
DATA & INFORMATION

What is Data?

The word **Data** is taken from Latin word “**Datum**” which means to calculate.

Data is the plural form of **Datum**.

Definition: Facts that can be analyzed or used in an effort to gain knowledge or make decisions

OR: The raw facts and figures is called data.

Fact: Alphabets & Special Characters

Figures: Numbers

Example: 5+5 this is called data.

What are the types of data?

We have different types of data which is presented below.

1) **Alphabetic Data:** The Alphabetic data consist all the character from A to Z.

Example: Peshawar, Ahmad, Pakistan, Book, Computer

2) **Numeric Data:** The Numeric data consist of numbers from 0 to 9

Example: 14564897890545

3) **Alphanumeric Data:** The Alphanumeric data consist of Alphabets and also Numbers.

Example: Street No 24, House # 532

4) **Graphic Data:** The graphic data consist of Tables, Charts, Graphics and Statements.

5) **Audio Data:** The Audio data consist of only sounds.

6) **Video Data:** The Video data consist of Photos, Images, and Moving pictures.

7) **Mixed Data:** The mixed Data consist of more than one type of data, like audio and video.

What is information?

The organized form of data in meaningful form upon which people can take decision is called information or the processed form of data is called information.

Information is the summarization of data. Technically, data are raw facts and figures that are processed into information, such as summaries and totals.

Example: 5+5 = 10 so here the answer which 10 is information.

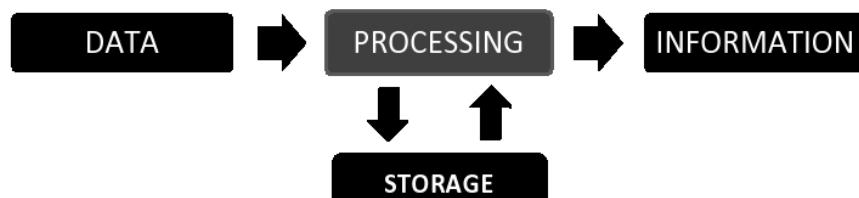
What is the difference between data and information?

Data	Information
1. Raw Fact and Figure	1. The process form of data
2. Meaningless	2. Meaningful
3. Cannot be used for decision making.	3. Can be used for decision making
4. As Input to computer	4. As Output from Computer
5. Data is normally huge in its volume	5. Information is normally short in volume
6. Data is used rarely	6. Information is used frequently

Data Processing Life Cycle

Data processing life cycle is collection of steps that converts data in to information, these steps are

- **Input:** In this step we are collecting data and give them to computer for processing.
- **Process:** In this step computer processor process the data to generate information.
- **Output:** in this step the information is given to user as output for their required purpose.
- **Storage:** in this step the given information is stored in the computer for future use.



What Is Data Processing

The system that process data and produce information is called data processing system.



Types of Data Processing system

we have two types of data processing

- ❖ **Manual Data Processing**
- ❖ **Electronic Data Processing**

Manual Data Processing	Electronic Data Processing
Also called Traditional Data processing system	Also called Computer Based Data processing system
The data is manually transferred to information by humans	The data is manually transferred to information by the machine
The humans being themselves collect data, arrange the data, perform manual calculation, and produce the required output	It uses computer and their hardware's, software's for processing the data
It is very simple and inexpensive but can be full of mistakes	The data processed by computer will be 100% accurate.
Manual data processing is slow	Electronic data processing is fast

What are the advantages of Electronic Data Processing?

- ❖ Cost of managing data is reduced. It aids decision making and data storage.
- ❖ Support of Business operations.
- ❖ Support of managerial decision making.
- ❖ Processing of data reduces paperwork and helps in reducing cost as the management of documents is costly.
- ❖ Helps in document management, enables use of integrated process and integrated system.
- ❖ Ability to search in a document saves time. In addition to this, it improves the internal and external collaboration.
- ❖ The famous software product such as Ms. Office is using the electronic data processing concept. The EDP has the facility to reduce the duplication of effort, repeated entries and make decisions.
- ❖ Provides effective control, increases data security, manages information assets and creates effective workflows.

What is computer?

The Word Computer is taken from Latin Word "**Compute**" which means **to calculate**.

A Computer is an electronic device that accepts input data and instructions with help of input device, store them until needed processes it and then produced the output as the result with the help of output devices

Definition: A computer is an electronic device which is used to store the data, process the data & retrieve the data.

Definition: A computer is an electronic device which used to take an input process on that and give us output.

Computer is composed of CPU, Input Devices, Output Devices, Storage Devices and Communication Devices. CPU is the Main Component of the Computer that Interpret and Execute the Instructions.

History of Computer

The term computing device is used for all machines that can perform calculation.

Early Computing Devices

- The **abacus** which was developed in Asia 5000 Years ago and this machine is still using, maybe consider the first computer.
- In the Year **1694** a **German** Mathematician and philosopher, **Gottfried Wilhem Von Leibniz** Created a **computing machine** that could add, subtract & multiply
- In the year 1822 the English Professor of mathematics, Charles Babbage developed a machine differential equation called **Difference Engine**.
- After working for 10 year Charles Babbage suddenly inspire and begin work first general Purpose Computer, which was called **Analytical Engine**.
- 1889 American Inventor developed **Tabulating Machine**, and its tasks was to find faster way to compute.
- Vannevar Bush developed **Calculator** in the year 1931 that solved all complex differentials.
- In the year 1941 a German Engineer Konrad Zuse had developed a computer the **Z3**.
- 1944 the IBM Produced **Mark I** electronic Calculator, perform basic and complex Calculation.
- **ENIAC** (Electronic Numerical Integrator and Computer) Developed by John Presper & John W.Mauchly, Speed was 1000 times faster than **Mark I**
- Von Neumann designed the electronic discrete Variable Automatic Computer (**EDVAC**) in 1945
- 1951 the **UNIVAC-I** Universal Automatic Computer
- Charles Babbage is the Father of Computer
- 1842 Charles Babbage (Calculating Machine)
- 1890 Punch Card (Use as a storage devices)
- 1942 ABC Computer (John Atanasoff & Clifford Berry)
- 1946 ENIAC (Electronic Numerical Integrator And Computer)

- 1958 The integrated Circuit also called chip
- 1970 Intel 1103 Computer Memory (RAM)
- 1971 Intel 4004 computer Microprocessor
- 1971 Floppy Disk (IBM)
- 1973 The Ethernet Computer Networking
- 1981 IBM introduce the first Home Computer (PC)
- 1983 Apple Lisa Computer (The first GUI Computer)
- 1984 Macintosh GUI Computer (Home Edition)
- 1995 Pentium Computer
- 1998 USB (Universal Serial Bus) Flash Drive
- 2006 Intel Core 2 Duo
- 2010 Core i3, i5, i7

Types of Computer

01. With Respect to Work
02. With respect to size
03. With respect to purpose

With respect to work we have 3 types of computer

01. Digital Computer: Is a Computer which can work on Digital Data.

The input data is represented by numbers. These are used for the logical and arithmetic operations.

- Based on digit.
- 0, 1 (0 for off, 1 for on).
- Show result in digit form.
- High speed.

Example: PC, IBM series, PDA, laptop, handheld, smartphone.....

02. Analog Computer: The Computers which provide us the information in continuous form are called. Process it and give the result in analog form. The output is usually on a graph the input data is not a number it is in a physical quantity like (Temperature, pressure, speed) etc.

- Limited memory.
- Used for specific work.
- High speed system.
- Used in the field of science and engineering.

Example: Speedometer in a car, Analog clock. Ohmmeter

03. Hybrid Computer: Is the computer which can work on both type of data, it can works on digital data and can be work on analog data.

- Feature of analog and digital.
- Combination of analog and digital.
- Represent data in analog and digital.
- Very high speed.
- These computer consist of Convertors which change analog
- Data into digital and digital into analog.
- Robots and laboratory.
- Use in Hospital ICU, Scientific Laboratories, Used in Petrol Pump.

