINARY NUMBER	DECIMAL NUMBER
Step 1	10101_2	$((1 \times 2^4) + (0 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	10101_2	$(16 + 0 + 4 + 0 + 1)_{10}$
Step 3	10101_2	21_{10}

Note: 10101_2 is normally written as 10101.

➢ *Octal Number System*

Characteristics
- Uses eight digits, 0,1,2,3,4,5,6,7.
- Also called base 8 number system
- Each position in a octal number represents a 0 power of the base (8). Example 8^0

- Last position in a octal number represents a x power of the base (8). Example 8^x where x represents the last position - 1.

Example

Octal Number: 12570_8

Calculating Decimal Equivalent:

STEP	OCTAL NUMBER	DECIMAL NUMBER
Step 1	12570_8	$((1 \times 8^4) + (2 \times 8^3) + (5 \times 8^2) + (7 \times 8^1) + (0 \times 8^0))_{10}$
Step 2	12570_8	$(4096 + 1024 + 320 + 56 + 0)_{10}$
Step 3	12570_8	5496_{10}

Note: 12570_8 is normally written as 12570.

➤ **Hexadecimal Number System**

Characteristics
- Uses 10 digits and 6 letters, 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F.
- Letters represents numbers starting from 10. A = 10. B = 11, C = 12, D = 13, E = 14, F = 15.
- Also called base 16 number system
- Each position in a hexadecimal number represents a 0 power of the base (16). Example 16^0
- Last position in a hexadecimal number represents a x power of the base (16). Example 16^x where x represents the last position - 1.

Example

Hexadecimal Number: $19FDE_{16}$

Calculating Decimal Equivalent:

STEP	BINARY NUMBER	DECIMAL NUMBER
Step 1	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (F \times 16^2) + (D \times 16^1) + (E \times 16^0))_{10}$
Step 2	$19FDE_{16}$	$((1 \times 16^4) + (9 \times 16^3) + (15 \times 16^2) + (13 \times 16^1) + (14 \times 16^0))_{10}$
Step 3	$19FDE_{16}$	$(65536 + 36864 + 3840 + 208 + 14)_{10}$
Step 4	$19FDE_{16}$	106462_{10}

❖ **Conversion**

There are many methods or techniques which can be used to convert numbers from one base to another. We'll demonstrate here the following

- Decimal to Other Base System
- Other Base System to Decimal
- Other Base System to Non-Decimal
- Shortcut method - Binary to Octal
- Shortcut method - Octal to Binary
- Shortcut method - Binary to Hexadecimal
- Shortcut method - Hexadecimal to Binary

➢ **Decimal to Other Base System**
Steps
- **Step 1** - Divide the decimal number to be converted by the value of the new base.
- **Step 2** - Get the remainder from Step 1 as the rightmost digit least significant digit of new base number.
- **Step 3** - Divide the quotient of the previous divide by the new base.
- **Step 4** - Record the remainder from Step 3 as the next digit to the left of the new base number.

Repeat Steps 3 and 4, getting remainders from right to left, until the quotient becomes zero in Step 3. The last remainder thus obtained will be the most significant digit MSD of the new base number.

Example

Decimal Number: 29_{10}
Calculating Binary Equivalent:

STEP	OPERATION	RESULT	REMAINDER
Step 1	29 / 2	14	1
Step 2	14 / 2	7	0
Step 3	7 / 2	3	1
Step 4	3 / 2	1	1
Step 5	1 / 2	0	1

As mentioned in Steps 2 and 4, the remainders have to be arranged in the reverse order so that the first remainder becomes the least significant digit LSD and the last remainder becomes the most significant digit MSD.

Decimal Number: 29_{10} = Binary Number: 11101_2.

➢ **Other base system to Decimal System**
Steps
- **Step 1** - Determine the column positional value of each digit this depends on the position of the digit and the base of the number system.
- **Step 2** - Multiply the obtained column values inStep1 by the digits in the corresponding columns.
- **Step 3** - Sum the products calculated in Step 2. The total is the equivalent value in decimal.

Example

Binary Number: 11101_2

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Calculating Decimal Equivalent:

STEP	BINARY NUMBER	DECIMAL NUMBER
Step 1	11101_2	$((1 \times 2^4) + (1 \times 2^3) + (1 \times 2^2) + (0 \times 2^1) + (1 \times 2^0))_{10}$
Step 2	11101_2	$16+8+4+0+1_{10}$
Step 3	11101_2	29_{10}

Binary Number: 11101_2 = Decimal Number: 29_{10}

➢ **Other Base System to Non-Decimal System**
Steps
- **Step 1** - Convert the original number to a decimal number base10.
- **Step 2** - Convert the decimal number so obtained to the new base number.

Example

Octal Number: 25_8

➢ **Decimal To Binary(25 decimal)**
     2 5
     2 1 2 1
     2 6 0
     2 3 0
     2 1 1
     2 0 1
Now take reverse 11001=Binary equivalent of 25

➢ **Decimal To Octal (90-decimal)**
   90
   8 11 2
   8 1 3
   8 0 1
   Now take reverse 132=Octal equivalent of 90

➢ **Decimal To Hexadecimal (335-deciaml)**
   335
   16 20 15=F
   16 1 4
   16 0 1
   Now take reverse 14F=Hexadecimal equivalent of 335

Calculating Binary Equivalent:

Step 1: Convert to Decimal

STEP	OCTAL NUMBER	DECIMAL NUMBER
Step 1	25_8	$((2 \times 8^1) + (5 \times 8^0))_{10}$
Step 2	25_8	$16+5_{10}$
Step 3	25_8	21_{10}

Octal Number: 25_8 = Decimal Number: 21_{10}

STEP	OPERATION	RESULT	REMAINDER
Step 1	21 / 2	10	1
Step 2	10 / 2	5	0
Step 3	5 / 2	2	1
Step 4	2 / 2	1	0
Step 5	1 / 2	0	1

Decimal Number: 21_{10} = Binary Number: 10101_2

Octal Number: 25_8 = Binary Number: 10101_2

  ➤ **Shortcut method - Binary to Octal**
    Steps
      • **Step 1** - Divide the binary digits into groups of three startingfromtheright.
      • **Step 2** - Convert each group of three binary digits to one octal digit.
      •

Example

Binary Number: 10101_2

Calculating Octal Equivalent:

STEP	BINARY NUMBER	OCTAL NUMBER
Step 1	10101_2	010 101
Step 2	10101_2	2_8 5_8
Step 3	10101_2	25_8

Binary Number: 10101_2 = Octal Number: 25_8

  ➤ **Shortcut method - Octal to Binary**
    Steps
      • **Step 1** - Convert each octal digit to a 3 digit binary number theoctaldigitsmaybetreatedasdecimalforthisconversion.
      • **Step 2** - Combine all the resulting binary groups of3digitseach into a single binary number.

Example

Octal Number: 25_8

Calculating Binary Equivalent:

STEP	OCTAL NUMBER	BINARY NUMBER
Step 1	25_8	2_{10} 5_{10}
Step 2	25_8	010_2 101_2
Step 3	25_8	010101_2

Octal Number: 25_8 = Binary Number: 10101_2

  ➤ **Shortcut method - Binary to Hexadecimal**
    Steps

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- **Step 1** - Divide the binary digits into groups of four startingfromtheright.
- **Step 2** - Convert each group of four binary digits to one hexadecimal symbol.

Example

Binary Number: 10101_2

Calculating hexadecimal Equivalent:

STEP	BINARY NUMBER	HEXADECIMAL NUMBER
Step 1	10101_2	0001 0101
Step 2	10101_2	$1_{10}\ 5_{10}$
Step 3	10101_2	15_{16}

Binary Number: 10101_2 = Hexadecimal Number: 15_{16}

➢ **Shortcut method - Hexadecimal to Binary**

Steps
- **Step 1** - Convert each hexadecimal digit to a 4 digit binary number thehexadecimaldigitsmaybetreatedasdecimalforthisconversion.
- **Step 2** - Combine all the resulting binary groups of4digitseach into a single binary number.

Example

Hexadecimal Number: 15_{16}

Calculating Binary Equivalent:

STEP	HEXADECIMAL NUMBER	BINARY NUMBER
Step 1	15_{16}	$1_{10}\ 5_{10}$
Step 2	15_{16}	$0001_2\ 0101_2$
Step 3	15_{16}	00010101_2

Hexadecimal Number: 15_{16} = Binary Number: 10101_2

❖ **Binary Arithmetic**

Binary arithmetic is essential part of all the digital computers and many other digital system.

• **Binary Addition**

It is a key for binary subtraction, multiplication, division. There four rules of the binary addition.

Case	A	+	B	Sum	Carry
1	0	+	0	0	0
2	0	+	1	1	0
3	1	+	0	1	0
4	1	+	1	0	1

In fourth case, a binary addition is creating a sum of 1+1=10 i.e. 0 is write in the given column and a carry of 1 over to the next column.

0011010 + 001100 = 00100110

```
         1 1        carry
     0 0 1 1 0 1 0  = 26₁₀
   + 0 0 0 1 1 0 0  = 12₁₀
   ─────────────────
     0 1 0 0 1 1 0  = 38₁₀
```

- **Binary Subtraction**

Subtraction and Borrow, these two words will be used very frequently for the binary subtraction.There four rules of the binary substration.There four rules of the binary Subtraction.

Case	A	-	B	Subtract	Borrow
1	0	-	0	0	0
2	1	-	0	1	0
3	1	-	1	0	0
4	0	-	1	0	1

Example - Subtraction

0011010 - 001100 = 00001110

```
         1 1        borrow
     0 0 1 1 0 1 0  = 26₁₀
   - 0 0 0 1 1 0 0  = 12₁₀
   ─────────────────
     0 0 0 1 1 1 0  = 14₁₀
```

- **Subtraction of 2 binary numbers:**
    - Though there are other methods of performing subtraction, we will consider the method of subtraction know as complementary subtraction.
    - This is a more efficient method of subtraction while using electronic circuits. We will be following three steps to perform subtraction :
        o Find the complement of the number you are subtracting.
        o To the complement of the number we obtained in step 1, we add the number we are subtracting from.
        o If there is a carry of 1 add the carry to the result of the addition else re complement the sum and attach a negative sign.

Consider the following example of subtraction :
e.g. 1
1010101 – 1001100
Step-1. Find the complement of 1001100
0110011

Step-2. Add the number you are subtracting from
Carry 1 1 1 0 1 1 1
1 0 1 0 1 0 1
+ 0 1 1 0 0 1 1
0 0 0 1 0 0 0
+ 1 (Continue since there is a carry of 1)
0 0 0 1 0 0 1 (Answer)
e.g. 2 101100 – 11100101

Step-1. Find the complement of 11100101
00011010

Step-2. Add the number you are subtracting from
Carry 0 1 1 1
0 0 1 0 1 1 0 0
+ 0 0 0 1 1 0 1 0
0 1 0 0 0 1 1 0

Step-3. Since there is no carry we
a. re complement the result
10111001
b. attach a negative sign
- 10111001 (Answer)

- **2's Complement Subtraction**

    Two's complement subtraction is the binary addition of the minuend to the 2's complement of the subtrahend (adding a negative number is the same as subtracting a positive one).

