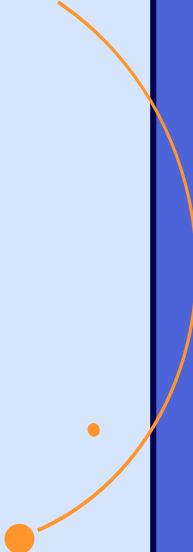


01

Computer System



Er. Mahesh Prashad Joshi

1.1 Introduction of Computer

Concept of computer:

- ✓ The word computer is derived from the Latin word 'computare' which means to calculate or the word computer is comes from the English word 'compute' which means to calculate. So that computer is a calculating device.
- ✓ Computer can perform complex mathematical calculations accurately in a short period of time.
- ✓ The modern computer has lots of capabilities like creating documents, videos, games, music presentation, etc.
- ✓ It can use AI (Artificial Intelligence) for understanding natural language, taking self-decision capabilities, analyzing graphs and patterns, etc.

Overall Combined Definition:

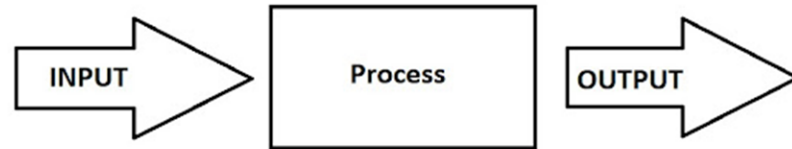
A computer is an electronic device that accepts raw data and instructions from users; processes it according to the given set of instructions, stores and gives meaningful information.

- Computer Means:

- ☐ C= Commonly
- ☐ O= Operating
- ☐ M= Machine
- ☐ P= Purposed by
- ☐ U= Unlimited
- ☐ T= Technology for
- ☐ E= Education and
- ☐ R= Research

Working of a Computer/ General Functions of Computer:

1. Inputting: It is the process of entering data and instruction into computer system.
2. Processing: It is the process of performing arithmetic and logical operation.
3. Storing: It is the process of saving or holding data, information and programs for future use.
4. Outputting: It is the process of producing useful information as a result.



I-P-O Cycle

Some Basic Terms in Computer:

1. Data: It is the collection of raw facts and figures about a person, place, and things etc. which can be recorded in the form of text, number, sound or image. Example, ram, 102, male etc.
2. Instruction: It is a command given to the computer to do s specific task.
3. Information: It is the processed form of data which we get in the required form. So it is very meaningful and useful to us.
4. Process: Processing is the conversion of inputted data into output (information) which is done by the processing unit of the computer.
5. Program: Program is set of instructions to perform specific task in a computer, a component of software.

Some Basic Terms in Computer:

6. Software: Software is the collection of computer programs to perform special work in a computer. Software tells the computer how to do and what to do.

7. Hardware: It is the physical parts of computer system which can be touch, felt and seen.

8. Input: It is data and instruction entered into computer for processing.

- 9. Output: It is called result or information.

10. Memory device: The device which is used to store data, instruction and information (temporarily or permanently) is called memory device. Examples are RAM, ROM, Hard Disk, Pen drive etc.

Characteristics of a Computer / Features of Computer:



Characteristics of a Computer / Features of Computer:

The main features or characteristics of computer are described below:

1. **Automatic:** A computer is an automatic device. It can do tasks automatically as instructed by software. It can automatically control various devices attached with computer system.
2. **Speed:** The calculation in the computer is at very high speeds. For example, a micro-computer can perform millions of instructions per second as many times without any mistake. The speed increases, as the power of computer increase. For example, a super computer can operate at speed measures on nanoseconds and even picosecond.

Characteristics of a Computer / Features of Computer:

The time taken to perform a task is measured in fraction of second:

Unit	Symbol	Equivalent in Seconds	Use Case
Millisecond	ms	1 ms = 1/1,000 sec (0.001 s)	Response time in apps, ping, loading time
Microsecond	μ s	1 μ s = 1/1,000,000 sec (0.000001 s)	CPU operations, embedded systems
Nanosecond	ns	1 ns = 1/1,000,000,000 sec	Memory access, signal processing
Picosecond	ps	1 ps = 1/1,000,000,000,000 sec	Scientific experiments, laser physics
Femtosecond	fs	1 fs = 1/1,000,000,000,000,000 sec	Ultra-fast spectroscopy

Characteristics of a Computer / Features of Computer:

• **3. Accuracy:** A computer performs tasks accurately. If data and instructions given to the computer are correct then it gives an accurate output. It means output totally depends on the given instructions and input data. If input data is incorrect then the output will be incorrect which is called GIGO (Garbage in Garbage out).

• **4. Storage:** Computer system consists of data storage unit. A computer has main storage and secondary storage. A large amount of data can be stored in secondary storage like hard disk, pen drive, CD/DVD, etc. for future use. The main memory (RAM) stores currently used data. Computer stores data in term of 0 and 1.

Characteristics of a Computer / Features of Computer:

Unit	Abbreviation	Equivalent In Bytes	Notes
Bit	b	1/8 byte	Smallest unit of data (0 or 1)
Byte	B	8 bits	Basic unit of data
Kilobyte	KB	1,024 bytes	Often used for small files like text
Megabyte	MB	1,024 KB	Common for images, music
Gigabyte	GB	1,024 MB	Used for videos, software
Terabyte	TB	1,024 GB	Used for hard drives, cloud storage
Petabyte	PB	1,024 TB	Very large data storage centers
Exabyte	EB	1,024 PB	Used in massive data environments
Zettabyte	ZB	1,024 EB	Global internet traffic per year
Yottabyte	YB	1,024 ZB	Beyond current common usage

Characteristics of a Computer / Features of Computer:

5. Diligence: A computer can continuously work for a long time without losing its speed and accuracy. So it is called diligent device. It doesn't get tired or bored or lazy while working.

6. Versatile: A computer is a versatile device which means it is flexible. It has capability of performing different types of tasks like drawing paints, playing games, music, calculations, sending an e-mail, desktop publishing work, etc. in different field efficiently. So it is used in different fields to perform varieties of tasks.

7. Reliability: Computers are used widely as they are reliable. The computer never gives the wrong result as long as the input is given correctly. The probability of error in the computer is negligible. A Huge amount of verities of data like monetary transaction, banking account, personal information is stored in a computer with the strong reliability to the computer.

Advantages and disadvantages of computer

Advantages/ Capabilities/ Benefits/ Merits

1. The computer can perform a complex operation in a short time.
2. The computer can process a large volume of data.
3. Computer can work continuously for a long time.
4. A single computer can perform multiple tasks such as watching a movie, playing games, listening song and others.
5. The computer does not make a mistake.
6. Computer increases the curricular performance of the student.

Advantages and disadvantages of computer

Disadvantages/Limitations/ Drawbacks/ De-merits

1. The computer does not have a brain and cannot decide itself.
2. It does not have its own intelligence.
3. The computer does not have emotion and feelings.
4. It needs electricity to operate.
5. It cannot operate itself, unless, a human command is given.

Application of computer

1. Home
2. Education
3. Industry
4. Business
5. Bank
6. Communication
7. Health and Medical Field
8. Computer In Graphics
9. Scientific Research
10. Defense
11. Entertainment

Application of computer

1. Computers at Home: Computers have already changed our lives at home. New gadgets such as automatic washing machines, dishwashers and microwaves have made our lives easier. Many of the educational software programs are used by children at homes. These programs enrich students' knowledge and skills.

2. Computers at School: Computers are used as teaching, research tools and analyzing systems in educational institutions. Educational software has become a major influence at all levels from elementary schools to universities.

3. Computers in Medicine: Computers have played very important roles in the growth and improvement of health care. They are used in medicine to keep the records of patients' case-histories, diagnosis and treatment of diseases. They are also used to monitor vital data during surgery in the operating theatre.

4. Industry

5. Business

6. Bank

7. Communication

8. Computer In Graphics

9. Scientific Research

10. Defense

11. Entertainment

Evolution of computer

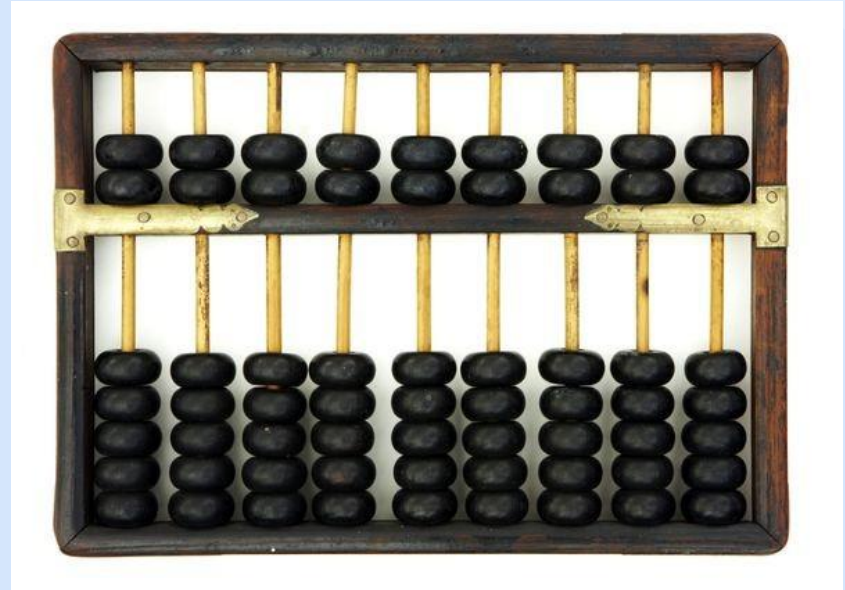
Evolution of computer is a study of past development of computer i.e. it is meant by the gradual improvements of accuracy, speed and efficiency of computers through generations. Ancient people lived on the earth for centuries without counting. The different generations are described below which has helped the humans for keeping records with the passing of time.