With respect to Size we have four types of computer

- a. **Super Computers** are the most powerful and most expensive Computer design for the scientific, engineering and business applications. This computer can process a billion of instructions per second. Usage includes weather forecasting, weapon research, stock analysis, automobile Design, Movies special effects. High computing speed and high memory capacity for storing data, faster primary memory and faster secondary memory
- b. **Mainframe computers** are the second powerful computer and expensive after super computer. Mainframe computers are used by large organizations for critical applications. These computer has powerful processor and large memories to process large amount of data at very high speed. These computer used as super-server for large client server networks. Mainly these are used by Airline companies, Government Departments, Bank and insurance companies. ATM (Automated Teller Machine) is the example of it.
- c. **Minicomputer** is Also Called Mid-range Computer are similar to Mainframes, they are used by business and government to process large amounts of information. Minicomputers are mainly multi-users systems where more than one user can work simultaneously. Or we can say that minicomputer is multiprocessing system. Minicomputers are used for scientific and engineering computations, business-transaction processing, file handling, and database management, and are often now referred to as small or midsize servers.
- d. **Macro Computer** is also known as PC's, are smaller and less powerful than the others. They are used in homes, schools, and small businesses. These computer were designed only for individual users, but nowadays these computer become very powerful and can be used anywhere and can serve more than one user. Micro Computer by itself has different types
 - Desktop Computers
 - Laptop Computers / Notebook Computer
 - Handheld computers

With respect to Purpose we have two types of computer**General Purpose Computer**

- The Computer which is used generally any where

Special Purpose Computer

- The computer which is used for special task

Generation of Computers

First Generation of Computers (1940-1956)

The first computers used vacuum tubes as a processing device and magnetic drums as a storage device. Due to the use of vacuum tubes, the size of computers of this generation was large and need to entire room for adjustment. There are many features of first generation computers such as

- ✓ Large
- ✓ Expensive
- ✓ Consume electricity
- ✓ Less Speed
- ✓ Solve one problem at a time

Ex: **UNIVAC** (Universal Automatic Computer), **ENIAC** (Electronic Numerical Integrator and Computer)

Second Generation Computer (1956-1963)

The Computer of this generation used the transistors as processing device instead of vacuum tubes. The first computers of this generation were developed for the atomic energy industry. It was less expensive than the first generation computer. It produce less heat then the first generation computer. High-level programming languages were also being developed at this time, such as early versions of COBOL and FORTRAN.

- ✓ Small in size as compare to vacuum tubes
- ✓ Less Expensive
- ✓ Consume less electricity as compared to vacuum tubes
- ✓ Accuracy and speed high as compare to vacuum tubes

Third Generation Computers (1964-1971)

The computer of this generation used the Integrated Circuits (IC) as a processing device instead of transistors. Transistors were placed on silicon chips, called semiconductors. Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with an operating system. Allowed the device to run many different applications at one time.

- ✓ Small compare to second generation
- ✓ Less Expensive & Accurate
- ✓ Speed become high
- ✓ less electricity

Fourth Generation Computers (1971-present)

The microprocessor brought the fourth generation of computers, as thousands of integrated circuits were built onto a single silicon chip. The Intel 4004 chip, developed in 1971, located all the components of the computer. From the central processing unit and memory to input/output control so a single chip. Fourth generation computers also saw the development of GUIs, the mouse and handheld devices.

IBM Introduce the first home edition computer

- ✓ Small in size fit in the palm of hand
- ✓ High speed and accuracy due to microprocessor
- ✓ Easy to assemble due to different devices like Mouse, Keyboard etc.

Fifth generation computers present and beyond

Fifth generation computing devices, based on artificial intelligence. Are still in development, though there are some applications, such as voice recognition. The goal of fifth-generation computing is to develop devices that act as human and are capable of learning and self-organization.

Advantages of Computers

The use of computer was not so common several years ago as it is today.

The following are advantages/important of computer

1. Speed:

Computer works at a very high speed and are much faster than humans. A computer can perform billions of calculations in a second. The time used by a computer to perform an operation is called the processing speed. Computer speed is measured in Mega Hertz (MHz)

2. Storage:

A computer can store large amount of data permanently user can use this data at any time.

3. Processing:

A computer can process the given instruction. It can perform different type of processing like addition, subtract, division etc.

4. Accuracy:

Accuracy means to provide result without any error. Computer can process large amount of data and generate accurate result.

5. Communication:

Most computers today have the capability of communicating with other computer. We can connect two or more computer by communication device such as modem, NIC card (Network Interface Card).

6. Versatile:

A computer can perform different type of task. We can use computer in hospital, bank, Office or at home etc.

7. Cost reduction:

We can perform a difficult task in less time and less cost. For example we have hire many people to handle an office. The same work can be performed by a single person.

Disadvantages of Computer

Although a computer has many advantages that provide benefits for people in different areas, there are also various disadvantages to a computer. Below is given a list of many of the disadvantages of a computer and described what kind of problem you may face.

- Online Cyber crime
- Crashed Network
- Negative Effects on Environment
- Data and Information Violation
- Health Issues "Damage Eyes"
- Virus and Hacking Attacks
- Computer cannot work on itself
- Wasted of time
- No guaranteed Performance

Hardware and Software

Hardware: Computer hardware includes the physical parts of a computer, such as the case, central processing unit, monitor, mouse, keyboard, computer data storage, graphics card, sound card, speakers and motherboard.

Components of Hardware

- **Input Devices:** It is also called input unit.
Any hardware device through which we enter data to our computer is called input device.
Examples: Keyboard, Mouse, Webcam, Scanner, Microphone.
- **Output Devices:** It is also called output unit.
Any hardware devices which display information or give result to user are called output devices.
Example: LCD, Printer, Loudspeaker.
- **System Device:** Is also called system unit / system part.
Is the central part of computer which receive input signals/ data from the input device process on it and prepare information / result than convey to the output devices.
- **Storage Devices:**
The drive which store/hold data, information, instruction and programs for future use are called storage devices.
Example: Hard Disk, RAM, ROM, CD, DVD, USB
- **Communication Devices:**
The devices which are used for exchange of data from one device to another device is called communication device.
Example: Modem, Router, Switch, Hub, Repeater, Bridge etc.

Main Components of Computer

Keyboard: A computer keyboard is one of the primary input devices used with a computer. Similar to an electric typewriter, a keyboard is composed of buttons that create letters, numbers, and symbols, and other functions. The following sections provide more in-depth information and answers to some of the more frequently asked questions about the keyboard.

Different Type of Keys

Typing (alphanumeric) keys. These keys include the same letter, number, punctuation, and symbol keys found on a traditional typewriter.

Control keys. These keys are used alone or in combination with other keys to perform certain actions. The most frequently used control keys are Ctrl, Alt, the Windows logo key , and Esc.

Function keys. The function keys are used to perform specific tasks. They are labeled as F1, F2, F3, and so on, up to F12. The functionality of these keys differs from program to program.

Navigation keys. These keys are used for moving around in documents or webpages and editing text. They include the arrow keys, Home, End, Page Up, Page Down, Delete, and Insert.

Numeric keypad. The numeric keypad is handy for entering numbers quickly. The keys are grouped together in a block like a conventional calculator or adding machine.

Mouse: Computer mouse is an integral part of a computer. It allows the user to control the cursor, which is displayed on the screen, by moving the mouse itself on the table surface.

- Bluetooth Mouse
- Trackball Mouse
- Optical Mouse
- Laser Mouse
- Magic Mouse
- USB Mouse
- Vertical Mouse

LED: A light-emitting diode is a semiconductor light source that emits light when current flows through it. Electrons in the semiconductor recombine with electron holes, releasing energy in the form of photons.

LCD: A liquid-crystal display is a flat-panel display or other electronically modulated optical device that uses the light-modulating properties of liquid crystals combined with polarizers. Liquid crystals do not emit light directly, instead using a backlight or reflector to produce images in color or monochrome

CPU: Is stand for (**Central Processing Unit**) Sometimes referred to simply as the **central processor** or **Nerve Centre** or **heart**, but more commonly called processor, the CPU is where most calculations take place. The CPU is the brains of the computer.

Central processing unit (**CPU**) is the central component of the Computer System. Sometimes it is called as **microprocessor or processor**. It is the brain that runs the show inside the Computer. All functions and processes that is done on a computer is performed directly or indirectly by the processor. Obviously, computer processor is one of the most important element of the Computer system. CPU is consist of transistors that receives inputs and produces output. Transistors perform logical operations which is **called processing**. It is also, scientifically, not only one of the most amazing parts of the PC, but one of the most amazing devices in the world of technology.

Parts of CPU

Arithmetic Logic Unit (ALU): It is the part of computer processor (CPU) can be used to perform arithmetic and logic operations. An arithmetic-logic unit (ALU) is further divided into two parts, (AU) arithmetic unit and a (LU) logic unit.

Control Unit (CU): Decodes the program instruction. CPU chip used in a computer is partially made out of Silicon other words silicon chip used for data processing are called Micro Processor.

Registers: It is temporary storage areas of the computer processor. It is managed by control unit (CU). Registers holding data, instruction and address that are needed by program while running.

Input Devices

Track ball Mouse: is a pointing input device. It works in the same way as a mouse except that the ball is on top. This ball is moved by fingers or thumb and the pointer moves accordingly on screen. A trackball is a stationary (motionless) device related to the mouse. The trackball is used in laptop computer. There is no need of mouse pad for track ball.