For example,
7 - 12 = (-5) 0000 0111 = +7
+ 1111 0100 = -12
1111 1011 = -5

    o   Here 7 is minuend and converted into binary 0000 0111.
    o   -12 is subtrahend and need to find 2's complement.
    o   Addition with minuend.
    o   Answer will be again converted into 2's complement and sign will be negative
        (because we have to subtract large number from small number)

- **Binary Multiplication**

Binary multiplication is similar to decimal multiplication. It is simpler than decimal multiplication because only 0s and 1s are involved.There four rules of the binary multiplication.

Case	A	x	B	Multiplication
1	0	x	0	0
2	0	x	1	0
3	1	x	0	0
4	1	x	1	1

Example - Multiplication

Example:

0011010 x 001100 = 100111000

$$
\begin{array}{r}
0\ 0\ 1\ 1\ 0\ 1\ 0 \quad = 26_{10}\\
\times\ 0\ 0\ 0\ 1\ 1\ 0\ 0 \quad = 12_{10}\\
\hline
0\ 0\ 0\ 0\ 0\ 0\ 0\\
0\ 0\ 0\ 0\ 0\ 0\ 0\\
0\ 0\ 1\ 1\ 0\ 1\ 0\\
0\ 0\ 1\ 1\ 0\ 1\ 0\\
\hline
0\ 1\ 0\ 0\ 1\ 1\ 1\ 0\ 0\ 0 \quad = 312_{10}
\end{array}
$$

- **Binary Division**

Binary division is similar to decimal division. It is called as the long division procedure.

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$101010 / 000110 = 000111$

$$
\begin{array}{r}
1\,1\,1 \quad = 7_{10} \\
000110\ \overline{)\ \not{1}^{1}0\,1\,0\,1\,0\ } \quad = 42_{10} \\
-1\,1\,0 \quad = 6_{10} \\
\overline{} \\
\not{1}\,0\,0\,1 \\
-1\,1\,0 \\
\overline{} \\
1\,1\,0 \\
-1\,1\,0 \\
\overline{0}
\end{array}
$$

❖ **Types of Codes**
  ➢ **BCD(Binary coded Decimal)**
    o In computing and electronic systems, binary-coded decimal (BCD)or, in its most common modern implementation, packed decimal, is an encoding for decimal numbers in which each digit is represented by its own binary sequence. Its main virtue is that it allows easy conversion to decimal digits for printing or display, and allows faster decimal calculations.
    o Its drawbacks are a small increase in the complexity of circuits needed to implement mathematical operations. Uncompressed BCD is also a relatively inefficient encoding—it occupies more space than a purely binary representation.
    o In BCD, a digit is usually represented by four bits which, in general, represent the decimal digits 0 through 9. Other bit combinations are sometimes used for a sign or for other indications (e.g., error or overflow).
    o Although uncompressed BCD is not as widely used as it once was, decimal fixed-point and floating point are still important and continue to be used in financial, commercial, and industrial computing.
    o Recent decimal floating-point representations use base-10 exponents, but not BCD encodings. Current hardware implementations, however, convert the compressed decimal encodings to BCD internally before carrying out computations.
    o Software implementations of decimal arithmetic typically use BCD or some other $10n$ base, depending on the operation To encode a decimal number using the common BCD encoding, each decimal digit is stored in a 4-bit

    nibble:
    Decimal: 0 1 2 3 4 5 6 7 8 9
    BCD: 0000 0001 0010 0011 0100 0101 0110 0111 1000 1001
    Thus, the BCD encoding for the number 127 would be:
    0001 0010 0111
    Whereas the pure binary number would be:
    0111 1111
    Unit Of Information (Codes)
    Most computer do not represent characters as pure binary numbers. They use a coded version of true
    binary to represent letters and special symbols as well as decimal numbers.

    Coding of characters has been standardized to enable transfer of data between computers.
    Codes used are :
    - ASCII

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- EBCDIC
- Unicode

> **ASCII**
  o ASCII stands for American Standard Code for Information Interchange. In this form of representation, each character (which includes alphabets, digits and symbols) is assigned a particular pattern of bits.
  o For example, A is represented as binary 1000012, B as 10000102 and so on.
  o The standard ASCII character set uses 7 bits and can be used to represent 128 different characters. It uses one extra parity bit for parity check. Other forms of ASCII codes use an extra bit to extend the representation to 256 characters. However, characters represented from binary are not universally agreed upon. The most popular form is the set used by IBM.
  o ASCII is commonly used to exchange data between data processing and communication systems.

> **EBCDIC**
  o EBCDIC stands for Extended Binary Coded Decimal Interchange Code. It uses 8 bits and can represent 256 distinct characters. It also uses one extra parity bit for parity check.
  o The EBCDIC code is used in IBM mainframe models and other similar machines. Electronic Circuits are available to transform characters from ASCII to EBCDIC and vice-versa and can also be achieved using computer programs.

> **Unicode**
  o With the onset of globalization through Internet, there emerged a need to cater for data interchange of the more common languages of the different nationalities like Chinese, Korea and Japanese. ASCII, EBCDIC and other forms of representation proved insufficient.
  o The Unicode/ISO 10646 standard was devised to overcome this problem. The 16 bits used by Unicode can represent 65536 symbols, one extra parity bit for parity check. which is more than enough to represent all the worlds written characters.
  o Although Unicode solves the problem of multi-language data representation, it is not the perfect solution as there remain issues to be addressed. Problems include the wastage of storage space, time needed for data transmission and the lack of support of current operating systems. Furthermore, Unicode does not guarantee a particular sort order

> **Parity Check**

	ODD PARITY	EVEN PARITY
Step 1	The parity bit will be forced to 1(or turned "on") if its corresponding byte of data contains an even number of 1's If the byte contains an odd number of 1's, the parity bit is forced to 0 (or turned "off")	The parity is forced to 1 if it's corresponding byte of data contain an odd number of 1's. The parity bit is forced to 0 if the byte contains an even number of 1's.
Step 2	The parity bit and the corresponding 8 bit of data are written to DRAM	(same as odd parity)
Step 3	Just before the data is sent to the CPU, it is intercepted by the parity circuit. If the parity circuit sees an odd number of 1's, the data is considered valid. The parity bit is stripped from the data and the 8 data bit are passed on to the CPU. If the parity circuit detects an even number of 1's, the data is considered invalid and a parity error is generated	(same as odd parity) Data is considered valid if the parity circuit detects an even number of 1's. Data is invalid if the parity circuit detects an odd number of 1's.

Even/odd Parity (1)

Computer can sometimes make errors when they transmit data

Even/odd parity:

Is basic method for detecting if an odd number of bits have been switched by accident.

Odd Parity:

The number of 1-bit must add up to an odd number.

Even Parity:

The number of 1-bit must add up to an even number.

LANGUAGES, OPERATING SYSTEM AND SOFTWARE PACKAGES

➤ **Introduction**
   o A computer can only do what a programmer asks it to do. To perform a particular task programmer writes a sequence, called the program.
   o An instruction command given to the computer to perform a certain specified operation on the given data.
   o Now as we know only human languages and computer knows only machine language, we need some media through which we can communicate with the computer.
   o So we can complete our desired task. That media is Language. So, languages are tools human can use to communicate with the hardware of a computer system.
   o Each language has a systematic method of using symbols of that language. In English, this method is given by the rules of grammar. Similarly, the symbols of particular one computer language must also be used as per set of rules which are known as the "Syntax" of that language, the language which you are using.

   Computer Languages can be classified into three broad categories:

   Computer Language
   - **Assembly Language**
   - **Machine Language**
   - **High-Level Language**

- **Machine Language**
   - Machine language is made up of only two symbols "0" and "1" with all its different combinations. So all the instruction are coded in 0s and 1s.
   - There is a specific binary code for each instruction. The binary code for certain operation differs from computer to computer.
   - Each microprocessor has its own instruction and set and corresponding machine codes.
   - An instruction prepared in any machine language has two-part format, as shown under :
      o e.g.
         ▪ Operation Code is the function that must be performed and Operand are the variables involved in this functions. Machine language is directly understood by the computer because it is made up of only two symbols "0" and "1". So no translation is required.

   Advantages

   · Programs can be executed immediately upon completion because it doesn't require any translation.
   · Now extra storage space is needed.
   · Programmer has complete control over the performance of the hardware.

Disadvantage

- · Tedious to program
- · Time consuming to code
- · Error prone
- · Operation codes have to be memorised
- · Assignment of memory is done by programmer
- · Time consuming for development
- · Programs development are machine dependent
- · Preparation of programs was slow and costly.

- **Assembly Language (Low Level Language)**
  - Machine language was tedious to code and error were expected to arise in bulk. To ease the programmer's burden, mnemonic codes and symbolic addresses were developed.
  - Letter symbols were substituted for basic machine language commands codes. That is sub or s for subtract, mvc for move character.
  - Symbolic addresses are used in place of actual machine address or location. Format of assembly language is similar to machine language :
    - o Examples of commands are MOV, ADD, SUB, INC, etc. Examples of Variable names are SUM, MARKS, AVERAGE, etc. Examples of Register Names are AX, DX, CX, etc.
    - o Example of Assembly language instruction :

      This instruction adds value of NUM1 to the AX (Accumulator Register). The symbolic language made program writing so much easier for the programmers but it must be translated into machine code before being used for operation. The translation is actually done by a special translating program.

  - **Assembler**

    - o Assembler is a special program (translator) which translates symbolic operation codes into machine codes, and symbolic address is addressed into an actual machine address.
    - o It allocates areas of main storage. It is able to produce a printed listing of the Object Programs together with comments.
    - o The symbolic instruction is translated into one machine code, which is one feature which distinguishes a low-level from a high level language.
    - o A symbolic program written by a programmer in assembly language is called a source program. After the source program has been converted into machine language by as assembler, it is referred to as an object program.

Mnemonic Code Symbolic Address ADD AX NUM1

Assembly Language Program Assembler Machine Language Program (Source Program) (Object Program) One-to-One

Execution Cycle

1. The assembly program is read into the computer procedure. This programs is generally supplied by the manufacturer of the machine as part of the total hardware/software package.

2. The source program written by programmer in the symbolic language of the machine is stored as an input medium.

3. During the assembly the source program is treated as data and is read into CPU, one instruction at a time under the control of the assembler.