1. The Mechanical Era (Zeroth generation):

The calculator of this age was developed by using mechanical components like wood, metal, stone, bone, etc. It was used for simple mathematical calculations. Some of the popular calculations used in this ages are:

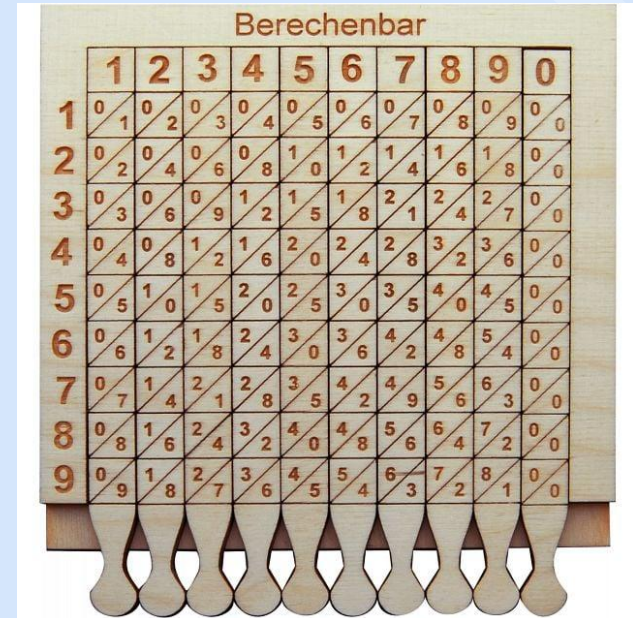
Evolution of computer

1. Abacus: Abacus is considered as the first calculating device. It was developed by Chinese and Egyptians around 3000 BC. It was used for performing simple calculation like counting, addition, subtraction and multiplication of number.



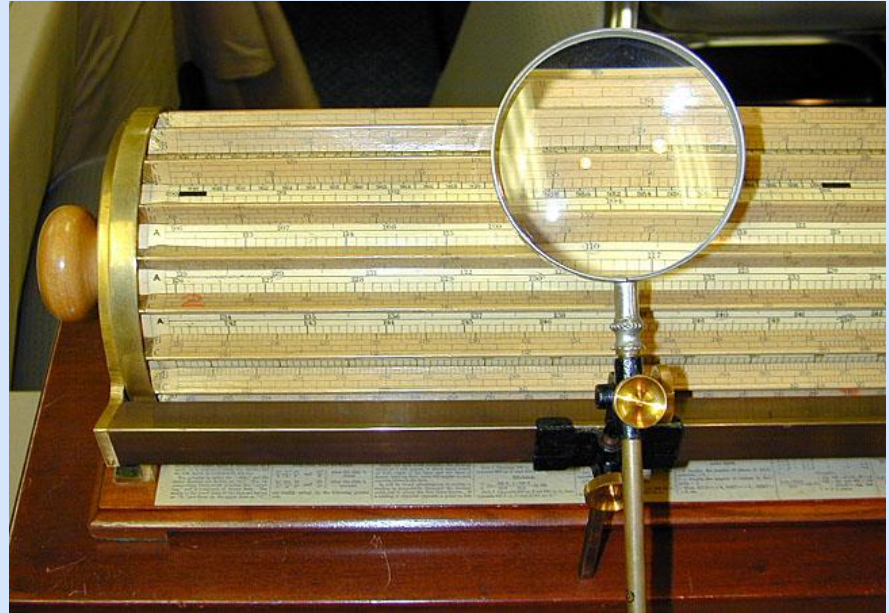
Evolution of computer

2. John Napier : THE SCOTTISH mathematician John Napier first published the table of logarithms in 1614 AD. It was very used and consists of a large number of calculations. . These are made of strips of bones on which numbers were carved and painted that's why it is also called Napier's bone.



Evolution of computer

3. William Oughtred : Slide Rule was developed by an English mathematician William Oughtred in 1620 AD. It is considered as the first analog device. It consists of two sets of scales overlapping together with marginal space between them. The rules were slide together for calculating. It is used for performing multiplication and division using the method of addition and subtraction.



Evolution of computer

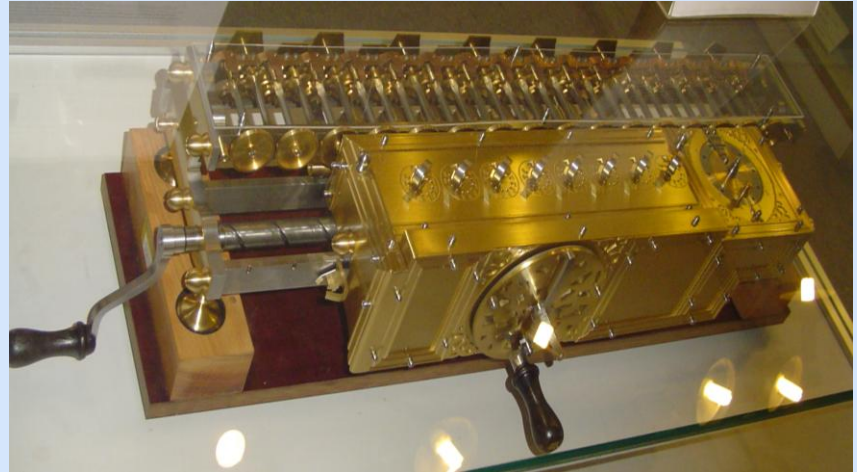
4. Blaise Pascal: The man name **Blaise Pascal**, was a brilliant mathematician who made a mercury barometer and measured atmospheric pressure to assist his father in his work accounting. Pascal invented the first mechanical calculation machine in Paris. It could only do addition and subtraction with numbers being entered by manipulating its dials.



Evolution of computer

5. Baron Gottfried Wilhelm Von Leibniz:

- Baron Leibniz invented the Stepped Reckoner calculator.
- It improved upon Pascal's original **Pascaline** design.
- The machine handled all four arithmetic operations.
- It could also calculate complex square roots.



Evolution of computer

6. Joseph Marie Jacquard: This was an automatic weaving machine. This machine was useful for weaving the patterns on the textiles. Punched cards were used to intricate design and produce the pattern in woven clothes.

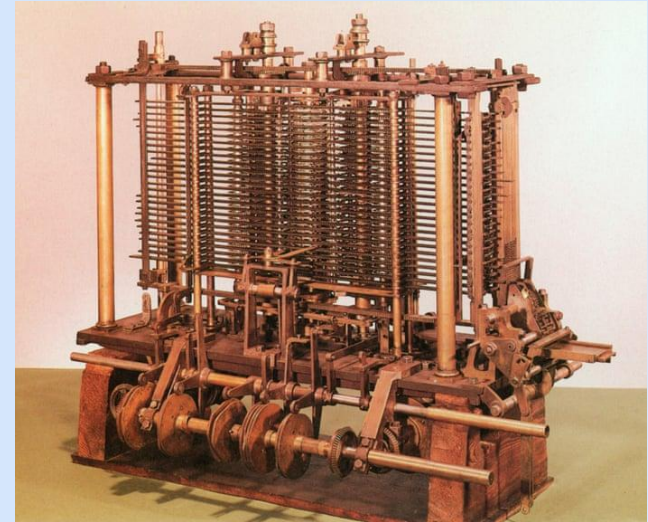


Evolution of computer

7. Charles Babbage: The English Professor and Mathematician, Charles Babbage, invented the Different Engines at Cambridge University, in 1822 AD. He developed the first mechanical computer called ***difference engine***.

It is capable of computing several sets of numbers and making hard copies of the results. Due to a lack of funding, he was never able to complete a full-scale functional version of this machine.

- Charles Babbage designed another machine named ***analytical engine*** that could be programmed to solve particular problems.
- Charles Babbage is considered as **Father of Modern computer.**



Evolution of computer

8. Lady Augusta Ada Byron Lovelace: The English intelligent and independent-minded woman, Lady Augusta, was a daughter of English poet Lord Byron and a very Great follower, assistant of Charles Babbage. Lady documents Babbage's work and writes programs for Babbage. This plan is now regarded as the first computer program. That's why she was considered the ***first computer programmer*** and a software language developed by the US Defense Department, was named **Ada** in her honor.



Evolution of computer

9. John Von Neumann: The Hungarian Mathematician, John gave an idea of stored program computer in the sense that program is stored internally in the main memory of the computer along with its associated data, in 1945. So, he is called the "**Father of Stored Program**".