Joystick: is a pointing device, which works on the same principle as a trackball. Typical uses of joystick include video games, training simulators and controlling industrial robots. It contains a stick and the button at the top of the stick is provided to make selection.

Scanner: Is an advance technology that is capable to recognize character, objects and picture known as "**Scanner**". It is used to enter data into the computer without need of retyping which save a lot of

time and has capability to convert bar-code into digits. OCR (**Optical Character Reader**) based optical scanning system are used extensively in the credit card billing operations of credit card companies and bank (ATM) etc.

Bar Code Reader (BCR): A device capable of reading data in the form of bar/lines. This device is dependent on the black & white stripes of the Universal Product Code (UPC). Used on items found in most supermarkets. Bar codes are used for labeling goods and stock in a shop after detecting the code, it transmits the data to the store's computer which locates the current price, updates the stock and prints the receipt for customer.

Microphone: It is an input device that is used for the input of voice in place of using the keyboard and mouse. Special software is used to convert voice into text. The microphone converts audio signals into digital form.

Pen-Based Computing (Light Pen): A light pen is a pointing input device. It provides input in the form of light-sensitive pen used in combination with a computer's monitor. It allows the user to point to display objects, or draw on the computer screen. Light pen is usually by engineer, graphic designer, and illustrator.

Touch screen: Touch screen is a video display screen that receives input from the touch of finger. The screen is covered with a plastic layer. The user enters data by touching icons or menus on the screen. Most touch screen computer use sensor to detect touch of a finger.

Video Camera: Video cameras are an input device that is able to capture images of any type data. Digital Camera is used to take and store picture in digital form. It does not use traditional camera film. It saves many and the photos can be customizing using different application - software.

Output Devices

An output devices are used to get the result of the processing done by the computer are called output devices. Most common output devices include Monitor, Printer, Speaker, Projector etc.

Printer: Printer is an output device that prints character, symbols, and graphics on piece paper. The printed output is called hard copy. Print resolution is commonly measured in dots per inch (dpi). Printer are divided into the following two categories.

- **Impact**
- **Non- impact**

Impact Printer: Impact printer works like a typewriter. It prints character or images by striking a print hammer or wheel against an inked ribbon. Impact printers are the following:

- ✓ **Dot-Matrix Printer**
- ✓ **Daisy-Wheel Printer**

Dot-Matrix Printer: They print by hammering the pins on the inked ribbon to leave ink impressions on the paper. Dot-matrix printers are noisy as compared to non-impact printers. Dot matrix printers are normally slow with speeds usually ranging 200 to 300 character per second. However, they are cheap in terms of both initial cost and cost of operation.

Daisy-Wheel Printer: They produce rather excellent letter-quality printout as compared the dot matrix printer. They work just like the typewriter and use a hammer and a wheel to print something on paper. But they are very much noisy and hence are not so popular.

Non-Impact Printer: They produce character without striking devices on paper. They are much quieter than impact printer.

The following are the non - impact printer.

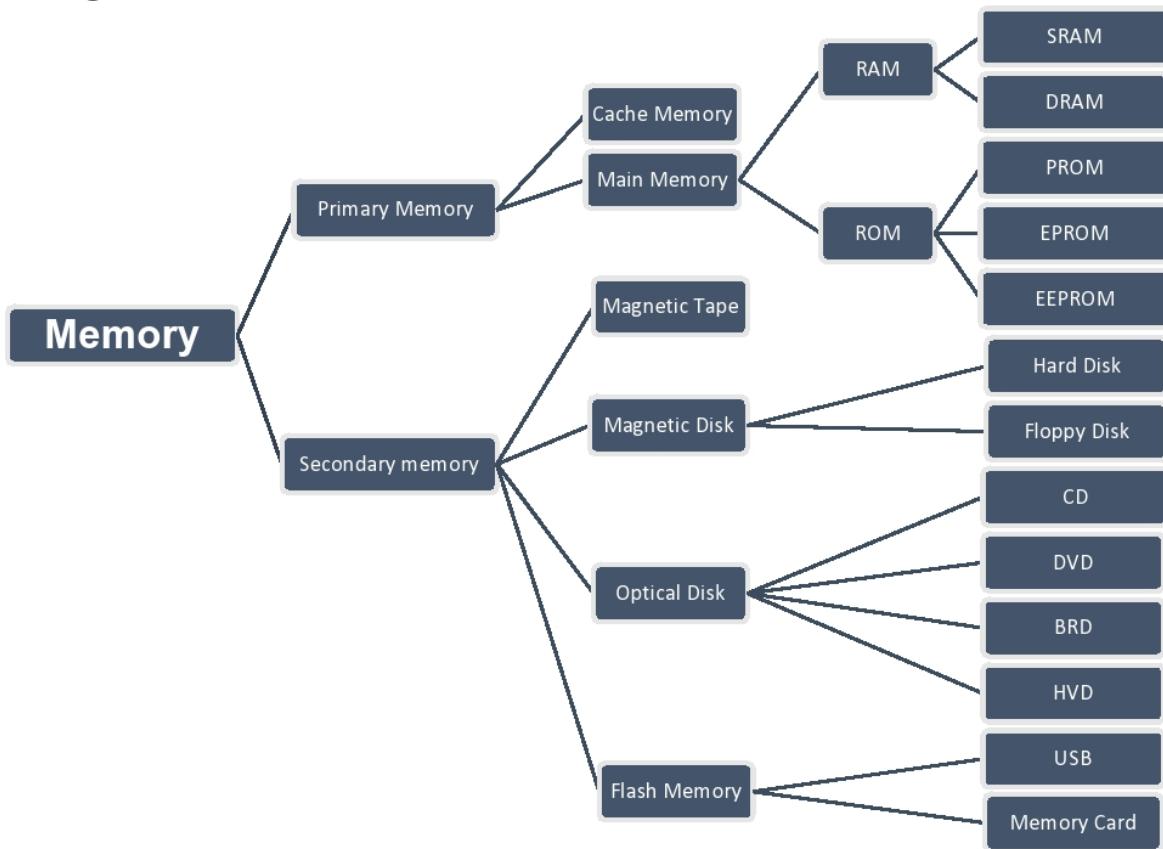
- ✓ **Laser Printer**
- ✓ **Inkjet Printer**

Laser Printer: A laser printer is a popular type of personal computer printer that uses a non-impact (keys don't strike the paper). It produces high-quality printout and are used for desktop publishing and graphics. A laser printer works on the principles of a Photocopier. Simply a metal drum called **TONER** is filled with special ink which, just sprinkle ink onto the paper and thus prints the character. They are very fast and use multiple fonts for text and graphics.

Ink-Jet Printer: It prints character and graphics by spraying tiny drops of liquid ink on paper. They can produce text and graphics in both black-white and color. Inkjet printer is slower than laser printers and can print 1 to 6 pages per minute. Its print quality is higher than dot matrix printer.

Plotter: A plotter is an output device that is used to produce quality graphics in a variety of colors. Plotters work by drawing lines on paper using pens held in a mechanical arm. They are mostly used for Engineering and Maps drawing purposes. Like design of mechanical components of an aircraft or car, etc.

Speaker & Headset: Speaker is an output device that produces audio output. These devices produce music, speech, or other sounds like beep etc. Speaker and Headsets are two commonly used audio output devices. It produces softcopy output. We use speakers to hear any type of sound.

Storage Devices

What is Computer Memory?

Computer memory is one the important and compulsory components of every computer system. Computer memory is used to store data or program on a temporary or permanent basis for use in a computer from the moment user turn the computer on until the time it is shut down, the CPU of the computer is constantly using memory.

Volatile Memory: Is the type of Storage whose contents are erased when the system's power is turned off.

Non-Volatile Memory: Is the type of storage whose contents are not erased when the system's power is turned off.

Types of Memory

01. Primary memory: Primary memory

is computer **memory** that is accessed directly by the CPU. This includes several types of **memory**, such as the processor cache and system ROM. However, in most cases, **primary memory** refers to system **RAM**. The memory or storage device which is used to hold the data or instructions for booting or other operation of microprocessor is called primary storage.

- Also called internal memory.
- Online to the processor.
- Composed of RAM and ROM
- It is also known as main memory.
- There are two types of main Memory.

RAM store data temporary.

- ❖ **RAM - Random Access Memory**
- ❖ Read/Write Memory
- ❖ Volatile
- ❖ Lost all the contents when power is turned off.

ROM store data permanent.