4. The assembler translates the program into a machine language object.

5. Program, which is recorded on tapes or cards as the output of the assembly run.

6. It is important to remember that during the assembly run no program data is processed. That is, the source program is not executed.

7. After the assembly run, the assembler is filed for future use.

8. Then the object code program is read into the CPU as the first step in the production run.

9. Data recorded on a suitable input medium, is read into the CPU under object program control.

10. The application is processed, the information output is properly received, and the object code is filed for future use.

Advantage

1. Easier to code and understand programs as compared to machine language programs.

2. Task of memory management and allocation not done by program (taken care of by the assembler)

3. Can use Macros (Macro is a bunch of instruction referred as a single name)

Disadvantage

1. Programs have to be translated before execution.

2. Translation of programs take up time.

3. Programs are machine dependent. (Restricted for use on that machine)

4. Additional storage area needed for the source programs and object codes.

Examples of Assembly Language

Microsoft Assembly Language (MASM), Turbo Assembler

- **High Level Languages (Higher Level Language)**
    - To write a program in any languages, a programmer has to remember all the operation codes of the computer and know in detail what each code does and how it affects the various registers of the computer.
    - However, we have also seen that in order to write good computerized programs the programmer should mainly concentrate on the logic of the problem rather than the details of internal structure of the computer.
    - This is a term which describes programming languages that do not control the functions of the computer's components so closely.
    - The instruction here is even more English like, and as a result, the software industry began to explode with varying applications and systems software.

        High level languages have the following feathers:

Self Documenting

Extensive use of English words and English-like statement structures make the codes easy to read and remember.

Requires Translation

Since, instructions cannot be directly understood by the computer, they have to be converted into machine codes. Translations like compilers and interpreters are used to convert each instruction into many instructions.

Syntax

Syntax is the rule of the language are to be followed. Statements have to be coded in a particular manner and certain keywords cannot be used for purposes other than what they were meant for.

Library Subroutines
Pre-defined procedures and functions which perform tasks that are commonly needed by programmers. Developed by software manufacturers.

Machine Independent
Programs written for 1 machine can be run on another with little or no modifications.

Factors Affecting the Selection of an Programming Language
There are factors affecting the selection of a programming language when solving a problem. It depends on the facility that the programming languages is providing.

Purpose of the language
Determines if the language is suitable for developing the required software

Familiarity with the language
Affects the language which the programmer would select.

Features of the languages
Whether the language support top down, modular or structured programming approaches.

Ease of learning and using the language
Allows programmers to get familiar with the language in the shortest time possible.

Efficiency of language
Its memory utilization, speed in execution and storage needed for source, object and executable codes

Availability of error checking and diagnostic facilities
Whether tools are available to facilitate the debugging of programs. (e.g. trace utility, variable watch facility – add watch facility)

ë 3GL (Third Generation Language)
- Procedure Oriented Computations are identified in sequences of instructions. Instructions identify not only the kind of ('what') tasks to be performed but indicates the way ('how') each task can be achieved.

- Advantages
1. Wide range of 3GL that support the development of software with varying nature (e.g. system software, business applications, etc.)
2. Allows programmers to have full control over the way tasks are performed.
3. Highly portable compared to Assembly Language.

- Disadvantages
1. Programmers must be adequately trained.
2. Databases / File oriented applications are tedious to code.
3. Programmers must identify how tasks are to be achieved.

- Examples of 3GL
BASIC (Beginners All Purpose Symbolic Instruction Code), COBOL (Common Business Oriented Language), PASCAL, FORTRAN (Formula Translation), C, RPG (Report Program Generator), PL/1 (Programming Language 1), etc.

ë 4GL (Fourth Generation Language)

Tools developed by software vendors to increase the productivity of programming and to reduce the amount of time needed for development of software. A programming language that uses high-level English like instructions to retrieve and form data for inquiries and reporting.

Non-Procedural Oriented
Instructions specify the tasks that have to be performed but do not identify how they should be achieved. It interacts with DBMS (DataBase Management System) software.

End User Oriented
4GL can be used by end users directly, such as tailoring a generalized piece of software to handle applications.

Object Oriented
It allows users to simply specify what the output should be without describing all the details of how the data should be manipulated to produce that result.

Facilities
4GL supports many facilities that a user can easily adopt and can use in developing a user-oriented software. Facilities provided by 4GL are :

Query Facilities
Query is a group of condition given to retrieve a particular or group of records. 4GL permits formulation of queries related to several records.

Report Generators
Permits extraction of data from a file and formatting it into reports. Allows arithmetic of logic to be performed on the data before they are displayed or printed.

Screen Generators
Provides attractive way for user to display information on screen.

Application Generators
Permit data entry facility with data validation. They permit the application creator to specify how files will be update and what output is created.

Graphic Facilities
Provide a particularly attractive way for certain types of end users to display information in graphic manner i.e. bar charts.

Advantage
1. Simplifies tasks for application development
2. Suitable for developing database oriented applications.
3. Easy to use
4. Programming can be done with little training.
5. Less time needed for development
6. End user can be involved during development process.

Disadvantage
1. Not suitable for development of all software types (e.g. system software, scientific applications, etc.)
2. Does not allow intricate control of hardware when needed.
3. Graphic facilities not able to generate complex graphical displays.
4. Programmer loses control over how tasks are achieved.

Examples of 4GLs
   FOCUS, SQL (Structured Query Language), FOXPRO

ë Fifth Generation Language
Fifth generation language is yet to come fully. But in today's computer worlds fifth generation language has taken place widely. There some softwares which are under fifth generation category. Example of Fifth Generation Language is ERP package.

Artificial Intelligence (AI)
The ability of a computer to reason, to learn, to strive for self improvement and to stimulate human sensory capabilities is called as Artificial Intelligence in computers. Computer can get experience through trial and error method.

In Artificial Intelligence computer have that human intelligence to solve unstructured problem. Machine "learns" what not to do through trial and error. Chess Game is an example of fifth generation language software.

Decision Support Systems (DSS)
Decision support systems provide managers with information that can help them make better and more informed decisions. All sort of "what if" type of analyses can be performed using electronic spreadsheet programs and trends can be depicted using graphics programs. A DSS is designed to interact with users as they make a trial-and-error search for solutions to often vexing problems, which is another MIS (Management Information System) component. It is an interactive systems containing all the relevant information related to your subject.

Management Information System (MIS)
An integrated database accessible throughout all levels and components of an organization, whereby the collection, transfer and presentation of information is optimized to meet the needs of the organization.

Expert Systems (ES)
It is a special computer package which can perform the function of human expert by helping users to make complex decisions. An interactive knowledge based system that

responds to questions, ask for clarification, make recommendations, and generally help users make complex decisions. The user of the Expert system sits at the terminal, PC or workstation and takes part in a question and answer session in which the problem and recommends action to be taken.

ë Factors Affecting the Selection of an Programming Language
There are factors affecting the selection of a programming language when solving a problem. It depends on the facility that the programming languages is providing.

- Purpose of the language
> Determines if the language is suitable for developing the required software

- Familiarity with the language
> Affects the language which the programmer would select.

- Features of the languages
> Whether the language support top down, modular or structured programming approaches.

- Ease of learning and using the language
> Allows programmers to get familiar with the language in the shortest time possible.

- Efficiency of language
> Its memory utilization, speed in execution and storage needed for source, object and executable codes

- Availability of error checking and diagnostic facilities
> Whether tools are available to facilitate the debugging of programs. (e.g. trace utility, variable watch facility – add watch facility)

➢ **Compiler**
- In high level language source program is compiled and object program is generated. After object program has been generated linker (used to incorporate any library subroutines) links library subroutines and at last it generates an Executable Program.
- It uses compiler or interpreter are the translators used for translation of program into machine language.
- Compiler compiles the whole program, from first to last line, before link and run the program. Then it generates entire program execution and displays if any error has been occurred. Interpreter reads each line of program code and converts it on a line by line basis and executes the program immediately after checking.

➢ **Interpreter**
- In computer science, an **interpreter** normally means a computer program that executes, i.e. performs, instructions written in a programming language.
- An interpreter may be a program that either
  1. Executes the source code directly
  2. Translates source code into some efficient intermediate representation (code) and immediately executes this.
  3. Explicitly executes stored precompiled code made by a compiler which is part of the interpreter System while interpretation and compilation are the two principal means by which programming languages are implemented, these are not fully distinct categories, one of the reasons being that most interpreting systems also perform some translation work, just like compilers.
  4. The terms "interpreted language" or "compiled language" merely mean that the canonical

implementation of that language is an interpreter or **Source Program Translator Object Program Linker Library Executable Program** a compiler; a high level language is basically an abstraction which is (ideally) independent of particular implementations.

- Instead of producing a target program as a translation, an interpreter performs the operation implied by the source program. For an assignment statement, for example, an interpreter might build a tree and then carry out the operation at the node as it "walks" the tree.
- Interpreters are frequently used to execute command languages, since each operator executed in command language is usually an invocation of a complex routine such as an editor or compiler.

Advantages and disadvantages of using interpreters

Programmers usually write programs in high level code which the CPU cannot execute. So this source code has to be converted into machine code. This conversion is done by a compiler or an interpreter.

A compiler makes the conversion just once, while an interpreter typically converts it every time a program is executed (or in some languages like early versions of BASIC, every time a single instruction is executed).

Difference:
A compiler first takes in the entire program, checks for errors, compiles it and then executes it. Whereas, an interpreter does this line by line, so it takes one line, checks it for errors and then executes it.
E.g. of Compiler - Java
E.g. of Interpreter – PHP
An Assembler converts Assembly instructions into executable machine language. A Compiler converts higher level programming language instructions into Assembly instructions, and then those are turned into executable machine language. Most Compilers allow generation of "object" code, which is the Assembly instruction set generated by the Compiler. Some older Compilers allow for the Assembly instructions to be fine tuned by the programmer.

➢ **Operating System**

- Operating System (OS) is a system software which acts as an interface between users and applications programs and the computer hardware.
- Operating System provides an easy and simple environment for the users to execute the programs. Users of the system do not need to know the details of hardware. Operating system will take over all the tedious operations and interactions with the hardware.
- An operating system consists of a suite of programs which is used efficiently to allocate the resources of the computer system. It is used to implement complex user requirements with minimum operator intervention.

A number of desirable features of a comprehensive operating systems are :
USER APPLICATION SOFTWARE OPERATING SYSTEM COMPUTER Job Control Language (JCL)

It is a system language that handle the information required by the operating system on the following
events :
· The input/output devices needed.
· The likely events and corresponding actions.
· All the facilities offered by an operating system.