Evolution of computer

2. The Electro-Mechanical Era:

The calculator of this age was developed by using mechanical and electronic component vacuum tube.

Evolution of computer

1. The Mark I Computer:

A Professor of Physics, Howard H. Aiken designed a general purpose mechanical computer at Harvard University and IBM Automatic Sequence Controlled Calculator (IBM ASCC). It was the first fully automatic calculating machine. It used binary numbers for its operation.

- **2. The Mark II Computer** Later, Mark II was invented by Aiken and his colleagues that were working electromechanical relays for its operation. It is 51 feet long, 8 feet height and 3 feet wide as bulky in size. It was capable of performing five basic arithmetic operations; additions, subtraction, multiplication, division and table reference. The result was printed at the rate of one result per five seconds.

Evolution of computer

3. The Atanasoff-Berry Computer:

In 1939, John Vincent Atanasoff and Clifford Berry designed Atanasoff-Berry computer or ABC solving systems of mathematical simultaneous equation. This computer was first electronic digital computer and was the first machine to use vacuum tubes.

- ### 4. The Colossus:

- In 1944, Colossus computer is designed by Alan M. Turing and build by British mathematician Alan Mathison Neuman. Alan with some colleagues, creates a computer named colossus at the University of Manchester, England, which comprised 1800 vacuum tubes.

Evolution of computer

3. The Electronic Computer Era

The computers of this age are developed by using electronic components like a vacuum tube, transistors IC, VLSI, etc. These computers are smaller, faster and more reliable.

1. The ENIAC:

- In 1946, John W. Mauchly and J. presper Eckert constructed ENIAC (Electronic Numerical Integrated and Calculator), at the Moore School of Engineering of the University of Pennsylvania, USA. ENIAC was the first **general-purpose, fully electronic, digital computer**. John Von Neumann was the consultant of the ENIAC project. It was a very large machine weighing about 30 tons and containing about 17,468 vacuum tubes, 70,000 resistors, 5 million soldered joints and it consumed 160 kilowatts.

Evolution of computer

2. The EDVAC:

EDVAC (Electronic Discrete Variable Automatic Computer) was developed by Dr. John Von Neumann, and a member of the Moore School of Engineering of the University of Pennsylvania, J.P. Eckert, and J.W. Mauchly. The EDVAC is used for more school personnel and the Ballistics Research Laboratory of the US Army, which was based on John Von Neumann's ideas of Stored Program".

3. EDSAC (Electronic Delay Storage Automatic Calculator):

EDSAC was the first **full sized stored program computer** built at the University of Cambridge by the group of scientist. It was built according to the John Von Neumann principles of stored program. The input and output were provided by the paper tapes. It could do about 700 addition and multiplication per second. The machine occupied a room with 5/4 meters.

Evolution of computer

4. The UNIVAC:

UNIVAC (Universal Automatic Computer) was developed by J.P.Eckert and J. Mauchly in 1951. It was the first computer manufactured for **commercial use**. It was designed to handle both numeric and textual information. Before this, all the computers were either used for defense or census was by General Electrical Corporation in 1954.

Generation of Computers

Computer generation is the classification of computers into different groups according to their manufacturing date, memory device, and other hardware and software technology used inside those computers.

Generation of computer is a steps in developing (advancing) technology.

Generation of Computers

1. First Generation Computer:

Features of first generation computers:

- 1) Technology used: vacuum tube.
- 2) Machines languages were used to instruct the computer.
- 3) Magnetic core memory was used as primary memory.
- 4) Electrostatic tubes, Paper tape, punch card, magnetic tape.
- 5) Punched card, printing devices were used for input/output operations and store the result.
- 6) It occupies very large space, slow processing, inefficient and unreliable due to low accuracy. Power consumption was very high and it generated much heat.
- 7) It could only perform straight forward simple numerical calculation.
- 8) Computer used to be much expensive.
- 9) The example of first generation computers is **ENIAC, UNIVAC, EDVAC, and EDSAC.**

Generation of Computers

2. Second Generation Computer:

Features of Second generation computers:

- 1) Technology used: Transistor
- 2) Operating speed was in terms of a microsecond.
- 3) Assembly language and machines independent language such as COBOL (Common Business Oriented Language) and FORTRAN (Formula Translation) were introduced.
- 4) Magnetic core memory was used as primary memory.
- 5) Magnetic drum and magnetic tape were used as secondary memory.
- 6) Power required to operate them was low.
- 7) It could perform scientific calculation such as solving differential equations.
- 8) Storage capacity and use of computers are increased.
- 9) The Example of second generation of computer are *IBM 1401, IBM 1620, IBM 7090 etc*

Generation of Computers

3. Third Generation Computer:

Features of Third generation computers:

- 1) The technology used: IC (Integrated Circuit).
- 2) Transistors were replaced by IC in their electronic circuitry.
- 3) High-level languages like FORTAN, BASIC and other are used to develop programs.
- 4) Semiconductor memory like RAM and ROM were used as primary memory.
- 5) Monitor and keyboard were introduced for data input and output respectively.
- 6) Multiprogramming facility was developed.
- 7) The computer was used in census calculation, military, banks and industries.
- 8) Size, cost, power requirement and heat generation decreased.
- 9) Processing speed and storage capacity used of computer increased.
- 10) The example of third generation of computer are IBM 360, IBM 370, PDP-11 etc.

Generation of Computers

4. Fourth Generation Computer:

Features of Fourth generation computers:

- 1) Technology in use: VLSI is introduced and used Microprocessor-based technology.
- 2) Problem-oriented fourth generation language (4GL) is used to develop the program.
- 3) Semiconductor like RAM, ROM and cache memory is used as a primary memory.
- 4) Magnetic disks like hard disk, optical disk (CD, DVD), Blue-ray disk, flashes memory (memory chip, pen drive) are used as secondary memory.
- 5) E-mail, Internet and mobile communication are developed.
- 6) Advanced, user-friendly, web page software are developed.
- 7) Size, cost, power requirement, heat generation decreased compared to the previous generation.
- 8) Operating speed, storage capacity ,use of computer increased compared to the previous generation.
- 9) The example of the fourth generation computer is IBM-PC, HP laptops, Mac notebook etc.

Generation of Computers

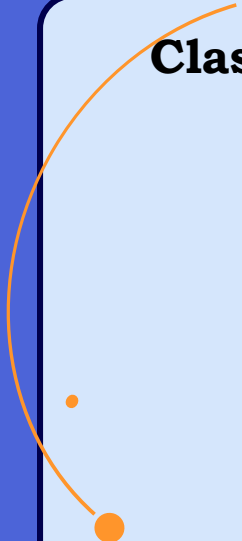
5. Fifth Generation Computer:

Features of Fifth generation computers:

- 1) Technology to be used: These machines will incorporate Bio-chip and VVLSI (Very Large Scale Integration) or Ultra-Large Scale Integration (ULSI).
- 2) The computer will have Artificial Intelligence (AI).
- 3) Natural language will be used to develop programs.
- 4) The computer will have parallel processing in full fledge.
- 5) The operating speed will be in terms of LIPS(Logical Inference per Second)
- 6) This aim is to solve highly complex problems, which require great intelligence and expertise when solved by people.
- 7) Quantum computation, molecular and nanotechnology will be used completely.
- 8) The example of fifth generation of computer are PARAM 1000, Intel P4, IBM laptops, notebooks, and PCs of Pentium.

AI (Artificial Intelligence):

- 1) It is a branch of computer science which concerned with programs that solves and analyze problems intelligently.
- 2) Artificial intelligence is the science of making machines imitates human thinking and behavior.



Classification of Computer

- 1) On the basis of purpose**
- 2) On the basis of Work**
- 3) On the basis of Size**
- 4) On the basis of Brand**
- 5) On the basis of Model**

Classification of Computer

1. On the basis of purpose

1. General-purpose computer

A general-purpose computer is a description of a computer capable of performing many different tasks rather than a specific one like a special-purpose computer. For example, in laptop ,to browsing the Internet, you can play a game, write a letter in a word processor, and other tasks.

2. Special Purpose computer

A special-purpose computer is embedded in almost all electronic devices and is the most widely used computer. This computer is designed for a specific task and is found in ATMs, cars, microwaves, TVs, the VCR, and other home electronics.

Classification of Computer

1. On the basis of purpose

Differences Between General Purpose Computer and Special Purpose Computer

SN	General Purpose Computer	SN	Special Purpose Computer
1	A computer designed to perform a wide variety of tasks.	1	A computer designed for a specific task or application.
2	Highly flexible and programmable for different uses.	2	Limited flexibility, performs only the task it is designed for.
3	Desktop computers, laptops, smartphones.	3	ATMs, washing machine controllers, traffic control systems.
4	Can be reprogrammed to perform new tasks.	4	Usually not reprogrammable or has very limited programming.
5	Generally cost-effective for multiple applications.	5	Can be more expensive due to specialized hardware.

Classification of Computer

1. On the basis of purpose

SN	General Purpose Computer	SN	Special Purpose Computer
6	Moderate performance, depends on software.	6	High performance for the specific task it is built for.
7	More complex due to versatility.	7	Simpler as it handles one specific function.
8	User can control and operate different software programs.	8	User has limited or no control over operations.
9	Larger memory and storage to support many applications.	9	Smaller memory as it only needs to store specific programs.
10	Word processing, internet browsing, gaming, etc.	10	Controlling industrial machines, embedded systems, etc.