- ❖ **ROM - Read Only Memory**
- ❖ Non-volatile
- ❖ Data will not disappear when power is turned off

There are two types of RAM

	Static RAM (SRAM)	Dynamic RAM (DRAM)
1	In static RAM data is not refreshed periodically. In modern computer this form of Ram is used as cache Memory.	In Dynamic RAM, data is refreshed periodically. The important features are
2	SRAM is more Expensive Compare to DRAM	DRAM is less expensive as compare to SRAM.
3	Faster	Slower
4	Less Power require	More Power Needed
5	Complex structure 6 transistor to refresh a single bit.	Simple Structure because it need only 1 transistor and 1 capacitor to refresh a single bit.

ROM: It is an example of nonvolatile memory. **ROM full form is Read Only Memory.** It is a class of storage medium used in computers and other electronic devices. *Read Only Memory (ROM)*, also known as firmware, is an integrated circuit programmed with specific data when it is manufactured. The instructions for starting the computer are housed on Read only memory chip.

TYPES OF ROM

PROM: Short for programmable read-only memory, a memory chip on which data can be written only once. Once a program has been written onto a PROM, it remains there forever. Unlike RAM, PROMs retain their contents when the computer is turned off. The difference between a PROM and a ROM (read-only memory) is that a PROM is manufactured as blank memory, whereas a ROM is programmed during the manufacturing process. To write data onto a PROM chip, you need a special

device called a PROM programmer or PROM burner. The process of programming a PROM is sometimes called burning the PROM.

EPROM: Acronym for erasable programmable read-only memory, and pronounced EEPROM, EPROM is a special type of memory that retains its contents until it is exposed to ultraviolet light. The ultraviolet light clears its contents, making it possible to reprogram the memory. To write to and erase an EPROM, you need a special device called a PROM programmer or PROM burner.

EEPROM: Short form of electrically erasable programmable read-only memory. EEPROM is a special type of PROM that can be erased by exposing it to an electrical charge. Like other types of PROM, EEPROM retains its contents even when the power is turned off. Also like other types of ROM, EEPROM is not as fast as RAM.

02. Secondary Memory: **Secondary memory** refers to storage devices, such as hard drives and solid state drives. It may also refer to removable storage media, such as USB flash drives, CDs, and DVDs. Unlike primary **memory**, **secondary memory** is not accessed directly by the CPU. The devices of a computer that store information such as software and data permanently are called secondary storage.

- External Memory or Auxiliary Memory.
- It is a non-volatile memory that hold data until delete it or overwritten

Magnetic tape: Is a medium for magnetic recording, made of a thin, magnetizable coating on a long, narrow strip of plastic film. It was developed in Germany in 1928, based on magnetic wire recording.

Magnetic Disk: The magnetic Disk is made up of one or more rotating platters, on which data is stored magnetically. It is made up of plastic, coated on both sides with a special magnetic object that is iron oxide.

There are two main types of magnetic Disks

- **Floppy Disk:** It is a removable plastic Disk. It is not fixed in the computer.
- **Hard Disk:** It made up of one or more rotating Platter, which is encoded with magnetically object that is iron oxide.

Optical Disk: An optical disc is an electronic data storage medium that can be written to and read from using a low-powered laser beam. Originally developed in the late 1960s, the first optical disc, created by James T. Russell.

CD: Stand for **Compact Disk** in CD we can store the data up to 700 MB

DVD: **Digital Versatile Disk** or Digital Video Desk in DVD we can store the data up to 4.7 GB

BRD: Stand for Blue Ray Disk in BRD we can store the data up to 50 GB

HVD: Stand for Holographic Versatile Disk so in HVD we can store the data from 3TB to 6TB

Flash memory is a non-volatile **memory** chip used for storage and for transferring data between a personal computer (PC) and digital devices. It has the ability to be electronically reprogrammed and erased. It is often found in **USB flash drives**, MP3 players, digital cameras and solid-state **drives**.

- **USB (UNIVERSAL SERIAL BUS)**
- **MEMORY CARD**
 - Uses an electrically erasing technology.
 - Whole flash memory can be erased in one or few second.
 - Much faster than EPROM.

Cache Memory: Memory-Processing speed of CPU is about 50 times faster than RAM. It is very time-consuming to access the data from RAM again and again. To boost up the speed, new memory concept is introduced that top up with the central processing unit. CPUs have at least three independent caches: an instruction cache to speed up executable instruction fetch, a data cache to speed up data fetch and store, and a translation look a side buffer (TLB) used to speed up virtual-to-physical address translation for both executable instructions and data.

Cache is available in different size and different types like L1, L2, and L3 according to the usage of memory.

What is Software?

- ❖ A computer program or (set of instruction) that tells the computer how to perform a particular tasks.
- ❖ Software is set of instructions that direct the computer what to do and how to do. It turns the data into information that makes computer a useful machine.
- ❖ Software is the collection of programs which perform a specific task

Software, is a kind of program that enable a user to perform some specific task or used to operate a computer. It directs all the peripheral devices on the computer system – what to do and how to perform a task. PC Software plays the role of mediator between the user and computer hardware. Without software, a user can't perform any task on a digital computer.

A computer system can be divided into three components: the hardware, the software, and the users. Software can be further divide into mainly two parts: Application software and System Software. Bare use of hardware is not easy, so to make it easy, software created.

We have two Types of Software

01. System Software

02. Application Software

01. System software is a group of program that controls all the operation of computer. It also enables are other application programs to execute. It also controls all of the operation to move data into or out of the computer. It makes better and effective utilization of the entire computer system.

- **Operating System:** Is the set of Programs that manages and coordinates the hardware of a computer and provides services to applications software's. Without operating system computer cannot do anything.
Ex: Windows XP, Vista, Mac, 7, 8, 10, Linux.
- **Device Driver:** A device driver is a program that control a particular type of device that is attached to the computer. Without driver, a hardware device would not be able to work with the computer. There are device drivers for printers, monitors, CD-ROM drivers.
- **Utility Software:** Utility software is the kind of system software designed to analyze, configure, optimize and maintain the computer. A single piece of utility software is usually called a utility or tools. Utility software usually focuses on how the computer infrastructure operate. Ex: Disk Cleaner, Antivirus, Backup, Disk Defragmentation.
- **Language processor:** Language processor or translator is a type of system software that translates a source program into object program (machine Language).
Converts assembly and high-level language into machine language. Such that 0 and 1 form.
- **Assembler:** Converts Assembly Language code into binary code or Machine code
Ex: MOV B, M
- **Compiler:** Converts a high-level language code into binary code or we can say machine code.
- **Interpreter:** Work same as compiler but Interpreter Converts and executes one instruction at a time.

Application software

Is the type of software that can be used for a variety of takes It is not limited to one particular functions. It helps to solve problems in the real world.

Ex: MS Office, Photoshop, Accounting software.

There are two types of Application Software

01. General Purpose: The software programs that perform common information processing jobs for end users.

Ex: Educational Software, Entertainment Software

02. Special Purpose: The software that is designed to perform a special task is known as special purpose software.

Ex: Database software

What Is Computer Language

A language is a way of communication. A programming language allows a programmer to develop the sets of instruction that tell computer "what to do" and "How to do".

THERE ARE TWO TYPES OF LANGUAGE

- Low Level Language
- High Level Language

What Is Low Level Language

Machine language: the lowest and most elementary language of computer is machine language. Machine language is also called binary language or language of 0 and 1 computers direct understand machine language. Machine language is very difficult for humans to memory it or understand it.

What Is High Level Language

A type of language that is close to human language is called high level language. High level language gives formats to English language and use common mathematical notation. Program in high level language are much easier than low level language because program instruction re similar to those in every day English and contain commonly use mathematically notation. A translator program compiler or interpreter convert high level language into machine language.

What Is Translator

To convert the source code / Source Program into machine code or object code / object Program is called translator.

What is source code / source program?

A Program written in a non-machine language is called source code.

For Example: A program written in a High level language like FORTRAN, COBOL, C++, C etc.

What is object code / object program?

Source program is translated into the machine language. The translated program is called the object code / object program and is ready to be used by the computer.

What Is Compiler?

Compiler is a translator that convert the source code into machine code. Compiler convert the whole program at once time is called compiler.

What Is Interpreter?

Interpreter is a translator that convert the source the code into machine code. Interpreter convert the program statement by statement is called interpreter. Or a translator that convert that convert the program line by line is called interpreter.

The difference between Compiler and Interpreter

Compiler	Interpreter
Compiler converts a program into machine code as a whole	Interpreter converts a program into machine code statement by statement
Program execution is fast	Program execution is slow
Compiler display syntax errors after compiling the whole program	Interpreter display syntax errors on each statement of program

Impact of Computer

Uses of Computer: The well use of computer are uses of computer. Computer is just like a ball point we can use it in every dimension and it is strongly associated with all fields of life Speed up Computer is several times faster than human brain so it speeds up our work even complex calculation and numerical analysis etc.