Failure and Recovery

Any error situations, such as a peripheral failure or an attempted violation of storage, causes an interrupt to be signalled to the operator. The OS handles these by invoking error recovery routines which generally record enough data for failure diagnosis.

File Management

Utilities are on offer for file creating, deletion and copying. For security, data files are grouped according to user and access classifications; they can be reached only through a hierarchy of levels with restrictions on access at each level.

Logging

Some sort of system journal is kept; in it the system records every occurrence, along with essential details and the time. In case of sudden failures, this gives valuable information regarding what was happening at the time; such as which jobs were actually in the system and may have been affected.

Accounting

Each use made of each facility is recorded with details of user and time. The information helps in billing or for working out wear and tear and for evaluating system usage, performance and areas in which expansion is required.

Scheduling

Determining priorities and servicing queues, taking decisions in cases of contention. This is done on the basis of priority ratings, urgency ratings or deadline inputs, according to which internal priority
parameters are set and used during resource allocation.

Communications with user

These consist of essential messages to the user such as signalling error situations, requests for loading of certain tapes or files, and notifying an end of job. They are generally kept to a minimum to avoid slow and error-prone (that is, human) activity and to make the computer more self sufficient and independent.

Security

The multi-access facility makes it essential to restrict data access by users to safeguard their interests
and prevent accidental or deliberate interference with files belonging to others. A system of passwords and access classifications is created and handled by the OS for this purpose.

➢ **Batch Operating System**
- In Batch operating system, data is collected over a period of time and the processing of the data is deferred to a later time.
- This approach was used very commonly in the past when punch cards served as data storage media and is used as input into the computer system for processing.
- In batch processing, the data have first to be captured, normally as a form of source documents, like time cards, or alternatively, by RJE (Remote Job Entry) where data is gathered through remote terminals.
- The data will then be transmitted to the computer or the source document will be physically transported to the data centre where transcription (conversion of source document data into machine readable form) is performed.
- The data is processed by the computer and the resulting output is given to the users. Batch processing is suitable in application where there are large amounts of data and when the turnaround times are not critical. As data are transcribed into machine readable form before

submitting for processing, the speed of processing is therefore determined by the computer and not by the operator.

- Payroll processing is suitable for batch processing as it is only performed on a regular basis. (for example every month).

➢ Multiprogramming Operating System

- Multiprogramming is the process of combining hardware and software to create a situation in which more than one program may be held in main store at one time.
- IT is thus possible to process several tasks simultaneously. The main objective is to minimize unused CPU time.
- In the time sharing mode the computer switches from one job to the other at a rapid rate. The jobs are entered into the computer through different terminals connected to the computer by cables.
- After processing the first user's job it proceeds to the second and then the third, and so on, for short bursts of time or "time slices" before returning to the first user's job from where it was earlier suspended.
- This cycle continues indefinitely; when one program is finished it is replaced by another one.
- The computer thus performs interleaved execution of two or more different and independent programs.
- The processor is kept busy while channels and buffers are occupied with job of bringing in data and writing out information.
- Multiprogramming is dependent on interrupts (an external event which causes running of current program, runs its defined procedure and comes back).
- Although commands are executed in sequence the system is sometimes required to respond to requests. This routine works according to a system of priorities, with each program having an associated priority number.

➢ Time Sharing Operating System

- As the name "Time Sharing" implies it has the ability to process several tasks simultaneously. In the time sharing mode the computer switches from one job to the other at a rapid rate.
- The jobs are entered into the computer through different terminals connected to the computer by cables.
- After processing the first user's job it proceeds to the second and then the third, and son on, for short bursts of time or "time slices" before returning to the first users job from where it was earlier suspended.
- This cycle continues indefinitely, when one program is finished it is replaced by another one.
- The exchange of programs from the secondary storage unit and the CPU takes some amount of time called over head time. Thus it is not efficient in processing long programs. Main advantage is that a number of users can use the computer simultaneously.

➢ On-Line Operating System

- In an On-Line system, the terminal used by the operator is connected to the main computer so that the operator can interact with the computer in a conversational mode. It is used in applications requiring fast response from the computer.
- There are some benefits by allowing users to communicate with the computer on-line. Error checking can be performed by the computer when data entry is carried out. The operator can be informed of the error so that immediate correction can be made. On-Line queries can be performed to allow immediate retrieval of information.

- The nature of on-line systems allow centralization of information, fast data retrieval immediate file updates and improved customer services. Limited validation checks at the terminal increases the accuracy of input.
- However, the cost of implementation such a system is much more than the batch system.
- Furthermore, as the terminals may be located remotely from the main computer site, security aspects of implementation must receive special considerations.
- Aspects which should be incorporated are
  - · Security of access to facilities
  - · Security of data files
  - · Audit trial – maintaining a record of all actions that have been carried out to any data

➢ Real-Time Operating System
- A Real-Time systems are always on-line but on-line systems need not be real-time systems. However, further constraints are placed in terms of response time and availability of the system.
- By definition, a real time system receive data and process it quickly enough to produce output which can be used to control or affect the outcome of an ongoing activity of process.
- In general, real-time systems handles small volumes of data at any one time and the turnaround time is critical. Feedback is essential in real-time systems so that processing can keep pace with external factors.
- Most real-time systems are used in mission critical application like process control and therefore, reliability and availability is of paramount importance.
- Missile guidance systems are examples of real-time systems. Control signals are sent to the fins of the missile to correct any deviations.

Advantages
· Error messages are immediate
· Source documents are available at the time the error occurs.
· Faster than on-line systems.

Disadvantages
· Direct access devices have to be used.
· Elaborate controls and backup procedures to guard against unwarranted access to the system.
· Control checks are difficult since updation occurs at the time of processing.

ë Different Packages

Packages are defined as a set of programs, which are used to solve general requirements of user. Some different packages are mentioned as under :

- Word processing Packages
- A word processor provides more facilities for text storage, manipulation and retrieval of files. It provides several other facilities such as boldfacing text, text formatting, automatic paging, text alignment, margin setting, headers-footers, etc.
- Block operations in word processing are used to define blocks of text, copy or move blocks and delete and print blocks. Facilities for printing text a specified format are also available in word processors.
- Printer control settings, character fonts, text sizes, highlighting and underlining are used to create special effects for presentation.
- A word processing package also provides file manipulation features, such as copying, deleting or renaming files automatic backup, searching, replacing and merging of documents.

- Word processors are used for Office automation and personal productivity. Examples of word processors are Word Star, Word Perfect, MS-Word, Page Maker, Lotus Word-Pro, etc.

- Spreadsheets Packages

- Spreadsheets are program equivalent to a computerized ledger sheet with rows and columns. The display screen and computer store are divided into cells organized into rows and columns. Each cell is the intersection of a column and row which stores one data item.
- Most spreadsheets come in an "integrated" package which allows the business person to readily save data in files, enter data into the spreadsheet, perform calculations and create graphics from the results. It is a powerful analytical tool for preparing budgets, managing inventory, developing plans, accounting, etc.
- Formulas can be entered into the cell address. Formulas are mathematical expressions encompassing basic addition, subtraction, multiplication, divisions and other formulas built into a spreadsheet to perform calculations. E.g. sum, average, max, min, etc.
- Macros in spreadsheets can be used to activate several commands. They are defined by specifying the list of instructions to be executed and called by quoting their labels.
- Examples of spreadsheets are Lotus 1-2-3, MS-Excel, Q-Pro, etc.

- Graphical Packages
- A "graphical" package is an application package that allows user to draw graphs, charts, or images using a prescribed set of tools. Tools available include :
  o Graphical Tools : Which can automatically produce various type of graphs given a set of values.
  o Shape/Line Tools : Allows user to easily create shapes like circles and boxes.
  o Painting Tools : Allows painting and shading using different colors and patterns.
  o Text Drawing Tools : Allows text in various formats to be entered.

- A programmer usually use a mouse to draw figures on the screen and also to pick the graphics tools that he wishes to use to draw the diagrams, symbols, images, etc. Examples of graphical packages are Animator Pro, 3D Studio, Coral Draw, Photo Shop, etc.

- Database Packages
- A database management package is used to create an environment where data can be stored in one place and need only a single input and updating to have data integrity, integration and data sharing. The essential features of a database package include :
  o Creating, saving and printing simple database files.
  o Creating custom data entry forms, modifying databases file structures, creating data entry screens. Adding data to database files, editing entries and deleting entries.
  o Moving around a database, finding data and indexing data. Creating query files and using them to locate and print specified records only.
  o Creating and printing reports from database files, generating mailing labels, and summarizing data statistically.
  o Cross-referencing data from more than one database file, as if it were on a single file.
  o Creating different views of the same data required by different users.
  o Importing files from other software and exporting data to other software. Creating or writing program to suit user requirements.
  o The DBMS let us specify data base structure and query (search condition) the database in a large number of ways. Examples of Database packages are dBase, foxbase, FOXPRO, Oracle, etc.

Unit -5(Emerging Technologies and Virus And Important Terms and Acronyms)

GIS

- o A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.
- o A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared.GIS technology can be integrated into any enterprise information system framework.
- o Geographical information system, is any system that captures, stores, analyzes, manages, and presents data that are linked to location. In the simplest terms, GIS is the merging of cartography and database technology.
- o GIS systems are used in cartography, remote sensing, land surveying, utility management, photogrammetry, geography, urban planning, emergency management, navigation, and localized search engines.
- o As GIS is a system, it has boundaries that may be jurisdictional, purpose or application oriented for which a specific GIS is developed. Hence, a GIS developed for an application; jurisdiction or purpose may not be necessarily interoperable or compatible with a GIS that has been developed for some other application, jurisdiction or purpose.
- o What goes beyond GIS is spatial data infrastructure (SDI), a concept that has no such restrictive boundaries.
- o Therefore, in a general sense, the term describes any information system that integrates stores, edits, analyzes, shares, and displays geographic information. In a more generic sense, GIS applications are tools that allow users to create interactive queries (user-created searches), analyze spatial information, edit data, maps, and present the results of all these operations.

GPS

- o The **Global Positioning System** (**GPS**) is a space-based global navigation satellite system that provides reliable location and time information in all weather and at all times and anywhere on or near the Earth there is an unobstructed line of sight to four or more GPS satellites.
- o It is maintained by the United States government and is freely accessible by anyone with a GPS receiver.
- o The GPS System was created and realized by the U.S. Department of Defense (DOD) and was originally based on and run with 24 satellites.
- o It was established in 1973 to reduce the large number of navigation aids and to overcome the limitations of previous navigation systems

Applications

- o GPS has become a widely used aid to navigation worldwide, and a useful tool for map-making, land surveying, commerce, scientific uses, tracking and surveillance, and hobbies such as geocaching and way marking.