Classification of Computer

2. On the basis of work

1. Analog Computer

Characteristics of analog computer

- 1) Based on continuous varying data.
- 2) Measure only natural or physical values.
- 3) Used for special purpose.
- 4) Generally, no storage facility is available because they work on real time basis. If provided, then only a little amount of storage is available in it.
- 5) Accuracy of these types of computer is very less because of noise and filtering facility.
- 6) Examples: - ohmmeter, speed meter, seismograph etc.

Classification of Computer

2. On the basis of work

2. Digital Computer

Characteristics of Digital computer

- 1) Based on discrete data which are not continuous with time.
- 2) Based on principle of logic 1 and 0 or high and low voltage.
- 3) Used for general purpose.
- 4) They are more reliable because of less noise and filtering facility.
- 5) It has large memory capacity because the calculations are to be stored internally for future use and re-programming.
- 6) It is multipurpose and programmable so, it is of high cost and faster processing.
- 7) Signal representation of digital pulse is as follows.
- 8) Example: - IBM PC, Apple/Macintosh etc.

Classification of Computer

2. On the basis of work

3. Hybrid Computer

Characteristics of Hybrid computer

- 1) It is the combination of qualities of analog as well as a digital computer.
- 2) It can process both continuous and discrete data.
- 3) It is special purpose computer.
- 4) It can convert one type of data into another.
- 5) It is mostly used in radar communication, rocket launching, weather forecasting and in other fields. It usually high cost compared to analog and digital computer.
- 6) Hybrid Machines are generally used in scientific applications or in controlling industrial processes.

Classification of Computer

2. On the basis of work

Differences Between Analog Computer and Digital Computer

SN	Analog Computer	SN	Digital Computer
1	Processes data in continuous form.	1	Processes data in discrete (binary) form.
2	Less accurate due to continuous signals and approximation.	2	Highly accurate due to binary (0 and 1) operations.
3	Faster in solving specific types of real-time and scientific problems.	3	Generally slower for real-time processing but fast in logical and arithmetic tasks.
4	Represents data using physical quantities (e.g., voltage, pressure).	4	Represents data using binary numbers (0s and 1s).

Classification of Computer

2. On the basis of work

Differences Between Analog Computer and Digital Computer

SN	Analog Computer	SN	Digital Computer
5	Used in scientific applications like simulations and control systems.	5	Used in general-purpose computing, business, education, etc.
6	Usually in the form of graphs, charts, or readings on dials/meters.	6	Output is in digital form—numbers, text, images on screens or printers.
7	Thermometer, speedometer, analog oscilloscope.	7	Laptop, smartphone, desktop, digital calculator.
8	Complex to design and maintain.	8	Easier to design and troubleshoot.
9	Cannot store data efficiently.	9	Can store large amounts of data in memory or storage devices.

Classification of Computer

3. On the basis of size

1) Micro Computer

These are the smallest computer systems on the basis of size. These computers are based on micro chips because microprocessor is used as memory device and they are very small. These computers are also called PC (personal computer) or home computers.

- **Characteristics of micro computer**

- 1) Smallest in terms of size can be kept on top of a desk (desktop), on top of laptop and like a notebook.
- 2) Speed and cost is also smaller.
- 3) Since a single user system is used, storage devices and memory are smaller sized.
- 4) Example: IBM Pentium Pc, Apple/ Macintosh etc.

Classification of Computer

3. On the basis of size

1) Micro Computer

Types of Micro Computer:

1. Desktop Computer:

- A Desktop computer is a personal computer that is designed to fit on top of a typical office desk.

2. Laptop Computer:

- A Laptop computer is a portable personal computer light and small enough to sit on a person's lap.

Classification of Computer

3. On the basis of size

1) Micro Computer

Types of Micro Computer:

3. Handheld computer:

It can fit one hand and we can operate it with the other hand. Because of its reduced size, the screen of handheld computer is quite small. Similarly, it also has small keyboard.

Notebook: Notebook is also designed for the people in move. But it is smaller in size compared to laptop. It is device with a reduced keyboard, screen, functionality, and software support than laptop.

Palm top: A small computer that literally fits in your palm. Compared to full size computers, palmtops are severely limited, but they are practical for certain function such as phone books and calendars.

Smart phone/PDA: A smart phone is a mobile phone that includes advanced functionality beyond making phone calls and sending text messages.

Classification of Computer

3. On the basis of size

2) Mini Computer

Minicomputer is medium in size it is bigger than micro and smaller than mainframe computer.

Characteristics of mini computer

- 1) Medium sized computer occupying approximately 10 sq. feet of area.
- 2) More than 50 terminals and large capacity storage devices than micro computer.
- 3) But minicomputer is smaller than mainframe computer.
- 4) Used for general purpose.
- 5) Used in medium sized organizations and corporations for their database administration.
- 6) Examples: - Prime 9755, vax 36 etc.

Classification of Computer

3. On the basis of size

3) Mainframe Computer

It has more storage capacity and fast processing speed. It takes about 100 sq. feet. At least 100 people can work at a time. A centrally located server or CPU is connected with more than 100 terminals.

- **Characteristics of Mainframe computer**

- 1) Larger in size with approximately 10000 sq. feet area.
- 2) Central processor, central administration.
- 3) More than 100 terminals, large capacity storage devices used.
- 4) Fastest and very expensive system.
- 5) It is General purpose computer.
- 6) It Used by large agencies and government for large scale data processing.
- 7) Examples: - IBM 1401, ICL 2950/10 etc.

Classification of Computer

3. On the basis of size

4) Super Computer

Super computer is very large machine which works in MIPS. They are most powerful and expensive computers. They have extremely large storage capacities and processing speed is at least 10 times faster than other computer.

- **Characteristics of Super computer**

- 1) It is very large and powerful computer.
- 2) It is large storage capacities and work is done by very fast.
- 3) It can calculate about 400 million numbers every second.
- 4) It can result is always exactly correct.
- 5) Super computers are used in weather forecasting petroleum engineering and medicine and for creating computer graphics.
- 6) It is used in weather research and scientific research.
- 7) Some examples of the super computers are CRAY, NEC Super SX11, and CYBER 205 etc.

Classification of Computer

4. On the basis of brand

1) IBM Computer (IBM PC)

IBM, which established by Dr. Herman Hollerith in 1923 AD, is the largest computer manufacturing company in the world till today. It uses the processors multimedia devices and some other hardware parts developed by some other Companies like Intel but use the principle of its own. So, all the computers developed by IBM Company are called IBM computers. Example: - IBM PC etc.

2) IBM Compatible

The computers developed by IBM company is itself are called branded or IBM PC computer which are developed or assembled by other companies using the parts and principle of IBM PCs are called IBM compatibles. So, IBM compatibles are also called duplicate of IBM PCs.

Classification of Computer

4. On the basis of brand

3) Apple / Macintosh Computer

Apple Corporation was established in 1970 AD in USA.

Within these 3 decades it has gone much forward and produced PCs with good qualities and user friendly.

- These computers are architecturally totally different than that of IBM's. Not only hardware part, but their software architecture is also totally different. Software made for IBM PC can't be run in Macintosh or vice versa.

Classification of Computer

4. On the basis of brand

Differences Between IBM PC and IBM Compatible:

Aspect	IBM PC	IBM Compatible
Manufacturer	Manufactured by IBM (International Business Machines Corporation).	Manufactured by other companies (not IBM) using IBM architecture.
Originality	Original product designed and produced by IBM.	Clone or copy of IBM PC, not original but functionally similar.
Hardware	Uses original IBM components and design.	May use third-party or varied components but maintains compatibility.
Cost	Generally more expensive due to brand and quality.	Usually cheaper and more affordable.

Classification of Computer

4. On the basis of brand

Differences Between IBM PC and IBM Compatible:

Aspect	IBM PC	IBM Compatible
Support and Warranty	Full IBM support and warranty services.	Support and warranty provided by the manufacturer (not IBM).
Quality and Standards	High quality, consistent with IBM standards.	May vary in quality depending on the manufacturer.
Software Compatibility	100% compatible with IBM software.	Compatible with IBM software but may face occasional issues.
Market Availability	Limited models and availability.	Wide range of models and widely available.

Classification of Computer

5. On the basis of Model

1) XT Computer

XT (Extra technology) computer are the old technology computers with much slower processing speed (not more than 4.77 MHz.). Advanced GUI (Graphical user interface) based Software like (Windows) can't be run in these computers. Everything was based on text based system.

2) AT Computer:-

AT (Advanced Technology) computers are the new technology computers. They are faster in processing (more than 2 GHZ) and can run any type of software whether that is text based or GUI based.

3) PS/2 Computer:-

PS (personal system)/2 computers actually, these are not totally different models of computers but are refinement of AT computers. These models were built 1990 and mostly used in laptop computers. Rechargeable and battery operated systems with faster and flexible

Mobile Computing and its applications



Mobile Computing

Mobile computing is the form of human-computer interaction by which a computer is expected to be transported during normal usages. Mobile computing has three aspects: mobile communication, mobile hardware and mobile software.