❖ Computer in hospital

Using computer can easily diagnose a patient and all the previous record will be preserved with him.

❖ Computer in bank

Through computer all the accounts and data regarding accounts are safe and fully accurate preserved there by a specific account no.

❖ Computer in airport: At airport through computer all the arrival passenger's data the departure passenger data and their legal checking is on computer base.

- ❖ **All Fields association**

In short computer is strongly associated with all fields of life it may be either technical or non-technical, because due to computer we can work properly with high accuracy and low or zero errors

Misuse of Computer

Use of something not for their efficient purpose is its misuse

- ❖ **Entertainment:** use of computer only for enjoyment purpose.
- ❖ **Immorally use:** Watch different immoral movies and films.
- ❖ **Health wise:** To stay more in touch with computer leads to mental retardation and lowering of thinking capability loss of vision.
- ❖ **In form of net cafés:** the modern and well dominant misuse of computer in our society is in the form of net cafes, because it's is easily accessible to the new generation
- ❖ **Playing Games:** the new generation is addicted to playing digital games and spent most of their time playing games. Playing digital games effects their eye sight, loose their concentration from studies, setting at one place is also dangerous for health. In short they waste their prestigious property of time and health very badly.

Uses of Internet

Internet is used for beneficial purpose by human beings in many ways, some of which are as follow:

- ❖ **Access of information:** Internet is used for accessing information, news, research and educational material.
- ❖ **Business:** To conduct business from a remote location and monitoring one's business from a remote location (i.e. from another country).
- ❖ **Online banking:** Online transfers from one account to another or doing any other kind of transaction is the most important use of internet.
- ❖ **Online shopping:** Now days with the help of computer, one can buy things online from shops even abroad shops.
- ❖ **Video conferences:** Through video conferencing, online interviews, meetings or lectures are held very effectively and from a large distance in between.
- ❖ **File/Screen Sharing:** Through internet one can share files with other people online and even screen sharing is also done to get the expertise of experts from distant location.
- ❖ **News:** The newspapers are now days available online and once can read it online.
- ❖ **Search Engines:** Through advance search engines one can search for sites and information with in fraction of seconds.
- ❖ **Advertisement:** Many commercial organizations advertise through internet and the most suitable people see this information in advertisements.

Misuse of internet:

Misuses of internet has discussed below:

- ❖ **Viruses:** Viruses are mostly spread through internet and many innocent users are affected and lose their information.
- ❖ **Wastage of time:** Due to the excessive use of social networking sites and enjoyments sites a lot of time of students and professional is wasted and they lose concentration from their actual job.
- ❖ **Hacking:** One of the most dangerous disadvantage of internet is hacking. Due to hacking a lot of information is lost or the data is lost. Most users lose their credit card numbers etc.
- ❖ **Immorality:** The unethical contents and sites and misleading information has crowded the internet and the non-technical user might get affected very dangerously.
- ❖ **Security:** Security is a main issue for the sensitive data. It can be hacked over the internet and might get changed or get deleted. Also one privacy can be exploited. These security threats make computer internet the most dangerous things. It should be handled carefully.
- ❖ **Cybercrime:** Internet is now days used for negative activities, like hacking credit card numbers and passwords and using them for online shopping. Many governments have introduced laws for stopping cybercrimes.

What is Virus?

A computer virus is a malicious program that self-replicates by copying itself to another program. In other words, the computer virus spreads by itself into other executable code or documents. The purpose of creating a computer virus is to infect vulnerable systems, gain admin control and steal user sensitive data. Hackers design computer viruses with malicious intent and prey on online users by tricking them.

- It is designed to be non-detected

Virus Hoax

Is the type of Virus which can give you a warning through email which is fake? It does not exist in the reality & mislead the user through that message. It gives you a message like that your data is going to be destroyed and follow that whatever I say and the user follows the steps and loses all the personal data.

Ex: Going to website or delete some files from windows.

What is Antivirus?

Antivirus is a kind of software used to prevent, scan, detect and delete viruses from a computer. Once installed, most antivirus software runs automatically in the background to provide real-time protection against virus attacks. Computer antivirus are programs which help to remove any malicious code from your data files and alert you, when a virus, malware or Trojan enter into your system through use of external storage devices, shared devices computers of a network or internet.

What is Word-processing?

A word processor is a device or computer program that provides for input, editing, formatting and output of text, often with some additional features. Early word processors were stand-alone devices dedicated to the function, but current word processors are word processor programs running. A Word processing program is used to produce letters, applications and other documents. Word processing is used in business to generate different documents. Word processing includes a number of tools to format your pages.

For example, you can organize your text into columns, add page numbers, insert illustrations, etc.

Word helps you create and organize documents more efficiently. Microsoft Word is the most popular and common word processor.

Advantages of word processors

- It is faster and easier than writing by hand.
- You can store documents on your computer, which you cannot do on a typewriter.
- There are more formatting choices with a word processor (the spelling, grammar and language tools).
- You can print copies of your documents' on general purpose computers.

Word processing packages are:

- MS Word
- Word Pad
- Word Perfect
- Lotus
- Word Pro etc.

What is Spreadsheet?

A **spreadsheet** is a computer application for organization, analysis and storage of data in tabular form. Spreadsheets were developed as computerized analogs of paper accounting worksheets. The program operates on data entered in cells of a table.

- Data in spreadsheet is arranged in cells, formed by a sequential intersection of rows and columns in tabular form.
- The three most common general uses for **spreadsheet** software are to create budgets, produce graphs and charts, and for storing and sorting data. Within business **spreadsheet** software is used to forecast future performance, calculate tax, completing basic payroll, producing charts and calculating revenues.

Spreadsheet packages are

- Lotus 1-2-3 having rows = 65,536 and columns = 256
- Microsoft Excel 2016 having rows = 1048576 and columns = 16384
- Quattro Pro having rows = 1,000,000 and columns = 18,276

What is Database?

A **database** is a collection of information that is organized so that it can be easily accessed, managed and updated. A database is an organized collection of structured information, or data, typically stored electronically in a computer system. A database is usually controlled by a **database management system (DBMS)**. Together, the data and the DBMS, along with the applications that are associated with them, are referred to as a database system, often shortened to just database.

CAD (Computer Aided Design)

Computer aided Drafting: Is the process of preparing a drawing of an object on the screen of computer.

Computer Aided Design is the integration of the computer and graphics to aid in the areas of design of drafting. Computer aided design and drafting software are design for mechanical designer and draftsmen, but also for the other field. Architectural firms used for of CAD. Use of CAD Architecture can draw different design like room plan and different structural model. Computer Aided design, or simply CAD by definition is combination of hardware and software components providing the tool of planning and designing and modeling.

MCAD (Mechanical CAD)**AEC (Architecture Engineering and Construction)****GIS (Geographical Information System)****CAM (Computer Aided Manufacturing)**

CAM refer to the use of computer to assist in all operation of a manufacturing, plant including planning, management, transportation and storage. Today a single computer can control banks of robotics milling machine, lathes and welding machine and other tools. The use of computer to control the factory machines is the manufacturing process is called computer Aided Manufacturing.

CAM Software: CREO, DELL CAM, MASTER CAM.

AI (Artificial Intelligence)

The term AI stand for Artificial Intelligence and it sis the branch of computer science to deal with intellectual abilities of computers. At focus on rational thinking and act accordingly, similarly, it also focuses on the replacement of human expert of different fields. The main reasons for the introductions of AI are.

- Automated Problem solving
- Machine Learning
- Logic and deduction

Robotics

Robotics deals with the design, construction, operation, and use of **robots**, as well as computer systems for their control, sensory feedback, and information processing. These **technologies** are used to develop machines that can substitute for humans and replicate human actions. This technology produces computer-based machines which have computer based intelligence and computer control human like capabilities.

Most robots are unintelligent they programmed to do specific tasks. An unintelligent robot cannot respond to a situation for which it has not been specifically programmed.

Expert System

A piece of software which use database of expert knowledge to offer advice or make decision in such areas as medical diagnosis, account, coding and games etc. In artificial intelligence, an expert system is a computer system that emulates the decision-making ability of a human expert. Expert systems are designed to solve complex problems by reasoning through bodies of knowledge, represented mainly as if-then rules rather than through conventional procedural code.

Number System and Their Conversion

Number System: A number system is a term for a set of different symbols or digits. Which represents a numerical value or quantity. The number system varies according to their names, characteristics and utilization. Following are the four commonly used number systems:

- Decimal Number System.
- Binary Number System.
- Octal Number System.
- Hexadecimal Number System.