- o The precise time reference provided by GPS is used in many applications including the scientific study of earthquakes and as a time synchronization source for cellular network protocols.
- o In addition, GPS has, in the words of the website gps.gov, become a mainstay of transportation systems worldwide, providing navigation for aviation, ground, and maritime operations.
- o Disaster relief and emergency services depend upon GPS for location and timing capabilities in their life-saving missions.
- o The accurate timing provided by GPS facilitates everyday activities such as banking, mobile phone operations, and even the control of power grids. Farmers, surveyors, geologists and

countless others perform their work more efficiently, safely, economically, and accurately using the free and open GPS signals.

CDMA
o   Code division multiple access (CDMA) is a channel access method used by various radio communication technologies.
o   CDMA is an example of multiple access, which is where several transmitters can send information simultaneously over a single communication channel. This allows several users to share a band of frequencies (see bandwidth).
o   To permit this to be achieved without undue interference between the users, CDMA employs spread-spectrum technology and a special coding scheme (where each transmitter is assigned a code).
o   CDMA is used as the access method in many mobile phone standards such as cdmaOne, CDMA2000 (the 3G evolution of cdmaOne), and WCDMA (the 3G standard used by GSM carriers), which are often referred to as simply *CDMA*.

GSM
o   GSM (Global System for Mobile Communications, originally *Groupe Spécial Mobile*), is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe protocols for second generation (2G) digital cellular networks used by mobile phones. It is the de facto global standard for mobile communications with over 90% market share, and is available in over 219 countries and territories.
o   The GSM standard was developed as a replacement for first generation (1G) analog cellular networks, and originally described a digital, circuit-switched network optimized for full duplex voice telephony.
o   This was expanded over time to include data communications, first by circuit-switched transport, then packet data transport via GPRS (General Packet Radio Services) and EDGE (Enhanced Data rates for GSM Evolution or EGPRS).
o   Subsequently, the 3GPP developed third generation (3G) UMTS standards followed by fourth generation (4G) LTE Advanced standards, which are not part of the ETSI GSM standard.
o   "GSM" is a trademark owned by the GSM Association. It may also refer to the initially most common voice codec used, Full Rate.

MODEM
o   A modem (modulator-demodulator) is a device that modulates an analog carrier signal to encode digital information and demodulates the signal to decode the transmitted information. The goal is to produce a signal that can be transmitted easily and decoded to reproduce the original digital data.
o   Modems can be used with any means of transmitting analog signals, from light emitting diodes to radio.
o   The most familiar type is a voice band modem that turns the digital data of a computer into modulated electrical signals in the voice frequency range of a telephone channel. These signals can be transmitted over telephone lines and demodulated by another modem at the receiver side to recover the digital data..

CELL PHONE
o   A mobile phone (also known as a cellular phone, cell phone, and a hand phone) is a phone that can make and receive telephone calls over a radio link while moving around a wide geographic area.
o   It does so by connecting to a cellular network provided by a mobile phone operator, allowing access to the public telephone network.
o   By contrast, a cordless telephone is used only within the short range of a single, private base station.

- In addition to telephony, modern mobile phones also support a wide variety of other services such as text messaging, MMS, email, Internet access, short-range wireless communications (infrared, Bluetooth), business applications, gaming and photography. Mobile phones that offer these and more general computing capabilities are referred to as smartphones.
- The first hand-held cell phone was demonstrated by John F. Mitchell and Dr Martin Cooper of Motorola in 1973, using a handset weighing around 2.2 pounds (1 kg). In 1983, the DynaTAC 8000x was the first to be commercially available. From 1990 to 2011, worldwide mobile phone subscriptions grew from 12.4 million to over 6 billion, penetrating about 87% of the global population and reaching the bottom of the economic pyramid.

WIFI

- Wi-Fi, also spelled Wifi or WiFi, is a technology that allows an electronic device to exchange data or connect to the internet wirelessly using 2.4 GHz UHF and 5 GHz SHF radio waves.
- The name is a trademark name, and was stated to be a play on the audiophile term Hi-Fi. The Wi-Fi Alliance defines
- Wi-Fi as any "wireless local area network (WLAN) products that are based on the Institute of Electrical and Electronics Engineers' (IEEE) 802.11 standards".
- However, since most modern WLANs are based on these standards, the term "Wi-Fi" is used in general English as a synonym for "WLAN". Only Wi-Fi products that complete Wi-Fi Alliance interoperability certification testing successfully may use the "Wi-Fi CERTIFIED" trademark.
- Many devices can use Wi-Fi, e.g., personal computers, video-game consoles, smartphones, some digital cameras, tablet computers and digital audio players.
- These can connect to a network resource such as the Internet via a wireless network access point. Such an access point (or hotspot) has a range of about 20 meters (66 feet) indoors and a greater range outdoors. Hotspot coverage can comprise an area as small as a single room with walls that block radio waves, or as large as many square kilometers achieved by using multiple overlapping access points.

INFRARED

- o Infrared (IR) light is electromagnetic radiation with longer wavelengths than those of visible light, extending from the nominal red edge of the visible spectrum at 700 nanometers (nm) to 1 mm.
- o This range of wavelengths corresponds to a frequency range of approximately 430 THz down to 300 GHz. Most of the thermal radiation emitted by objects near room temperature is infrared.
- o Infrared radiation was discovered in 1800 by astronomer William Herschel, who discovered a type of invisible radiation in the light spectrum beyond red light, by means of its effect upon a thermometer.
- o Slightly more than half of the total energy from the Sun was eventually found to arrive on Earth in the form of infrared. The balance between absorbed and emitted infrared radiation has a critical effect on Earth's climate.
- o Infrared light is emitted or absorbed by molecules when they change their rotational-vibrational movements. Infrared energy elicits vibrational modes in a molecule through a change in the dipole moment, making it a useful frequency range for study of these energy states for molecules of the proper symmetry. Infrared spectroscopy examines absorption and transmission of photons in the infrared energy range.
- o Infrared light is used in industrial, scientific, and medical applications. Night-vision devices using active near-infrared illumination allow people or animals to be observed without the observer being detected.
- ° Infrared astronomy uses sensor-equipped telescopes to penetrate dusty regions of space, such as molecular clouds; detect objects such as planets, and to view highly red-shifted objects from the early days of the universe.
- o Infrared thermal-imaging cameras are used to detect heat loss in insulated systems, to observe changing blood flow in the skin, and to detect overheating of electrical apparatus.

BLUE TOOTH

- o Bluetooth is a wireless technology standard for exchanging data over short distances (using short-wavelength UHF radio waves in the ISM band from 2.4 to 2.485 GHz) from fixed and mobile devices, and building personal area networks (PANs).
- o Invented by telecom vendor Ericsson in 1994, it was originally conceived as a wireless alternative to RS-232 data cables. It can connect several devices, overcoming problems of synchronization.
- ° Bluetooth is managed by the Bluetooth Special Interest Group (SIG), which has more than 19,000 member companies in the areas of telecommunication, computing, networking, and consumer electronics.
- ° Bluetooth was standardized as IEEE 802.15.1, but the standard is no longer maintained. The SIG oversees the development of the specification, manages the qualification program, and protects the trademarks.
- o To be marketed as a Bluetooth device, it must be qualified to standards defined by the SIG. A network of patents is required to implement the technology, which is licensed only for that qualifying device.

VIRUS

- A virus is a small infectious agent that replicates only inside the living cells of other organisms. Viruses can infect all types of life forms, from animals and plants to bacteria and archaic.
- Since Dmitri Ivanovsky's 1892 article describing a non-bacterial pathogen infecting tobacco plants, and the discovery of the tobacco mosaic virus by Martinus Beijerinck in 1898,about 5,000 viruses have been described in detail,although there are millions of different types.
- Viruses are found in almost every ecosystem on Earth and are the most abundant type of biological entity. The study of viruses is known as virology, a sub-speciality of microbiology.
- Virus particles (known as virions) consist of two or three parts: i) the genetic material made from either DNA or RNA, long molecules that carry genetic information; ii) a protein coat that protects these genes; and in some cases iii) an envelope of lipids that surrounds the protein coat when they are outside a cell.
- The shapes of viruses range from simple helical and icosahedral forms to more complex structures. The average virus is about one one-hundredth the size of the average bacterium. Most viruses are too small to be seen directly with an optical microscope.
- The origins of viruses in the evolutionary history of life are unclear: some may have evolved from plasmids—pieces of DNA that can move between cells—while others may have evolved from bacteria.
- In evolution, viruses are an important means of horizontal gene transfer, which increases genetic diversity.
- A **computer virus** is a malware that, when executed, replicates by reproducing itself or infecting other programs by modifying them.
- Infecting computer programs can include as well, data files, or the boot sector of the hard drive. When this replication succeeds, the affected areas are then said to be "infected". The term computer virus was a misnomer until it was coined by Fred Cohen in 1985.
- Viruses often perform some type of harmful activity on infected hosts, such as acquisition of hard disk space or CPU time, accessing private information, corrupting data, displaying political or humorous messages on the user's screen, spamming their contacts, logging their keystrokes, or even rendering the computer useless.
- However, not all viruses carry a destructive payload or attempt to hide themselves—the defining characteristic of viruses is that they are self-replicating computer programs which install themselves without user consent.

Cloud Computing : -
- In the simplest terms, cloud computing means storing and accessing data and programs over the Internet instead of your computer's hard drive. What cloud computing is not about is your hard drive.
- When you store data on or run programs from the hard drive, that's called local storage and computing.
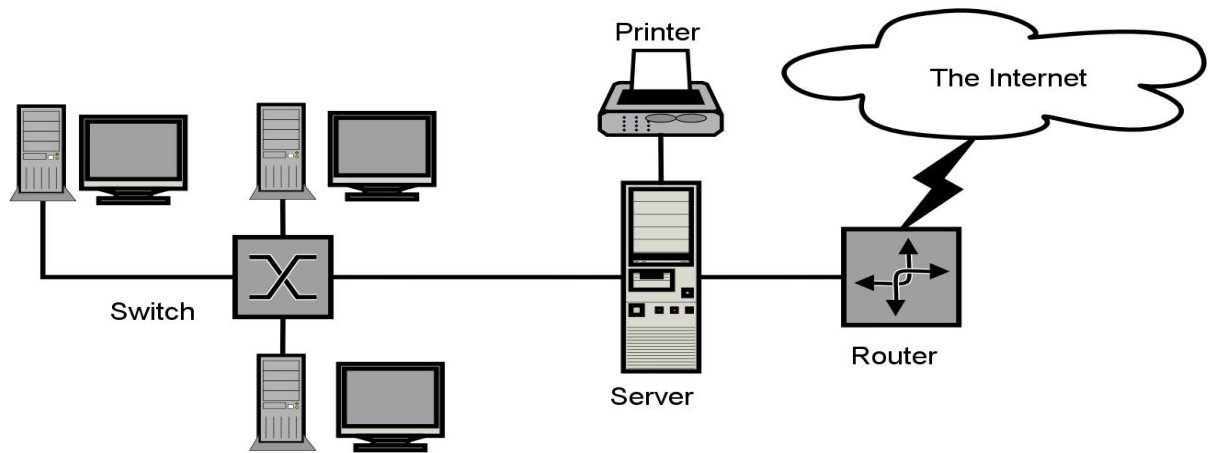
- Everything you need is physically close to you, which means accessing your data is fast and easy, for that one computer, or others on the local network. Working off your hard drive is how the computer industry functioned for decades; some would argue it's still superior to cloud computing, for reasons I'll explain shortly.
- The lines between local computing and cloud computing sometimes get very, very blurry.
- That's because the cloud is part of almost everything on our computers these days. You can easily have a local piece of software (for instance, Microsoft Office 365) that utilizes a form of cloud computing for storage (Microsoft OneDrive).