- - ✓ The first aspect addresses communication issues in ad-hoc and infrastructure networks as well as communication properties, protocol, data format and concrete technologies.
 - ✓ The second aspect is on hardware, e.g., mobile device or device components.
 - ✓ The third aspect deals with the characteristics and requirements of mobile applications.
 - ✓ Many types of mobile computers have been introduced since the 1990's including wearable computer, PDA, enterprise digital assistant, smart phone, UMPC (Ultra-mobile PC), Tablet PC.

Advantages of mobile computing

- **Portable** – Easy to carry and use anywhere.
- **Social interactivity** – Lets people communicate and share easily.
- **Context sensitivity** – Adapts to location, time, or situation.
- **Connectivity ability** – Always stays connected through networks.
- **Commonly used** – Used by almost everyone in daily life.
- **Quick services** – Provides fast access to information and apps.
- **Easy and quick enhancement** – Can be updated or improved easily.

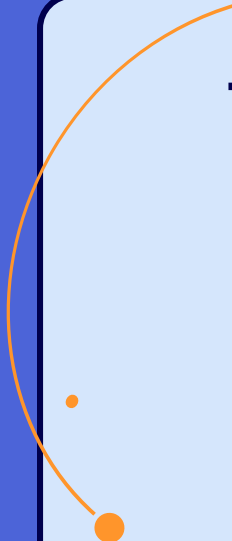
**Mobile Computing = Computing
on the Move**

Disadvantages of mobile computing

- **Insufficient bandwidth** – Internet speed may be slow or unstable.
- **Security standards** – Data can be hacked or misused if not protected.
- **Power consumption** – Devices run out of battery quickly.
- **Human interface with device** – Small screens and keyboards can be hard to use.

Application of Mobile Computing

- **Business** – Mobile computing allows employees to work remotely, attend online meetings, and access company data anytime. It improves productivity and faster decision-making.
- **Education** – Students can learn through e-books, online classes, and educational apps. Teachers can share notes and interact with students beyond classrooms.
- **Medical** – Doctors can access patient records, monitor health remotely, and provide telemedicine services. It helps in quick diagnosis and emergency care.
- **Banking** – Customers can check balances, transfer money, and pay bills through mobile banking apps. It makes financial transactions faster and safer.
- **Airlines** – Mobile computing helps passengers book tickets, check flight status, and use digital boarding passes. Airlines use it for better customer service and operations.
- **Defense**
- **Traffic etc**



1.2 Computer System and I/O devices

Concept of Computer Architecture and Organization

Computer architecture is a specification detailing how a set of software and hardware technology standards interact to form a computer system or platform.

- In short, computer architecture refers to how a computer system is designed and what technologies it is compatible with.

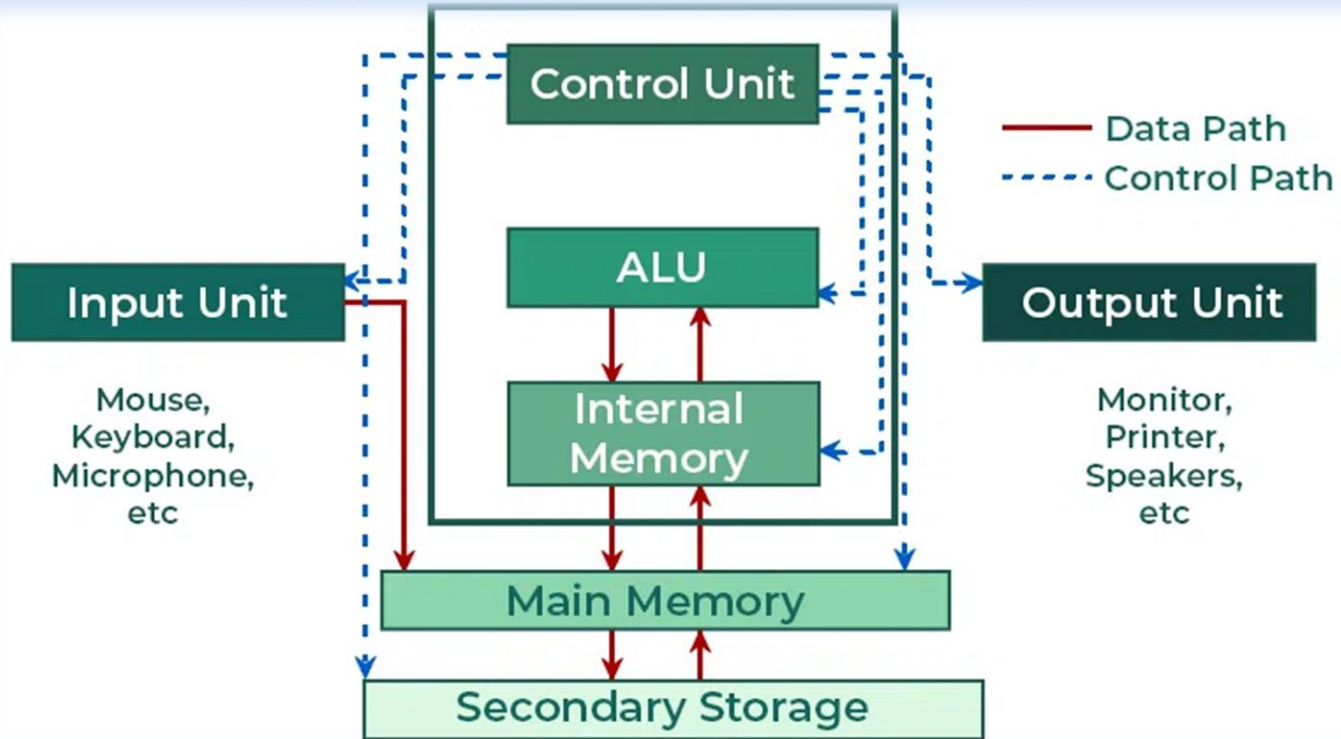
Concept of Computer Architecture and Organization

Computer organization explains how different parts of a computer system work together.

- It deals with the physical components (hardware) of the system.
- Focuses on the internal working, control signals, and data flow inside the computer.
- Describes the function of CPU, memory, I/O devices, and storage units.
- Explains how instructions are fetched, decoded, and executed.
- Covers registers, buses, ALU (Arithmetic Logic Unit), and control unit.
- Helps understand performance factors like speed, efficiency, and cost.

Assignment: Write Differences Between Computer Architecture and computer organization.

Component of computer system



Component of computer system

1. Input unit: It accepts the data or instructions given by the user and it converts the data and instructions from human readable to machine readable code.

→ Some common input devices are keyboard, mouse, scanner punched cards etc.

2. Central Processing Unit: The CPU (Central Processing Unit) is the brain of the computer because it controls everything the computer does. When you enter information using an input device, the CPU processes it. Some Primary Component of CPU are:

- A. Arithmetic Logic Unit:** ALU carries out the arithmetic and logical operations on the data made available to it.
- B. Control unit:** The control unit is the brain of the CPU itself. It controls overall operations and devices of computer.
- C. Memory Unit:** Memory Unit is the primary storage of the computer. It stores both data and instructions. Data and instructions are stored permanently in this unit so that they are available whenever required.

Component of computer system

Memory is mainly of two types:

- i. Primary/ Main Memory:** It is a volatile memory of computer. As soon as a computer starts, primary memory stores all running applications, operating system, user interface and any others. Its storage capacity is smaller but faster.
- ii. Secondary/ Auxiliary storage:** It is the secondary memory of computer. They have slower access rates but greater storage capacity and data stability. Auxiliary memory holds programs and data for future use because it is non-volatile.

3. Output Unit: When the computer its processing task, the results must be conveyed back to the user. Information from the CPU is converted into an understandable form through output devices.

Microprocessor

A microprocessor is a small electronic chip that acts as the brain of a computer. It performs all the major operations like calculations, decision-making, and controlling other parts of the system. It contains the CPU (central processing unit) on a single integrated circuit (IC).

Functions:

1. It controls the input and output devices of a computer.
2. It controls the storage of data inside a computer.
3. It performs the arithmetical and logical operations of computer.
4. It processes every type of data.
5. It handles every other parts of the computer.



Brain Of
Computer
!!

Microprocessor

Clock Speed: Clock speed of a microprocessor is the rate at which it executes instructions. It measures how many clock cycles the processor completes per second, usually expressed in Hertz (Hz) — such as MHz (million cycles per second) or GHz (billion cycles per second).

In simple words: Higher clock speed means the microprocessor can perform tasks faster.