Decimal Number System

The most popular and commonly used number system is the decimal number system. As it supports all the mathematical and accounting concepts in the world. This number system is all called "Natural Number System" because it is natural to humans. Human beings use their ten fingers for counting numbers and the same is true with decimal system. It is composed of ten symbols or digits and hence the system is known as "Decimal Number System"

0 1 2 3 4 5 6 7 8 9 (0 is the smallest and 9 is the highest value)

Binary Number System

The binary number system is a way to write numbers using only two digits (0&1). These are used in computers as a series of "off" and "on" switches. As the total number of digits or symbols in the circuit, respectively. In such a way, binary number system is used in running and managing machine operation.

(0 1)

Octal Number System

Octal Number System as the name implies, (octal means eight). The octal system is commonly used with computers by grouping binary 3 bits. The octal number system uses 8 digits **0, 1,2,3,4,5,6,7**. It has base 8 and uses a power of 8 to determine the digit of a number's position.

For Example: 25 in decimal = 11001 in binary = 31 in octal.

Hexadecimal Number System

The Hexadecimal Number System has 16 digits or symbols (Hexa means six and decimal means ten, sum is sixteen) and hence has the base 16. This number system uses numerical values from **0-9** and alphabets from **A-F**. Alphabets from A-F represents decimal numbers from 10-15 **Example:** A is used in Place of 10. B is used in Place of 11. C is used in Place of 12 so on up to F in Place of 15. Hexadecimal number system is required in the assembly language programming.

The hexadecimal number system digits or symbols are as follow

0 1 2 3 4 5 6 7 8 9 A B C D E F

Ex: The representation of Number 18 and 28 in binary, octal, decimal and hexadecimal number systems is shown the following.

Number	In Binary Form	In Octal Form	In Decimal Form	In Hexa Form
18	10010	22	18	12
28	11100	34	28	1C

The list of valid and invalid examples of numbers system are shown in following table.

Example	Status (Valid/Invalid)	Description
$(10)_2$	Valid	
$(10)_8$	Valid	
$(10)_{10}$	Valid	
$(10)_{16}$	Valid	
$(AC)_{16}$	Valid	
$(1A)_{16}$	Valid	
$(G1)_{16}$	Invalid	G is not valid digit of Hexa Decimal number system
$(81)_8$	Invalid	8 is not valid digit in octal number system
$(13)_2$	Invalid	3 is not valid digit in binary number system
$(10.11)_2$	Valid	Here . is known as binary point instead of decimal point
$(1E.C4)_{16}$	Valid	Here . is known as Hexa point instead of decimal point

Conversion of Number System

A number of any number system can be represented into any other number system by using multiplication and remainder methods of math.

To convert the try to know these two steps

1. Convert Decimal number to any number we using multiplication rule
2. Convert Any number to Decimal number using division rule

01) Conversion of Binary number to Decimal Number

Any binary number can be converted into decimal by multiplying its digits with two (i.e. its base of No) and raised the power of each 2 from 0 to onward. Similarly, in case of use of binary point such as 1010.101, the power of each 2 increase for integer part and decrease for real part.

Method:

- ❖ Write binary number in power of 2 (base of binary system)
- ❖ Calculate the power, this will give the number in decimal

Example# 1: $(11011)_2$ to $(?)_{10}$

Let $(?)$ be the required decimal number.

$$(11011)_2 = (?)_{10}$$

Write 11011 in power of 2, we get

$$= 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$$

$$= 1 \times 16 + 1 \times 8 + 0 \times 4 + 1 \times 2 + 1 \times 1$$

$$= 16 + 8 + 0 + 2 + 1$$

$$= 27$$

$$(11011)_2 = (27)_{10}$$

Hence the result.

Example# 2: $(11000)_2$ to $(?)_{10}$

Let $(?)$ be the required decimal number.

$$(11000.1)_2 = (?)_{10}$$

Write 11000.1 in power of 2, we get

$$= 1 \times 2^4 + 1 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0 + 1 \times 2^{-1}$$

$$= 1 \times 16 + 1 \times 8 + 0 \times 4 + 0 \times 2 + 0 \times 1 + 1 \times 0.25$$

$$= 16 + 8 + 0 + 0 + 0 + 0.25$$

$$= 24.25$$

$$(11011.1)_2 \text{ to } (24.25)_{10}$$

Hence the result.

02) Conversion of Decimal number to Binary Number

Reminder method is used to convert a decimal to its binary number. This method can also be used to convert a decimal number into any other base. The man steps to apply remainder method are

Step-1. Divide the decimal number by the any other base (Here base is 2)

Step-2. Indicate remainder to the right.

Step-3. Continue dividing into each quotient (and indicating the remainder) until the divide operation produces a zero quotient.

Example: - Convert $(13)_{10}$ to $(?)_2$

Example# 1: $(13)_{10}$ to $(?)_2$

2	13
2	6 ----- 1
2	3 ----- 0
1	----- 1

$$(13)_{10} \text{ to } (1101)_2$$

Example# 2: $(13.25)_{10}$ to $(?)_2$

2	13
2	6 ----- 1
2	3 ----- 0
1	----- 1

$$\begin{aligned} 0.25 \times 2 &= 0.50 \\ 0.50 \times 2 &= 1.00 \end{aligned}$$

$$(13.25)_{10} \text{ to } (1101.01)_2$$

03) Conversion of Octal number to Decimal

Any octal number can be converted into decimal by multiplying its digit with 8 (i.e. its base of number) and raised the power of each 8 from 0 to onward. Similarly in case of use of binary points such as 345.14 the power of each 8 increases for integer part and decreases for real part.

Example: Convert $(2131)_8$ to $(?)_{10}$

1×8^0	$= 1 \times 1 = 1$
3×8^1	$= 3 \times 8 = 24$
1×8^2	$= 1 \times 64 = 64$
2×8^3	$= 2 \times 512 = 1024$
	1113

$$\text{Answers: } (2131)_8 \text{ to } (1113)_{10} \quad (2131.10)_8 \text{ to } (89.125)_{10}$$

Example: Convert $(2131.10)_8$ to $(?)_{10}$

0×8^{-2}	$= 0 \times 1/64 = 0$
1×8^{-1}	$= 1 \times 0.125 = 0.125$
1×8^0	$= 1 \times 1 = 1$
3×8^1	$= 3 \times 8 = 24$
1×8^2	$= 1 \times 64 = 64$
2×8^3	$= 2 \times 512 = 1024$
	89.125

04) Conversion of Decimal number to octal number

Reminder method is used to convert a decimal to its binary number. This method can also be used to convert a decimal number into any other base. The main steps to apply remainder method are

Step-1. Divide the decimal number by the any other base (Here base is 8)

Step-2. Indicate reminder to the right.

Step-3. Continue dividing into each quotient (and indicating the remainder) until the divide operation produces a zero quotient.

Example: Convert $(4010)_{10}$ into $(?)_8$

8	4010	Reminder
8	501	----- 2 ↑
8	62	----- 5
	7	----- 6

Answer: $(4010)_{10} = (7652)_8$

Example: Convert $(4010.35)_{10}$ to $(?)_8$

8	4010	Reminder
8	501	----- 2 ↑
8	62	----- 5
	7	----- 6

$$\begin{array}{l} 0.35 \times 8 = 2.80 \\ 0.80 \times 8 = 6.40 \\ 0.40 \times 8 = 3.20 \end{array} \downarrow$$

Answer: $(4010.35)_{10} = (7652.263)_8$

05) Conversion of Hexa Decimal number to Decimal number

Any octal number can be converted into decimal by multiplying its digit with 16 (i.e. its base of number) and raised the power of each 16 from 0 to onward. Similarly in case of use of binary points such as 345.14 the power of each 16 increases for integer part and decreases for real part.

Example: Convert $(13A)_{16}$ into $(?)_{10}$

A $\times 16^0$	= $10 \times 1 = 10$
3 $\times 16^1$	= $3 \times 16 = 48$
1 $\times 16^2$	= $1 \times 256 = 256$
	314

Answer: $(13A)_{16} = (314)_{10}$

Example: Convert $(13A)_{16}$ to $(?)_{10}$

0 $\times 16^{-2}$	= $0 \times 1/256 = 0$
1 $\times 16^{-1}$	= $1 \times 0.0625 = 0.0625$
1 $\times 16^0$	= $1 \times 1 = 16$
3 $\times 16^1$	= $3 \times 8 = 48$
1 $\times 16^2$	= $1 \times 64 = 256$
	320.0625

Answer: $(13A.10)_{16} = (320.0625)_{10}$

06) Conversion of Hexa Decimal number to octal number

Reminder method is used to convert a decimal to its binary number. This method can also be used to convert a decimal number into any other base. The main steps to apply remainder method are

Step-1. Divide the decimal number by the any other base (Here base is 16)

Step-2. Indicate reminder to the right.