Characteristics

Cloud computing exhibits the following key characteristics:

- **Cost reductions** claimed by cloud providers.
- **Device and location independence** enable users to access systems using a web browser regardless of their location or what device they use (e.g., PC, mobile phone). As infrastructure is off-site (typically provided by a third-party) and accessed via the Internet, users can connect from anywhere.
- **Maintenance** of cloud computing applications is easier, because they do not need to be installed on each user's computer and can be accessed from different places.
- **peak-load capacity increases** (users need not engineer for highest possible load-levels)
- **Performance** is monitored, and consistent and loosely coupled architectures are constructed using web services as the system interface.
- **Security** can improve due to centralization of data, increased security-focused resources.
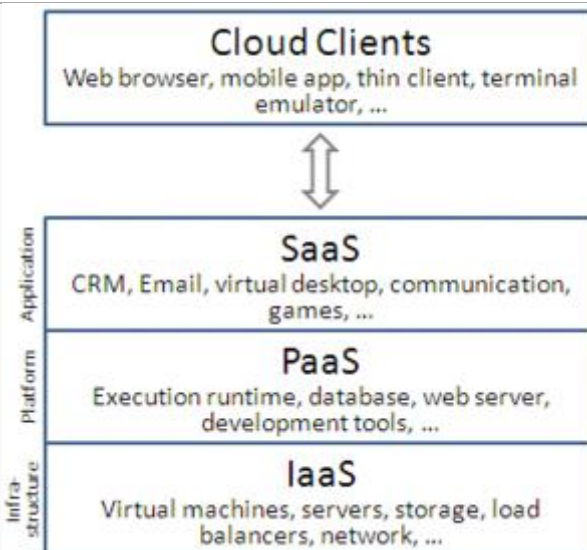
Cloud-computing layers accessible within a stack

Infrastructure as a service (IaaS)

- According to the Internet Engineering Task Force (IETF), the most basic cloud-service model is that of providers offering computing infrastructure – virtual machines and other resources – as a service to subscribers.

- Infrastructure as a service(IaaS) refers to online services that abstract the user from the details of infrastructure like physical computing resources, location, data partitioning, scaling, security, backup etc.

- A hypervisor, such as Xen, Oracle VirtualBox, Oracle VM, KVM, VMware ESX/ESXi, or Hyper-V, runs the virtual machines as guests.

- To deploy their applications, cloud users install operating-system images and their application software on the cloud infrastructure.

- In this model, the cloud user patches and maintains the operating systems and the application software. Cloud providers typically bill IaaS services on a utility computing basis: cost reflects the amount of resources allocated and consumed.

Platform as a service (PaaS)

- PaaS vendors offer a development environment to application developers.

- The provider typically develops toolkit and standards for development and channels for distribution and payment.

- In the PaaS models, cloud providers deliver a computing platform, typically including operating system, programming-language execution environment, database, and web server.

- Application developers can develop and run their software solutions on a cloud platform without the cost and complexity of buying and managing the underlying hardware and software layers.

- With some PaaS offers like Microsoft Azure and Google App Engine, the underlying computer and storage resources scale automatically to match application demand so that the cloud user does not have to allocate resources manually.

Software as a service (SaaS)

- In the software as a service (SaaS) model, users gain access to application software and databases.

- Cloud providers manage the infrastructure and platforms that run the applications. SaaS is sometimes referred to as "on-demand software" and is usually priced on a pay-per-use basis or using a subscription fee.

- In the SaaS model, cloud providers install and operate application software in the cloud and cloud users access the software from cloud clients.

- Cloud users do not manage the cloud infrastructure and platform where the application runs.

- This eliminates the need to install and run the application on the cloud user's own computers, which simplifies maintenance and support.

- Cloud applications differ from other applications in their scalability—which can be achieved by cloning tasks onto multiple virtual machines at run-time to meet changing work demand.

Architecture
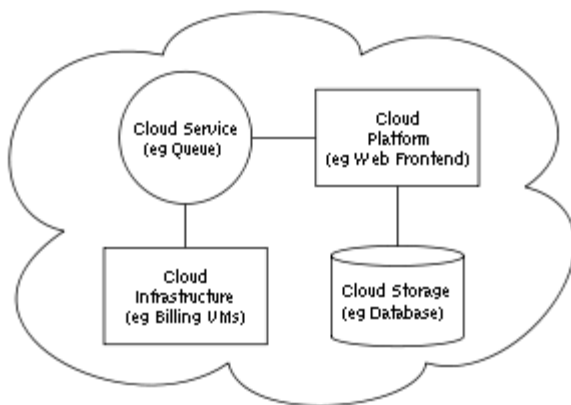
Cloud architecture, the systems architecture of the software systems involved in the delivery of cloud computing, typically involves multiple *cloud components* communicating with each other over a loose coupling mechanism such as a messaging queue. Elastic provision implies intelligence in the use of tight or loose coupling as applied to mechanisms such as these and others.

Security and privacy

- Cloud computing poses privacy concerns because the service provider can access the data that is in the cloud at any time.

- It could accidentally or deliberately alter or even delete information. Many cloud providers can share information with third parties if necessary for purposes of law and order even without a warrant.

- That is permitted in their privacy policies, which users must agree to before they start using cloud services.

- Solutions to privacy include policy and legislation as well as end users' choices for how data is stored. Users can encrypt data that is processed or stored within the cloud to prevent unauthorized access.

- According to the Cloud Security Alliance, the top three threats in the cloud are *Insecure Interfaces and API's*, *Data Loss & Leakage*, and *Hardware Failure*—which accounted for 29%,

25% and 10% of all cloud security outages respectively. Together, these form shared technology vulnerabilities

Important Terms and Acronyms

ATM

- An automated teller machine or automatic teller machine (ATM), also known as an automated banking machine (ABM) in Canada, and a Cashpoint (which is a trademark of Lloyds TSB), cash machine or sometimes a hole in the wall in British English, is a computerized telecommunications device that provides the clients of a financial institution with access to financial transactions in a public space without the need for a cashier, human clerk or bank teller.
- ATMs are known by various other names including *ATM machine*, *automated banking machine*, and various regional variants derived from trademarks on ATM systems held by particular banks.
- On most modern ATMs, the customer is identified by inserting a plastic ATM card with a magnetic stripe or a plastic smart card with a chip, that contains a unique card number and some security information such as an expiration date or CVVC (CVV).
- Authentication is provided by the customer entering a personal identification number (PIN). The newest ATM at Royal Bank of Scotland operates without a card to withdraw cash up to £100. The customers should registered first their mobile phone number and bank will give a six-digit code to enter into ATM to withdraw the cash.

BACKUP AND RESTORE:

- There are two different types of backup supported: File backup and system image. File backups are saved to ZIP files.
- Two types of file backup are supported:
  - The first type, normal backup, stores everything selected for backup.
  - The second type, incremental backup stores only files that are changed after a previous backup.

- However, unlike the file backup and NTBackup, in which data are backed up file by file, system image is a disk image of the backed up system saved block by block in a VHD file. Block-based backup is more efficient at performing subsequent differential backups, as only the blocks that have changed need to be backed up.
- During a backup, Windows uses Volume Shadow Copy Service to ensure that files are not changed while they are being backed up. Newer backup media such as CD, DVD and Blu-ray discs are supported in Backup and Restore.
- Windows Backup service is the Windows service responsible for backup and restore operation. The Backup and Restore application, however, is not the only way of interfacing with this service: The Wbadmin command-line utility may also be used.

System image

The image-based full system backup option, called *Complete PC Backup* in Windows Vista or *system image* in Windows 7, allows for the imaging of the entire system including operating system and data volumes.

The backed up image can later be restored through the Windows Recovery Environment either to the same computer or to a new computer of different brand and type. The file format used when doing an image-based backup is VHD. A VHD image can also be mounted for extracting individual files, or booted from(using Windows 7 Enterprise and Ultimate only) after the full system image backup has been done.

Beginning with Windows Vista SP1, system images can be restored to a machine with a different motherboard which may have a different disk controller; but the machine must have the same number of disks.

Related features

The Volume Shadow Copy Service also creates and maintains periodic copies of system and user data on the same local volume as a part of System Restore operation. This stores previous versions of those files with incremental block-level changes automatically but on the same volume. They can be restored using System Restore or the Previous Versions shell extension.

Limitations

Windows Backup does not support tape drives. It also does not support backing up to or restoring from a subfolder of a disk; instead, it creates subfolders of its own. Backup and Restore can only make a system image of disks with NTFS file system. If the system image is to be saved on a USB flash drive, it must be formatted with NTFS file system.

The version of Windows Backup supplied with Windows Server 2008 does not support hard disk drives with large sector sizes (4096 bytes) unless they support 512 byte emulation.

HARD COPY AND SOFT COPY:

- Soft copy and hard copy are types of output.
- A soft copy is the unprinted digital document file. This term is often contrasted with hard copy. It can usually be viewed through an appropriate editing program, such as word processing programs, database programs, or presentation software, depending on the file type.
- It can be transported from one computer to another through file transfer/downloading mechanisms such as ftp or http, as an email attachment, or through USB drives and other disk drives. Keeping a digital copy of a document can allow easy editing of it later on. See hard copy for information about printed documents.
- Using soft copies of work over traditional printed documents eliminates the need for paper and ink. Multiple copies of the same document can be kept in different versions, allowing the user to easily backtrack to an earlier version. Also, soft copies are more easily manipulated by users than hard copies, which can be both an advantage and a disadvantage.
- When soft copies are kept on storage devices, they conserve office space. Softcopy documents are more portable compared to hardcopy because it is not bulky like hardcopy.