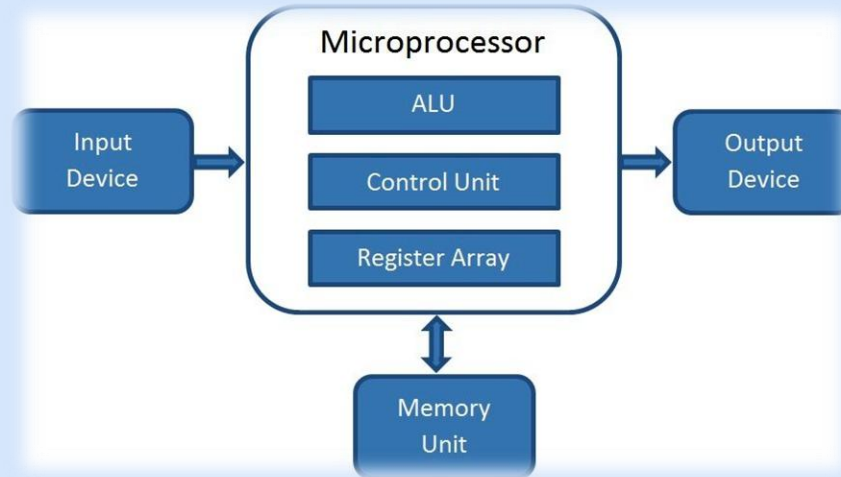
Microprocessor

Word length: Word length of a microprocessor refers to the number of bits it can process or handle at one time. It represents the size of data the CPU can work with in a single operation — for example, 8-bit, 16-bit, 32-bit, or 64-bit processors.

In simple words: Larger word length means the processor can handle more data at once and perform faster.

Microprocessor

Component of Microprocessor: The main component of microprocessor are ALU, Control Unit and Registers.

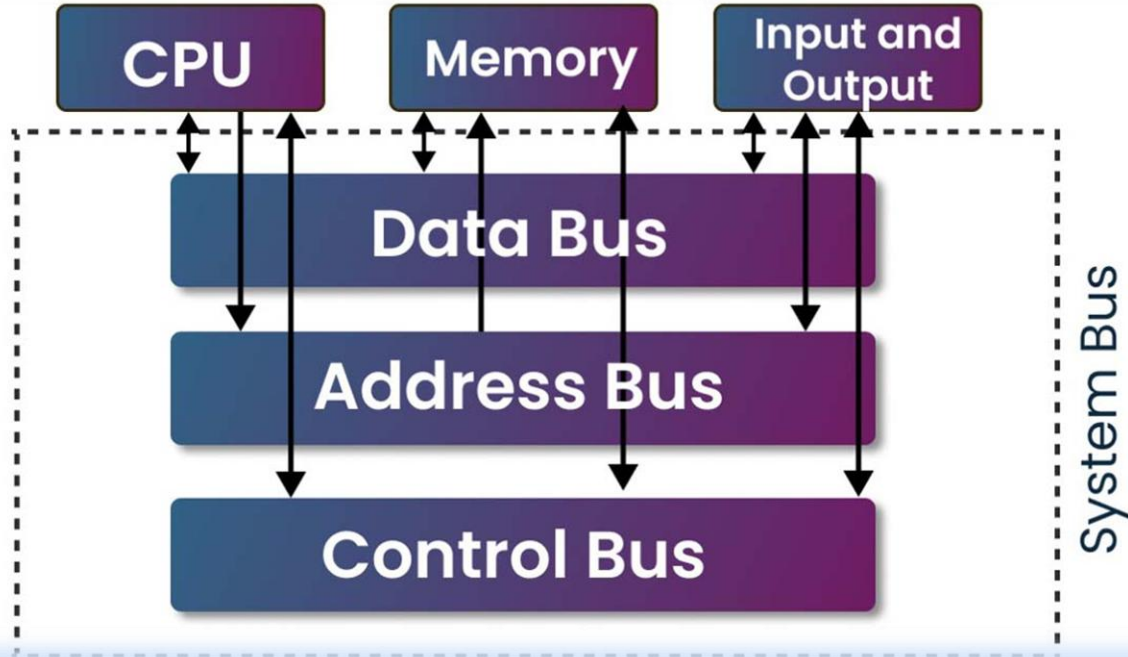


Microprocessor (Extra)

Types of Microprocessor: The main two types of microprocessor are:

1. CISC (Complex Instruction Set Computer)
2. RISC (Reduced Instruction Set Computer)

Bus System



Bus System

- ✓ Bus refers to the path between the components of a computer. Actually bus is set of hardware line(conductor) which lies inside the computer through which data is transmitted from one part of computer to the another part.
- ✓ The bus is a medium used to transfer data, memory address and control signal from one part to other part of computers.
- ✓ There are three types of bus :

Bus System

1. Data Bus

The **Data Bus** is used to transfer the actual data between the **CPU, memory, and input/output devices**.

It carries information such as numbers, characters, instructions, and files. The CPU can both **send data to devices** and **receive data from devices**.

Direction: Bidirectional ($\leftrightarrow$)

Example: When you open a file, data moves from memory to the CPU. When you save a file, data moves from the CPU to storage

Bus System

2. Address Bus

The **Address Bus** is used to transfer the **address (location)** of memory or an input/output device.

- The CPU uses it to tell where data should be stored or from where data should be read.
- Only the CPU sends addresses, so the information moves in one direction only.

Direction: Unidirectional (→)

Example: The CPU sends the address of a memory location to retrieve a particular piece of data.

Bus System

3. Control Bus

The **Control Bus** carries **control and timing signals** between the CPU and other devices.

- It controls the operations of the computer by sending signals such as **Read**, **Write**, and **Interrupt**.

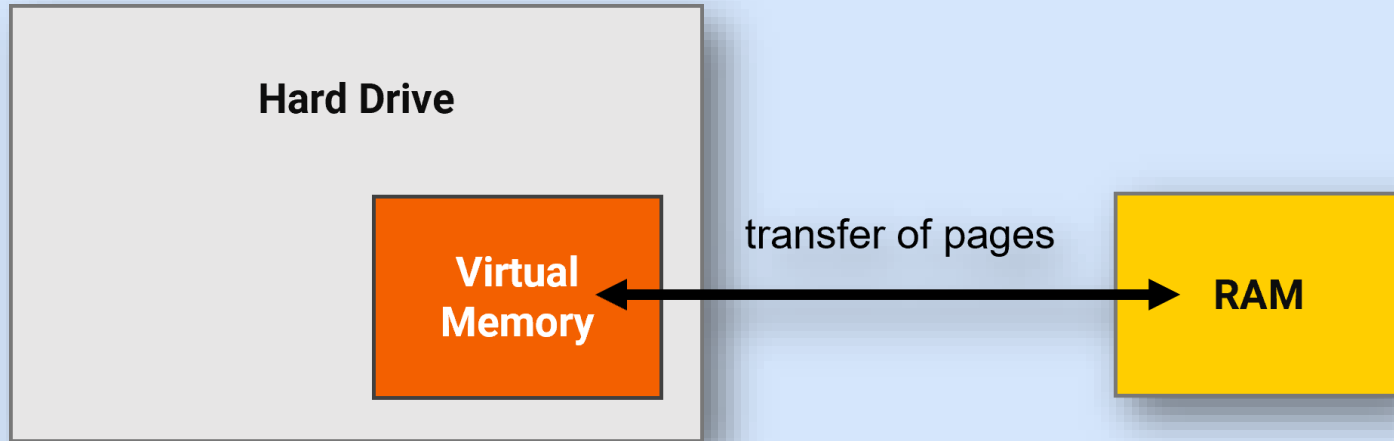
- Some signals are sent by the CPU, and some are sent back by other devices.

Direction: Mostly Bidirectional (↔)

Example: The CPU sends a **Read** signal to memory, and a device can send an **Interrupt** signal to the CPU.

Virtual Memory (Extra)

This is the hypothetical memory into the computer system. Exactly this is logical memory or not real memory exist into the computer system likewise physical memory (RAM).

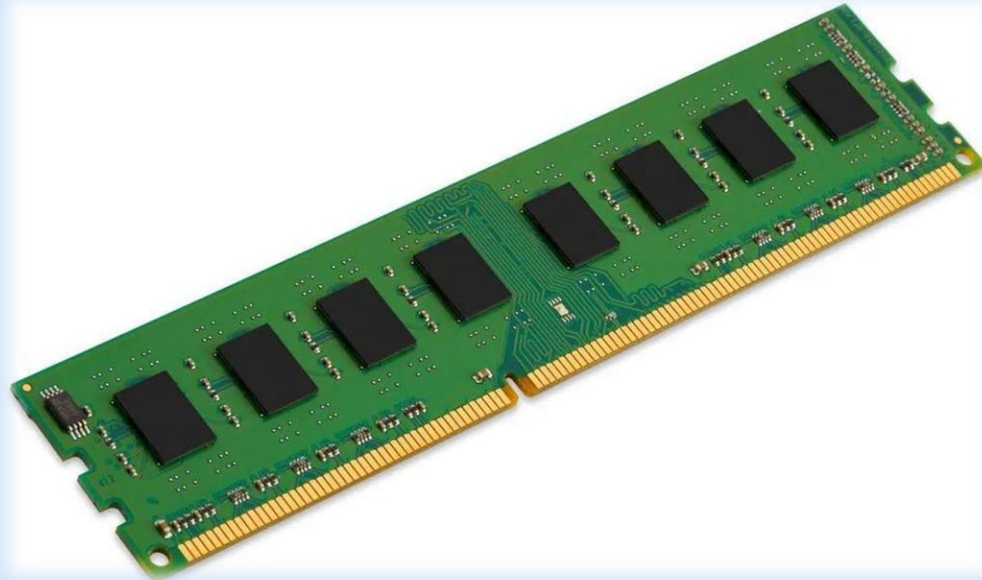


1.2.5 Primary Memory

1. Memory storage that communicates directly with CPU is called main memory.
2. It enables the computer to store, at least temporarily data and instruction.
3. It is mainly used to hold data and instructions and as well as the intermediate result of processing which the computer system is currently working on.
4. Primary memory is volatile, that is, it lose its content when power supply is off.
5. The Random access memory (RAM) is an example of a primary to main memory.