Step-3. Continue dividing into each quotient (and indicating the remainder) until the divide operation produces a zero quotient.

Example: Convert $(6B510)_{16}$ into $(?)_8$

We cannot convert Hexadecimal number to octal and an octal number to Hexadecimal number first we have to convert Hexadecimal number to binary and then from binary to octal

6	B	5	1	0	→ Hexa Number
↓	↓	↓	↓	↓	
0110	1010	0101	0001	0000	→ Convert to binary representing in 4 bits
↓	↓	↓	↓	↓	
001	101	010	010	100	→ Binary Number representing in 3 bits
↓	↓	↓	↓	↓	
1	5	2	2	4	→ Convert into octal number
				2	
				0	

07) Conversion of Octal number to Hexadecimal number

We cannot convert Octal number to hexadecimal directly first we have to convert the octal number to binary number and then from binary number to hexadecimal number.

Example: Convert $(5327)_8$ into $(?)_{16}$

5	3	2	7	→ Convert octal number
↓	↓	↓	↓	
101	011	010	111	→ Binary number in 3 bits
↓	↓	↓	↓	
1010	1101	0111		→ Binary number in 4 bits
↓	↓	↓		
A	D	7		→ Convert into hexadecimal number

08) Conversion of Binary number to octal number

Example#1: Convert $(101011)_2$ to $(?)_8$

111	011	
↓	↓	
7	3	

Answers: $(101011)_2 = (73)_8$

Example#2: Convert $(101011.101)_2$ to $(?)_8$

111	011	.	101
↓	↓		↓
7	3		5

Answers: $(101011.101)_2 = (73.5)_8$

09) Conversion of Binary number to Hexadecimal number

Example#1: Convert $(1011101111)_2$ to $(?)_{16}$

0010	1110	1111	
↓	↓	↓	
2	14=E	15=F	

Answers: $(1011101111)_2 = (2EF)_{16}$

Example#2: Convert $(101100011.101)_2$ to $(?)_{16}$

0001	0110	0011	.	1010
↓	↓	↓		↓
1	6	3	.	A

Answers: $(101100011.101)_2 = (163.A)_{16}$

10) Conversion of Decimal number to Hexadecimal number

Example: Convert $(65510)_{10}$ into $(?)_{16}$

16	65510	Reminder	
16	4094	-----	6 ↑
16	255	-----	E
16	F	-----	F →

Answer: $(65510)_{10} = (FFE6)_{16}$

Example: Convert $(65510.40)_{10}$ into $(?)_{16}$

16	65510	Reminder	
16	4094	-----	6
16	255	-----	E

$$\begin{array}{l} 0.40 \times 16 = 6.40 \\ 0.40 \times 16 = 6.40 \\ 0.40 \times 16 = 6.40 \end{array} \downarrow$$

Answer: $(65510.40)_{10} = (FFE6.666)_{16}$

11) Conversion of Hexadecimal number to binary number

Example: Convert $(EAF)_{16}$ to $(?)_2$

E	A	F	
↓	↓	↓	
1110	1010	1111	

Answer: $(EAF)_{16} = (111010101111)_2$

Example: Convert $(EAF.B1)_{16}$ to $(?)_2$

E	A	F	.	B	1
↓	↓	↓		↓	
1110	1010	1111		1011	0001

Answer: $(EAF.B1)_{16} = (111010101111.10110001)_2$

12) Conversion of Octal number to binary number

Example: Convert $(157)_{16}$ to $(?)_2$

1	5	7	
↓	↓	↓	
001	101	111	

Answer: $(157)_{16} = (001101111)_2$

Example: Convert $(157.24)_{16}$ to $(?)_2$

1	5	7	.	2	4
↓	↓	↓		↓	
001	101	111		010	100

Answer: $(157.24)_{16} = (001101111.010100)_2$

BCD Binary Code: The term BCD stands for Binary Coded Decimal. It is four bit code that represent the decimal digits from 0 to 9 BCD is still suitable for input and output operations in digital systems. The bits weights which are used for BCD binary coded are 1, 2, 4 and 8. The binary codes of numbers from 10 (1010) to 15 (1111) are considered as don't care and are neglected. The main drawback of BCD code is that it cannot be support complements. Ex: 9's complement of decimal digits 3(0011) is 6(1100) but here 1100 is not valid BCD for decimal digit 6. In below table valid code of 6 is 0110.

Decimal	BCD Bits Weights			
	8	4	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
DON'T CARE CONDITIONS				
10	1	0	1	0
11	1	0	1	1
12	1	1	0	0
13	1	1	0	1
14	1	1	1	0
15	1	1	1	1

ASCII Code

The term ASCII stands for American Standard Code Information Interchange. It is 7-bit or 8-bit alphanumeric code. The ASCII code with 7-bit can represent 27 characters and with 8-bit can store 28 characters. Standard ASCII series

start from 00h to 7Fh, where 00h-1Fh is used as control characters and 20h-7Fh as graphics symbols, 8-bit code is extended ASCII supports 256 symbols where special graphics and math's symbols are added some important characters with ASCII codes are shown below.

Character	ASCII Code	ASCII Binary Codes							
		128	64	32	16	8	4	2	1
0	48	0	0	1	1	0	0	0	0
9	57	0	0	1	1	1	0	0	1
A	65	0	1	0	0	0	0	0	1
Z	90	0	1	0	1	1	0	1	0
a	97	0	1	1	0	0	0	0	1
z	122	0	1	1	1	1	0	1	0
Caps Lock Key	32	0	0	1	0	0	0	0	0
Tab	8	0	0	0	0	1	0	0	0

EBCDIC Code:

The term EBCDIC stand for Extended Binary Coded Decimal Interchange Code it is 8-bit alphanumeric code developed by IBM EBCDIC code can support 256 symbols. It was mainly used in IBM mainframe computers. The EBCDIC Code for alphabet and digits (0 to 9) are not in sequence and in ASCII binary code, so this one is the main reason of popularity of ASCII code.

Uni Code:

In 1987, Joe Backer form Xerox introduces the universal character set in the form Unicode. The Unicode standard the latest version of Unicode consists of a range of more than 109,000 characters covering 93 scripts and an enumeration of character properties such as upper and lower case. In other words, Unicode represents

a character in an abstract way and leaves the visual rendering (size, shape font or style) to other software, such as a web browser or word processor. Unicode has become the dominant scheme for internal processing and storage of text

What is a Computer Network?

Computer Network is a group of computers connected with each other through wires, optical fibers or optical links so that various devices can interact with each other through a network.

The aim of the computer network is the sharing of resources among various devices. In the case of computer network technology, there are several types of networks that vary from simple to complex level.

The Main Feature of Computer Network

A list Of Computer network features is given below.

- ✓ Communication speed
- ✓ Share of resources
- ✓ Reducing cost to purchase hardware
- ✓ File sharing
- ✓ Back up and Roll back is easy
- ✓ Software and Hardware sharing
- ✓ Security
- ✓ Scalability
- ✓ Reliability

Uses of Computer Network

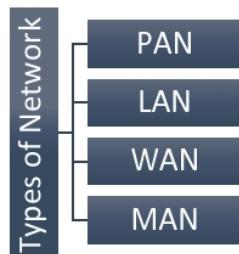
- **Resource sharing:** Resource sharing is the sharing of resources such as programs, printers, and data among the users on the network without the requirement of the physical location of the resource and user.
- **Server-Client model:** Computer networking is used in the **server-client model**. A server is a central computer used to store the information and maintained by the system administrator. Clients are the machines used to access the information stored in the server remotely.
- **Communication medium:** Computer network behaves as a communication medium among the users. For example, a company contains more than one computer has an email system which the employees use for daily communication.
- **E-commerce:** Computer network is also important in businesses. We can do the business over the internet. For example, amazon.com is doing their business over the internet, i.e., they are doing their business over the internet.

Computer Network Types with respect to Area

A computer network is a group of computers linked to each other that enables the computer to communicate with another computer and share their resources, data, and applications.

A computer network can be categorized by their size. A **computer network** is mainly of **four types**:

- ❖ **LAN**(Local Area Network)
- ❖ **PAN**(Personal Area Network)
- ❖ **MAN**(Metropolitan Area Network)
- ❖ **WAN**(Wide Area Network)



LAN (Local Area Network)

Local Area Network is a group of computers connected to each other in a small area such as building, office.

LAN is used for connecting two or more personal computers through a communication medium such as twisted pair, coaxial cable, etc.