BUS AND DATA BUS:
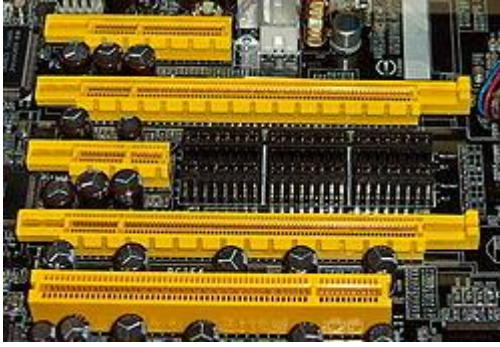
4 PCI Express bus card slots (from top to bottom: x4, x16, x1 and x16), compared to a 32-bit conventional PCI bus card slot (very bottom)

In computer architecture, a bus is a subsystem that transfers data between components inside a computer, or between computers.

Early computer buses were parallel electrical wires with multiple connections, but the term is now used for any physical arrangement that provides the same logical functionality as a parallel electrical bus. Modern computer buses can use both parallel and bit serial connections, and can be wired in either a multidrop (electrical parallel) or daisy chain topology, or connected by switched hubs, as in the case of USB.

BUFFER AND SPOOLING:

Buffer:
- A temporary storage area, usually in RAM. The purpose of most buffers is to act as a holding area, enabling the CPU to manipulate data before transferring it to a device.
- Because the processes of reading and writing data to a disk are relatively slow, many programs keep track of data changes in a buffer and then copy the buffer to a disk.
- For example, word processors employ a buffer to keep track of changes to files. Then when you *save* the file, the word processor updates the disk file with the contents of the buffer. This is much more efficient than accessing the file on the disk each time you make a change to the file.

Spooling:

- In computer science, spool refers to the process of placing data in a temporary working area for another program to process.
- The most common use is in writing files on a magnetic tape or disk and entering them in the work queue (possibly just linking it to a designated folder in the file system) for another process.
- Spooling is useful because devices access data at different rates. Spooling allows one program to assign work to another without directly communicating with it.
- The most common spooling application is print spooling: documents formatted for printing are stored usually into an area on a disk and retrieved and printed by a printer at its own rate. Printers typically can print only a single document at a time and require seconds or minutes to do so.
- With spooling, multiple processes can write documents to a print queue without waiting. As soon as a process has written its document to the spool device, the process can perform other tasks, while a separate printing process operates the printer.
- For example, when a city prepares payroll checks, the actual computation may take a matter of minutes or even seconds, but the printing process might take hours.
- If the program printed directly, computing resources (CPU, memory, peripherals) would be tied up until the program was able to finish.

- The same is true of personal computers. Without spooling, a word processor would be unable to continue until printing finished.
- Without spooling, most programs would be relegated to patterns of fast processing and long waits, an inefficient paradigm.
- Spooler or print management software may allow priorities to be assigned to jobs, notify users when they have printed, distribute jobs among several printers, allow stationery to be changed or select it automatically, generate banner pages to identify and separate print jobs, etc.

Cursor pointer and icon.

Cursor:

1. Computers . a movable, sometimes blinking, symbol that indicates the position on a CRT or other type of display where the next character entered from the keyboard will appear, or where user action is needed, as in the correction of an erroneous character already displayed.

2. a sliding object, as the lined glass on a slide rule, that can be set at any point on a scale.

Pointer

Grabber pointer   I-beam pointer   Selection pointer

(1) In graphical user interfaces, a pointer is a small arrow or other symbol on the display screen that moves as you move the mouse. You can select commands and options by positioning the tip of the arrow over the desired choice and clicking a mouse button. Many text processing programs use an *I-beam pointer*.

Icon:

A small picture that represents an object or program. Icons are very useful in applications that use windows, because with the click of a mouse button you can shrink an entire window into a small icon. (This is sometimes called *minimizing.*) To redisplay the window, you merely move the pointer to the icon and click (or double click) a mouse button. (This is sometimes called *restoring* or *maximizing*)

Icons are a principal feature of graphical user interfaces**.**

CLI AND GUI:

Cli: command line interface: a user interface in which you type commands instead of choosing them from a menu or selecting an icon.

(Short for Caller Line Identification, also known as caller ID. It is a telephony network feature that allows caller's number and/or name to be displayed on the screen of the recipient's phone, provided that the calling number is not blocked. This feature is available for all digital phones as well as for many analogue ones.)

GUI :

In computing, a graphical user interface (GUI, commonly pronounced *gooey*[1]) is a type of user interface that allows users to interact with electronic devices using images rather than text commands.

*GUI*s can be used in computers, hand-held devices such as MP3 players, portable media players or gaming devices, household appliances and office equipment.

A *GUI* represents the information and actions available to a user through graphical icons and visual indicators such as secondary notation, as opposed to text-based interfaces, typed command labels or text navigation.

The actions are usually performed through direct manipulation of the graphical elements.

The term *GUI* is restricted to the scope of two-dimensional display screens with display resolutions able to describe generic information, in the tradition of the computer science research at the PARC (Palo Alto Research Center).

The term *GUI* is rarely applied to other high-resolution types of interfaces that are non-generic, such as video games (where HUD[3] is preferred), or not restricted to flat screens, like volumetric displays.

Drive ,directory and path:

Drive:

Computer drives are an integral part of any computer system, be it a PC or a Mac. They perform a variety of different functions ranging from storage to CD and DVD input. Through input and output of different types of data, they give us the flexibility to customize and control the functionality of our computer systems.

Directory:

(1) An organizational unit, or container, used to organize folders and files into a hierarchical structure. Directories contain bookkeeping information about files that are, figuratively speaking, beneath them in the hierarchy. You can think of a directory as a file cabinet that contains folders that contain files. Many graphical user interfaces use the term *folder* instead of *directory*.

Computer manuals often describe directories and file structures in terms of an *inverted tree*. The files and directories at any level are contained in the directory above them. To access a file, you may need to specify the names of all the directories above it. You do this by specifying a *path*.
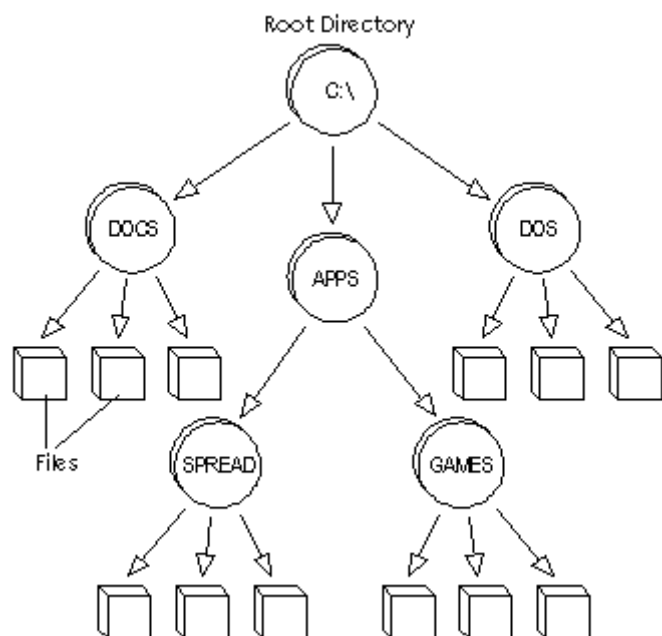
The topmost directory in any file is called the *root directory*. A directory that is below another directory is called a *subdirectory*. A directory above a subdirectory is called the *parent directory*. Under DOS and Windows, the root directory is a back slash

To read information from, or write information into, a directory, you must use an operating system command. You cannot directly edit directory files. For example, the DIR command in DOS reads a directory file and displays its contents.

Path:

path, the general form of a filename or of a directory name, specifies a unique location in a file system. A path points to a file system location by following the directory tree hierarchy expressed in a string of characters in which path components, separated by a delimiting character, represent each directory.

The delimiting character is most commonly the slash ("/"), the backslash character ("\"), or colon (":"), though some operating systems may use a different delimiter. Paths are used extensively in computer science to represent the directory/file relationships common in modern operating systems, and are essential in the construction of Uniform Resource Locators (URLs).

Systems can use either absolute or relative paths. A full path or absolute path is a path that points to the same location on one file system regardless of the working directory or combined paths. It is usually written in reference to a root directory.

Menu ,popup menu :

Menu:
Synonyms:
computer menu; menu
Hypernyms ("computer menu" is a kind of...):
list; listing (a database containing an ordered array of items (names or topics))
Domain category:
computer science; computing (the branch of engineering science that studies (with the aid of computers) computable processes and structures)
Hyponyms (each of the following is a kind of "computer menu"):
drop-down menu (a menu of options that appears below the item when the computer user clicks on it)
cascading menu; hierarchical menu; submenu (a secondary menu that appears while you are holding the cursor over an item on the primary menu)

pop up menu:

A pop-up menu displays a list of menu commands. Microsoft Active Accessibility creates a menu pop-up object when a menu item in a menu bar is opened. Microsoft Active Accessibility also creates menu pop-up objects for context menus, which are displayed when the user right-clicks a user interface element.

Shut down restart and reboot.

Shut down :

 (1) To turn the power off.

(2) In Windows 95 and Windows 98, the normal way to turn a computer off is to select **Start->Shut Down…**

Restart /reboot:

Reboot: To restart a computer. In DOS, you can reboot by pressing the Alt, Control and Delete keys simultaneously. This is called a warm boot. You can also perform a cold boot by turning the computer off and then on again. On a PC running Microsoft Windows you reboot by selecting the "Shut Down" option from the Start menu. On Macs, you reboot by selecting the "Restart" option from the Special menu.

Fiber optic:
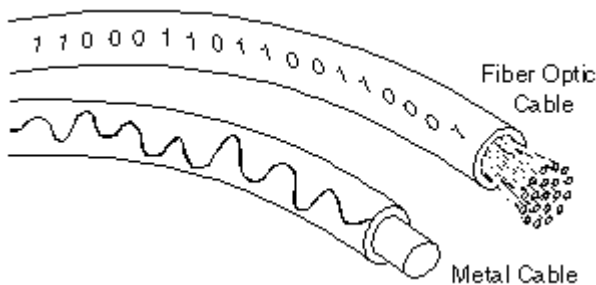
A technology that uses glass (or plastic) threads (fibers) to transmit data. A fiber optic cable consists of a bundle of glass threads, each of which is capable of transmitting messages modulated onto light waves.
Fiber optics has several advantages over traditional metal communications lines:
o   Fiber optic cables have a much greater bandwidth than metal cables. This means that they can carry more data. Fiber optic cables are less susceptible than metal cables to interference.
o   Fiber optic cables are much thinner and lighter than metal wires. Data can be transmitted digitally (the natural form for computer data) rather than analogically.
o   The main disadvantage of fiber optics is that the cables are expensive to install. In addition, they are more fragile than wire and are difficult to splice.
o   Fiber optics is a particularly popular technology for local-area networks. In addition, telephone companies are steadily replacing traditional telephone lines with fiber optic cables. In the future, almost all communications will employ fiber optics.