1.2.5 Primary Memory

RAM (Random Access Memory)



1.2.5 Primary Memory

RAM (Random Access Memory)

- ✓ RAM is the read/write memory of the computer.
- ✓ It is used for both purpose read and write.
- ✓ It possesses random access property that means CPU can access any memory location in a random sequence form.
- ✓ It is a volatile memory.
- ✓ It stores data or information as long as power supply is on. But, after power supply is off, data will be gone.

1.2.5 Primary Memory

RAM (Random Access Memory)

There are two types of RAM.

1. Static RAM (SRAM)

- ✓ SRAM stores data and programs as long as the computer is in ON state.
- ✓ It is expensive but faster for read/write than DRAM.
- ✓ It is typically used for CPU cache. DRAM is used for a computer's main memory.

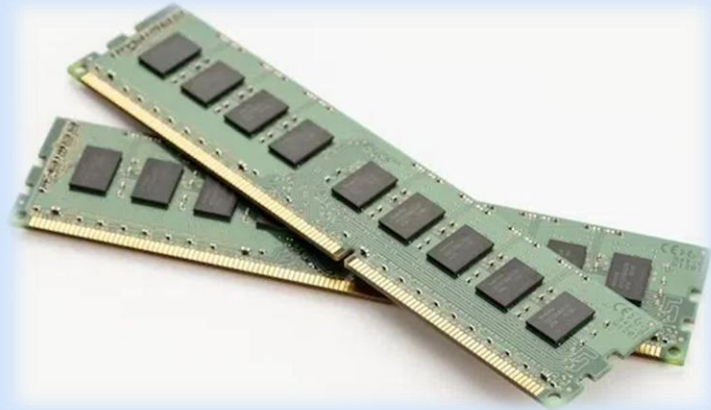


1.2.5 Primary Memory

RAM (Random Access Memory)

2. Dynamic RAM (DRAM)

- ✓ The data stored in DRAM will be lost after a few milliseconds even if the computer is on.
- ✓ It is cheap but slow for read/write than SRAM.
- ✓ DRAM is used for a computer's main memory.



1.2.5 Primary Memory

RAM (Random Access Memory)

Important Question !!

→ Write the difference between Static and Dynamic RAM.

1.2.5 Primary Memory

ROM (Read Only Memory)

- ✓ ROM stands for Read only memory.
- ✓ It can be used only to perform the read operations.
- ✓ It does not have write access.
- ✓ It is non-volatile memory i.e, the information stored in it is permanent and is not lost even if the power supply is cut down.
- ✓ It is used for permanent storage of programs.
- ✓ It is cheaper than RAM.

**ROM is cheaper than RAM on per unit basis
but while compared to storage ROM is
expensive than RAM.**

1.2.5 Primary Memory

ROM (Read Only Memory)

Types of ROM :

1. PROM (Programmable Read Only Memory):

- ✓ It is a programmable memory that users can write data at once only.
- ✓ The user can store permanent programs, data or any kind of information in PROM.

2. EPROM (Erasable Programmable Read Only Memory):

- ✓ It is an erasable memory.
- ✓ Data stored on it can be erasable via passing the Ultra-Violet light so that entire data will be erased.

3. EEPROM (Electrical erasable programmable read only memory):

- ✓ It is a memory that can also be erasable via electric.
- ✓ It can be erased and reprogrammed on the byte by byte basis single data or the entire chip can be erased.

1.2.5 Primary Memory

RAM (Random Access Memory)	ROM (Read Only Memory)
1. RAM is a volatile memory.	1. ROM is a non-volatile memory.
2. RAM supports read and write operations.	2. ROM supports read only operations.
3. RAM holds the programs and data that the CPU is currently processing.	3. ROM contains special instructions required for basic computer operations (booting, firmware).
4. It is used for buffering and temporary storage.	4. It is not used for buffering purposes.
5. It has higher memory capacity (usually larger in size).	5. It has lower memory capacity (usually smaller in size).
6. Data is lost when power is turned off.	6. Data is stored permanently, even without power.
7. Types of RAM: SRAM and DRAM.	7. Types of ROM: PROM, EPROM, and EEPROM.

1.2.5 Primary Memory

Cache Memory

- ✓ Cache memory pronounced as cash.
- ✓ Cache is a special high speed and expensive memory used in CPU, so that CPU doesn't have to wait for data to be delivered. The most frequently used instructions are kept in the cache memory.
- ✓ Cache memory computer runs fast and smoothly.
- ✓ It doesn't have to swap instruction in and out of RAM.
- ✓ The cache memory is placed in between CPU and RAM so that the speed of operation of main memory and cache memory together can meet speed requirements.

1.2.5 Primary Memory

Cache Memory

There are two processors in the cache:

1. **Cache Hit:** Firstly, the processor sends the address of the desired data to the cache, if the data is available, then , the event is called 'cache hit'.
2. **Cache Miss:** When the address sent by the processor is not present in the cache, the event is called cache miss. After the cache miss, the data of the main memory is copied to the cache for the next cache hit.

*Level of Cache:

L1, L2 Cache & L3 Cache

1.2.5 Primary Memory

Buffer

- ✓ Buffer is the temporary memory which stores the data from disk to RAM.
- ✓ The behavior of buffer is same as RAM but defined in disk.
- ✓ It is normally used between the CPU and the input/output devices.
- ✓ The purpose of a buffer is to hold data prior being used by CPU.
- ✓ Buffer is a small, high speed memory.
- ✓ It can be a reserved section of RAM or can be located in the input/ output devices.
- ✓ *The technique which is used to keep both the CPU and input/output device busy all the time is called buffering.*

<https://www.youtube.com/watch?v=xUeqVMqt1iE>

1.2.6 Secondary Memory

- ✓ Secondary / Auxiliary / External Storage/Backup Memory has a lower cost per bit. It generally has an operating speed far slower than that of primary memory. It is primarily used to store a large volume of data on the permanent basis that can be partially transferred to primary storage.
- ✓ It is not directly accessible to CPU.
- ✓ It requires primary memory for its operation.
- ✓ It is usually non-volatile memory.
- ✓ It is usually cheaper and slower for read /write operation than primary memory.

1.2.6 Secondary Memory

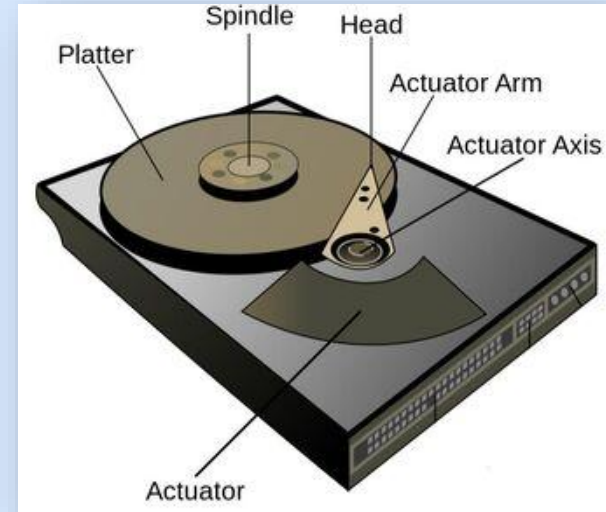
Magnetic Disk

- ✓ A magnetic disk is a storage device that contains a flat, circular platter coated with a magnetic material. Data is stored by magnetizing tiny regions on the disk surface.
- ✓ It is non-volatile, meaning data is not lost when power is turned off.
- ✓ The types of magnetic disk are hard disk, floppy disk etc.