It is less costly as it is built with inexpensive hardware such as hubs, network adapters, and Ethernet cables.

The data is transferred at an extremely faster rate in Local Area Network.

Local Area Network provides higher security.

PAN (Personal Area Network)

Personal Area Network is a network arranged within an individual person, typically within a range of 10 meters. Personal Area Network is used for connecting the computer devices of personal use is known as Personal Area Network. **Thomas Zimmerman** was the first research scientist to bring the idea of the Personal Area Network. Personal Area Network covers an area of **30 feet**. Personal computer devices that are used to develop the personal area network are the laptop, mobile phones, media player and play stations.

MAN (Metropolitan Area Network)

A metropolitan area network is a network that covers a larger geographic area by interconnecting a different LAN to form a larger network. Government agencies use MAN to connect to the citizens and private industries.

In MAN, various LANs are connected to each other through a telephone exchange line. The most widely used protocols in MAN are RS-232, Frame Relay, ATM, ISDN, OC-3, ADSL, etc.

It has a higher range than Local Area Network (LAN).

WAN (Wide Area Network)

A Wide Area Network is a network that extends over a large geographical area such as states or countries.

A Wide Area Network is quite bigger network than the LAN. A Wide Area Network is not limited to a single location, but it spans over a large geographical area through a telephone line, fiber optic cable or satellite links.

The internet is one of the biggest WAN in the world. A Wide Area Network is widely used in the field of Business, government, and education.

Types of Network with respect to Design

What is Peer to Peer Network?

Peer to peer is a simple and inexpensive network. It normally connects less than ten computers. Each computer in this network can share hardware, data or information of any computer in the network. Each computer stores files on its own storage devices. The operating system and application software are installed on all computers. Any computer in the network can use the resources of any other computer in the network. Peer to Peer network are suitable for small businesses and home users.

What is Server Base Network?

Client server is a network in which one or more computers work as servers and other computers work as clients. A client is a computer that is connected with a server to access different resources. The client computer sends request to the server for resources. The server computer provides the requested resources to the client computer. The client computer is less powerful than server computer.

What is Topology?

The physical layout of a network is called network topology. The physical topology of a network refers to the configuration of cables, computers, and other peripheral devices.

Bus Topology

Bus topology is the simplest topology and supports a small number of network of computers. In bus topology, all computers or network nodes are connected to common communication medium. This medium is often a central wire known as bus. Linear bus topology consists of a main cable act as backbone with a terminator at each end.

Ring Topology

Every computer is connected to the next computer in a ring. Each computer receives the message from the previous computer and transmits it to the next computer. The message flows in one direction. The message is passed around the ring until it reaches the correct destination computer.

Start Topology

In Star Topology each node (computer/networking device) is connected directly to a central point called hub or switch. Data on a star network passes through the hub or switch to reach its destination. Applications: Most of the LAN uses star topology.

Mesh Topology

In Mesh Topology each device has a point to point link to every other device. 1 node must be connected with $n-1$ nodes. A fully connected mesh can have $n(n-1)/2$ physical channels to link n devices. It must have $n-1$ I/O ports. Applications: Telephone Regional office **WAN** (Wide Area Network).

What is Networking Device?

The hardware used to transmit data, instructions and information between a sending and receiving device is called **communication device**. OR Networking devices are components used to connect computers or other device together so that they can share files or resources like Printer, Scanner and Fax machines. Networking devices are also called communicating devices. Sometimes, communication device may also convert the data from digital to analog and analog to digital signals.

Some important communication devices are as follows:

Node

Any system or device connected to a network is also called a node. It is a physical device attached to a network which is capable of sending, receiving, or forwarding information over a communications channel. A node can be a computer or some other device, such as a printer. Every node has a unique network address.

NIC Card

Every computer must have a NIC in order to connect with the network. Without NIC Network Device will not be able to communicate with each other. NIC is an interface that enables the computer to communicate over the network. It may be Internal/External or Wired/Wireless. NIC Card it send data from computer to the network and receive data from the network.

Modem

Modem is a communication device. Modem stands for **Modulator** and **Demodulator**. Modem sends and receives data from one computer to another on the internet through telephone lines. The sending and receiving computers have must modems.

Hub

The central connecting device in a computer network is known as a hub. It provides a central point for cables in a network. Hubs also transmit signals and have multiple ports to which devices are connected. Every computer is directly connected with the hub. Hub connects the computers to a network. When data arrives at hub, it broadcast to all the LAN cards in a network and the destined device picks them and all other computers discard the data.

Switch

Network switch is more intelligent device than hub. The switch improves the efficiency of the data transfer in the network. It receives a message from any device connected to the network and then transmits the message only to that device for which the message was sent.

Bridge

A bridge is type of computer network device. A **network bridge** can be used in computer networks to interconnect two LANs and to separate network segments. A segments is a section of a network separated by bridges, switches and routers.

What is Transmission Media?

The path through which data is transmitted from one computer to another is called **communication channel**. It is also known as communication media or transmission media. The amount of data that can be transferred through a communication medium in a unit of time is called **bandwidth**.

Types of Transmission Media

1. Wired / Guided / Bounded Media
2. Wireless / Unguided / Unbounded Media

Wired / Bounded Media

In bounded media, communication devices are directly connected with each other by using some physical media like wires. It is also called guided media or wire media. OR Bounded transmission media are the cables that are tangible or have physical existence and are limited by the physical geography. Popular bounded transmission media in use are twisted pair cable, co-axial cable and fiber optical cable. Each of them has its own characteristics and uses.

Twisted Pair Cable

Twisted pair cable is the most commonly used physical transmission medium. It is used in local area network to connect computers and other devices. Twisted pair cable consists of a pair of copper wires. The pair of wires is covered by a plastic insulation and it is twisted together. Twisting of wires protects them from interference by external electromagnetic waves.

Types of twisted pair cable

1. Shielded Twisted Pair (STP)
2. Un-shielded Twisted Pair (UTP)

Un-shielded Twisted Pair Cable

The most common twisted pair cable used in communication is UTP. The cable has four pairs of wires inside the jacket. Each pair is twisted to eliminate interference from adjacent pairs. UTP cable is installed using a Registered Jack-45 (RJ-45) connector. The RJ-45 is an eight-wire connector used commonly to connect computers onto a local-area network (LAN).

Shielded Twisted Pair Cable

In STP cable each pair of wires is individually shielded with foil. Then another shield covering all wires (8 wires = 4 pairs) as a group. UTP cable is installed using a Registered Jack-45 (RJ-45) connector. The extra shield improves the quality of the cable but is very expensive as compared to UTP and is rarely used.

What is Coaxial cable?

Coaxial cable consists of copper wire covered by an insulating material. The insulated copper wire is covered by copper mesh. The mesh protects the data signals from interference by external electromagnetic waves. Coaxial cable are used by the cable TV network and CCTV Camera network.

It is installed in BNC (Bayonet Niell Concelman) connector.

What is fiber optical cable?

Fiber optic cable consists of thin strands of glass or plastic called **core**. The strands are thin like human hair. The **core** is the center of the fiber optic cable that uses light to transmit data. Each strand is surrounded by a layer of glass inside the fiber optic cable called **cladding**. The cladding is further protected by a plastic coating called **jacket**. Most telephone companies, ISPs are using fiber optic in their networks.

Wireless / Unbounded Media

Un-bounded transmission media are the ways of transmitting data without using any cables. These media are not bounded by physical geography. This type of transmission is called wireless **communication**. It is also called un-guided media. It can be used to transfer the data all over the world. Nowadays wireless communication is becoming popular. Some example of un-bounded media for communication are as follows.

- ❖ **Microwaves signals**
- ❖ **Radio signals**
- ❖ **Infrared signals**

What is Microwaves?

Electromagnetic waves having frequencies between 1GHz and 300GHz. These waves are unidirectional, it means both the sender and receiver antennas must be in line-of-sight. These waves cannot penetrate walls. Microwave antennas are usually placed on top of buildings, mountain peaks. They are popular medium for both long-distance and metropolitan networks. Two types of antennas are used for microwave communications, Parabolic and Horn antenna.

What is Radio waves?

Electromagnetic waves ranging in frequencies between 3 KHz and 300GHz. Radio waves are (omnidirectional) transmitted by antenna in all directions? A sending antenna sends waves that can be received by receiving antenna. These waves can penetrate walls and can travel for long distance. This makes the radio waves a good medium for long-distance broadcasting communication such as FM, AM radio.

What is Infrared waves?

Electromagnetic waves having frequencies between 300GHz and 400THz. These waves cannot penetrate walls which prevents interference with other system. It can be used for short-range such as inside room or building and cannot be used outside because the sun rays contain infrared waves that can interfere with the communication.