Net meeting:

A product developed by Microsoft Corporation that enables groups to teleconference using the Internet as the transmission medium. NetMeeting supports VoIP, chat sessions, a whiteboard, and application sharing. It's built into Microsoft's Internet Explorer Web browser.

Ups :

An uninterrupted power supply (UPS), also known as a battery back-up provides emergency power and, depending on the topology, provide line regulation as well to connected equipment by supplying power from a separate source when utility power is not available. It differs from an auxiliary power supply or standby generator, which does not provide instant protection from a momentary power interruption. A UPS, however, can be used to provide uninterrupted power to equipment, typically for 5-15 minutes until a generator can be turned on or utility power is restored.

Peripherals:

A computer peripheral is any external device that provides input and output for the computer. For example, a keyboard and mouse are input peripherals, while a monitor and printer are output peripherals. Computer peripherals, or peripheral devices, are sometimes called "I/O devices" because they provide input and output for the computer. Some peripherals, such as external hard drives, provide both input and output for the computer**.**

E-mail (Electronic Mail)

- Email system can service any size group from a local workgroup to a corporation to the world.
- By installing email routing devices, we can transfer mail smoothly and efficiently among several LANs.
- Email also can be routed to and received from the Internet.
- This enables users in dozens of countries throughout the world to exchange electronic messages.
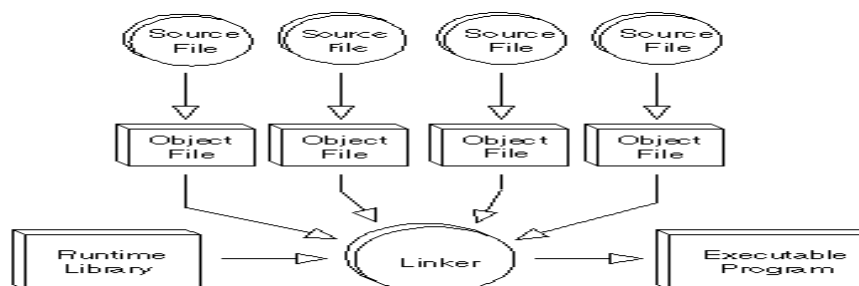
COMPILER AND ITS TYPES.

A program that translates *source code* into *object code*. The compiler derives its name from the way it works, looking at the entire piece of source code and collecting and reorganizing the instructions.

Thus, a compiler differs from an *interpreter*, which analyzes and executes each line of source code in succession, without looking at the entire program. The advantage of interpreters is that they can execute a program immediately. Compilers require some time before an executable program emerges.

However, programs produced by compilers run much faster than the same programs executed by an interpreter.

Every high-level programming language (except strictly interpretive languages) comes with a compiler. In effect, the compiler is the language, because it defines which instructions are acceptable.

Because compilers translate source code into object code, which is unique for each type of computer, many compilers are available for the same language.

For example, there is a FORTRAN compiler for PCs and another for Apple Macintosh computers. In addition, the compiler industry is quite competitive, so there are actually many compilers for each language on each type of computer. More than a dozen companies develop and sell C compiler in pc.

Types of compiler.

Compiler can be divided into following four main types.

1. one pass compilers
2. multi pass compilers
3. load and go compiler
4. optimizing compilers

SYNTAX:

In linguistics, syntax (from Ancient Greek "arrangement" from "together", and, "an ordering") is "the study of the principles and processes by which sentences are constructed in particular languages".

In addition to referring to the overarching discipline, the term *syntax* is also used to refer directly to the rules and principles that govern the sentence structure of any individual language, as in "the syntax of Modern Irish".

Modern research in syntax attempts to describe languages in terms of such rules. Many professionals in this discipline attempt to find general rules that apply to all natural languages. The term *syntax* is also used to refer to the rules governing the behavior of mathematical

WILD CARD CHARACTER:

A special symbol that stands for one or more characters. Many operating systems and applications support wildcards for identifying files and directories. This enables you to select multiple files with a single specification.

For example, in DOS and Windows, the asterisk (*) is a wild card that stands for any combination of letters. The file specification m* therefore, refers to all files that begin with *m*. Similarly, the specification m*.doc refers to all files that start with *m* and end with.*doc*.

Many word processors also support wild cards for performing text searches.

PRINTING SPEED.(CPS,CPM,LPM,DPI,PPM)
Cps(Character Per Second)
abbreviation of **c**haracters **p**er **s**econd, a unit of measure used to describe the speed of dot-matrix and daisy-wheel printers. The speed of laser and ink-jet printers is described in terms of pages per minute (ppm).

Ppm(Page PerMinute)
Stands for "Pages Per Minute." PPM is used to measure the printing speed of both inkjet and laser printers. Most printers include a PPM rating for both black and color documents. These speed measurements are typically listed in the printer's technical specifications.While a higher pages per minute rating does indicate a faster printing speed, this measurement can be misleading. This is because manufacturers measure the maximum PPM in the fastest printing mode, a.k.a. "economy mode," which is also the lowest quality. When printing in regular mode, the speed may be twice as slow. When printing in fine or high-quality mode, the speed will likely be reduced even further.

Cpm(Character Per minute)

Words per minute, commonly abbreviated wpm, is a measure of input or output speed.For the purpose of typing measurement a word is standardized to five characters or keystrokes, including spaces and punctuation. For example, "I run" counts as one word, and "rhinoceros" and "let's talk" both count as two.

Lpm(Line Per Minute)
A high-speed printer capable of printing an entire line at one time. A fast line printer can print as many as 3,000 lines per minute. The disadvantages of line printers are that they cannot print graphics, the print quality is low, and they are very noisy.

Dpi (dots per inch)

Stands for "Dots Per Inch." DPI is used to measure the resolution of an image both on screen and in print. As the name suggests, the DPI measures how many dots fit into a linear inch. Therefore, the higher the DPI, the more detail can be shown in an image.

It should be noted that DPI is **not** dots per square inch. Since a 600 dpi printer can print 600 dots both horizontally and vertically per inch, it actually prints 360,000 (600 x 600) dots per square inch.

Also, since most monitors have a native resolution of 72 or 96 pixels per inch, they cannot display a 300 dpi image in actual size. Instead, when viewed at 100%, the image will look much larger than the print version because the pixels on the screen take up more space than the dots on the paper.

FILE:

A collection of data or information that has a name, called the *filename*. Almost all information stored in a computer must be in a file. There are many different types of files: *data files, text files , program files, directory files,* and so on. Different types of files store different types of information. For example, program files store programs, whereas text files store text.
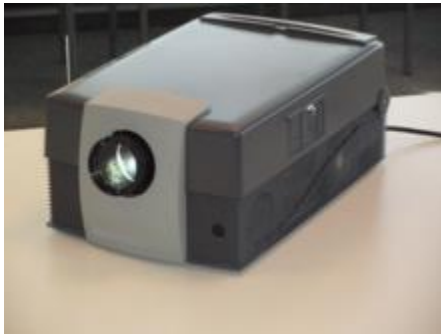
PATH:
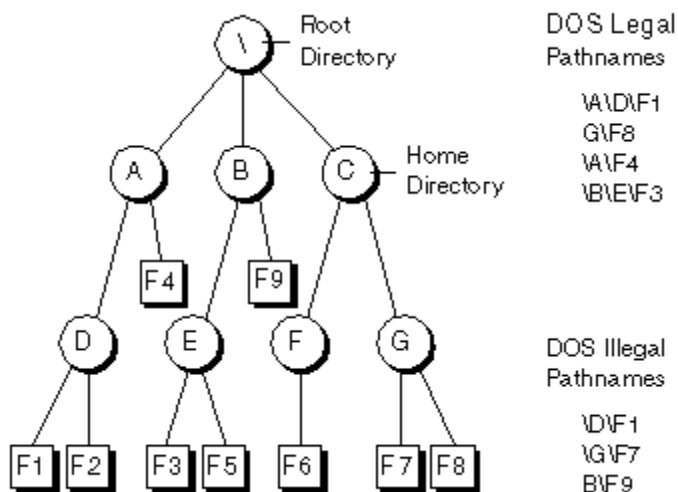
(**1**) In DOS and Windows systems, a path is a list of directories where the operating system looks for executable files if it is unable to find the file in the working directory. You can specify the list of directories with the PATH command.

LCD PROJECTOR

An LCD projector is a type of video projector for displaying video, images or computer data on a screen or other flat surface. It is a modern equivalent of the slide projector or overhead projector. To display images, LCD (liquid-crystal display) projectors typically send light from a metal-halide lamp through a prism or series of dichroic filters that separates light to three polysilicon panels – one each for the red, green and blue components of the video signal. As polarized light passes through the panels (combination of polarizer, LCD panel and analyzer), individual pixels can be opened to allow light to pass or closed to block the light. The combination of open and closed pixels can produce a wide range of colors and shades in the projected image.

Liesegang LCD Projector

Metal-halide lamps are used because they output an ideal color temperature and a broad spectrum of color. These lamps also have the ability to produce an extremely large amount of light within a small area; current projectors average about 2,000 to 15,000 American National Standards Institute (ANSI) lumens.

Other technologies, such as Digital Light Processing (DLP) and liquid crystal on silicon (LCOS) are also becoming more popular in modestly priced video projection.

COMPUTER SPEAKER.

Computer speakers, or multimedia speakers, are speakers external to a computer, that disable the lower fidelity built-in speaker. They often have a low-power internal amplifier. The standard audio connection is a 3.5 mm (approximately 1/8 inch) stereo phone connector often color-coded lime green (following the PC 99 standard) for computer sound cards. A few use a RCA connector for input. There are also USB speakers which are powered from the 5 volts at 500 milliamps provided by the USB port, allowing about 2.5 watts of output power. Computer speakers were introduced by Altec Lansing in 1990.

Computer speakers range widely in quality and in price. The computer speakers typically packaged with computer systems are small, plastic, and have mediocre sound quality. Some computer speakers have equalization features such as bass and treble controls.

The internal amplifiers require an external power source, usually an AC adapter. More sophisticated computer speakers can have a subwoofer unit, to enhance bass output, and these units usually include the power amplifiers both for the bass speaker, and the small satellite speakers.

Some computer displays have rather basic speaker's built-in. Laptops come with integrated speakers. Restricted space available in laptops means these speakers usually produce low-quality sound.

For some users, a lead connecting computer sound output to an existing stereo system is practical. This normally yields much better results than small low-cost computer speakers. Computer speakers can also

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serve as an economy amplifier for MP3 player use for those who wish to not use headphones, although some models of computer speakers have headphone jacks of their own.