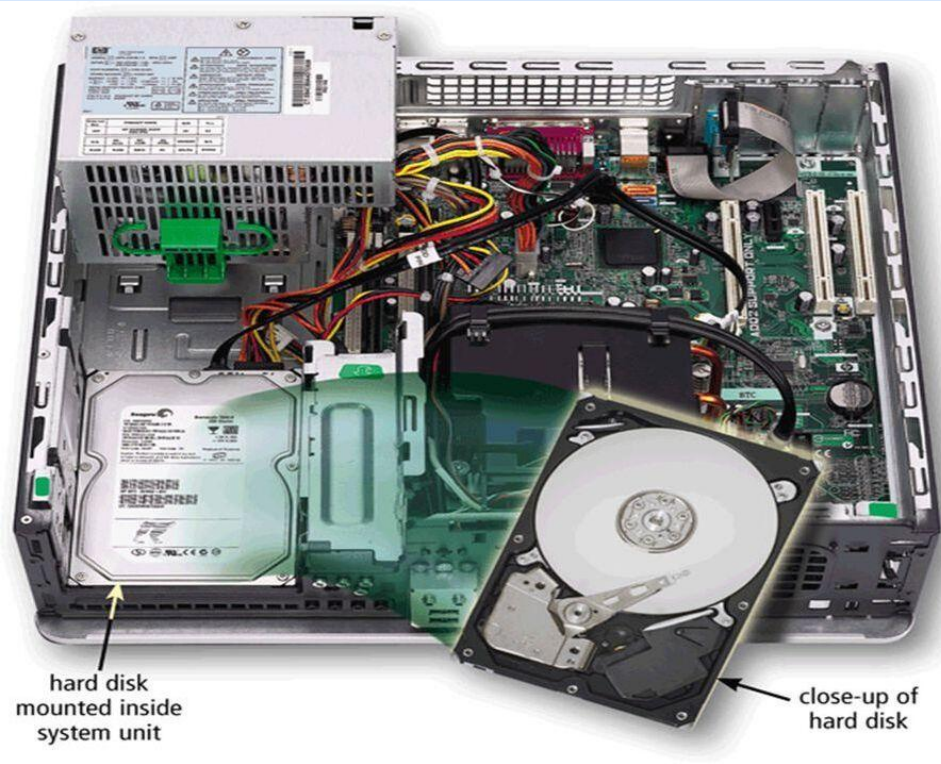
1.2.6 Secondary Memory

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1.2.6 Secondary Memory



1.2.6 Secondary Memory

Hard Disk

- ✓ Hard disk is commonly used storage device.
- ✓ It stores large amount of data and information permanently.
- ✓ It is also called fixed disk.
- ✓ It is made of aluminum materials and the surface is coated with the ferromagnetic element.
- ✓ Circular metal disk also called platters to rotate while writing or reading the data and information into them.
- ✓ The speed of the platters are measured in rpm (revolutions per minute). The hard disks with 5400 rpm or 7200, 15000 rpm are generally used in present-day computer system.
- ✓ A hard disk has a storage capacity in terms of gigabyte.

1.2.6 Secondary Memory

Advantages of Hard Disk

- ✓ Large storage capacity
- ✓ Low cost per GB
- ✓ Non-volatile storage
- ✓ Easy to replace and upgrade
- ✓ Supports random access
- ✓ Long lifespan if handled properly
- ✓ It is protected from dust, fires, heat etc.

1.2.6 Secondary Memory

Floppy Disk

- ✓ A **floppy disk** is a type of **magnetic storage device** used mainly in earlier computers (1970s–2000s).
- ✓ It is portable and lightweight, but has very **low storage capacity** compared to modern devices.
- ✓ Floppy disks have almost completely been replaced by CD's , DVD's.

1.2.6 Secondary Memory

Flash Memory

- ✓ Flash memory is a type of non-volatile memory used for storing data permanently.
- ✓ It does not require power to keep the stored information and has no moving parts, making it faster and more reliable than magnetic storage like HDDs and floppy disks.
- ✓ It is widely used in pen drives, memory cards, SSDs, smartphones, cameras, BIOS, and embedded systems.

1.2.6 Secondary Memory

Pen Drive

- ✓ A **pen drive** (also called **USB flash drive** or **thumb drive**) is a small, portable **flash memory-based storage device** that connects to a computer using a **USB (Universal Serial Bus)** port.
- ✓ It is widely used for transferring, storing, and backing up data.
- ✓ The storage capacity is GB to TB.

Advantages of Pen Drive

- ✓ Highly portable
- ✓ Easy to use (plug-and-play)
- ✓ Fast data transfer
- ✓ Durable and shock-resistant
- ✓ Rewritable thousands of times
- ✓ Compatible with many devices
- ✓ No need for external power
- ✓ Large storage options available



1.2.6 Secondary Memory

Memory Card

- ✓ A memory card is a **small, portable flash-memory storage device** used mainly in digital devices.
- ✓ Stores data **electronically** using flash memory (non-volatile).
- ✓ Very compact, lightweight, and durable.
- ✓ Commonly used in **mobile phones, cameras, tablets, drones, MP3 players**, etc.
- ✓ **Plug-and-play** device .
- ✓ Supports fast read/write operations.
- ✓ Can be removed and replaced easily.
- ✓ Storage capacity ranges from **2 GB to 1 TB+** depending on type.

1.2.6 Secondary Memory

Optical Disk

- ✓ The disc that uses laser light technology to store and retrieve data is called optical storage disc.
- ✓ The most commonly used optical storage discs are CD, DVD, Blu-ray disk, etc.

1.2.6 Secondary Memory

CD-ROM

A CD-ROM (Compact Disc Read-Only Memory) is a type of optical disc that stores data which can be read by a computer but cannot be written to or erased.

1.2.6 Secondary Memory

CD-RW

- ✓ CD-RW stands for Compact Disc-ReWritable, a digital optical disc format that allows data to be written, read, erased, and rewritten multiple times.
- ✓ Unlike a standard CD-R that can only be written to once, a CD-RW can be used for data that needs to be updated, such as backups or media files.

1.2.6 Secondary Memory

CD-R

CD-R stands for Compact Disc-Recordable, a type of optical disc that can be written to only once, but read many times.

These discs are used for data storage, such as backing up files or creating music CDs.

1.2.6 Secondary Memory

DVD

- ✓ DVD stands for Digital Versatile Disc or Digital Video Disc.
- ✓ Its storage capacity is higher than CD.
- ✓ Philips, Sony, Toshiba/ Panasonic companies developed first DVD in 1995. DVD Drive is used to read/write the data on DVD.



1.2.6 Secondary Memory

Difference between CD and DVD

S.N	CD	DVD
1.	The acquire size of <u>CD</u> is 700 MB.	While the acquire size of <u>DVD</u> is 4.7 GB to 17 GB.
2.	In CD, the recording or metal layer is situated on the top of disk.	While in DVD, the recording or metal layer is situated in middle of disk.
3.	In CD, the data transfer rate is 1.4 MB to 1.6 MB/sec.	While in DVD, the data transfer rate is 11 MB/sec.
4.	The thickness of CD is 1.2 mm.	While the thickness of DVD is 0.6 mm.

1.2.6 Secondary Memory

Blue-ray Disc

- ✓ A Blu-ray disc is a digital optical disc storage format designed to supersede the DVD, capable of holding high-definition video and large amounts of data.
- ✓ Its storage capacity is up to 200GB.



1.2.6 Secondary Memory

External Hard Disk



1.2.6 Secondary Memory

External Hard Disk

- ✓ An external hard disk is a portable storage device that connects to a computer via a USB, or Firmware cable to provide extra storage space for files and backups.
- ✓ There are two main types: Traditional Hard Disk Drives (HDDs), which use spinning magnetic disks, and Solid-State Drives (SSDs), which have no moving parts and are generally faster.
- ✓ They are used for storing large amounts of data, backing up important information, and transferring files between computers.

Write the
differences
between HDD
and SSD.

1.2.7 Input Devices

Input Unit

- ✓ The input unit is formed by the input devices attached to the computer.
- ✓ Input devices are used to interact with a computer system or used enter data and instructions to the computer.
- ✓ These devices convert input data and instructions into a suitable binary form such as ASCII, which can be acceptable by the computer.

In brief:

- ✓ It accepts data and instruction from the outside worlds.
- ✓ It converts these data and instruction into computer understandable from a binary form.
- ✓ It supplied the converted data and instruction to the computer system for further processing.
- ✓ Example of input devices are keyboard, mouse, scanner etc.

COMMONLY USED INPUT DEVICES

Keyboard

- ✓ A keyboard is the primary input device through which instructions and data are entered into the computer.
- ✓ It was first invented, in 1868 A.D, in America by Christopher Latham Sholes.
- ✓ This commonly used input device mostly uses a Qwerty layout. The layout is called "Qwerty layout" because such keyboard has those keys as the first 6 letters on top of an alphabetic line of a keyboard.



COMMONLY USED INPUT DEVICES

Keyboard

- ✓ A keyboard is connected to the CPU with a cable. When a key is pressed, an electronic signal is produced which is then detected by an electronic circuit called keyboard encoder.
- ✓ The main function of an encoder is to detect which key has been pressed and to send a binary code that is correspondent to the pressed key of a computer. This binary code may be ASCII, EBDIC or HEX code.

ASCII: American Standard Code for Information Interchange

EBCDIC: Extended Binary Coded Decimal Interchange Code

HEX: Hexadecimal

COMMONLY USED INPUT DEVICES

Keyboard

- ✓ These days, we have USB (Universal Serial Bus) port keyboard and some even wireless. Keyboard with navigation keys like play, pause, next, previous, etc. with multimedia functions is also available.
- ✓ There are 4 types of keyboards for PCs now available. The first 3 were invented by IBM while, the latter is the result of changes made when Microsoft Windows 95 was released. They are:
 - 1. The 83-key keyboard (PC/XT)
 2. The 84-key keyboard (PC/AT)
 3. The 102-key keyboard (called the extended keyboard)
 4. The 105-key Microsoft Windows 95-compatible keyboard)

COMMONLY USED INPUT DEVICES

Mouse

- ✓ A mouse is a small input device which is used to point, draw and select items that are displayed on the computer screen.
- ✓ The pointer of the mouse is called a cursor.
- ✓ As we move the mouse across the screen, the cursor moves according to the movement of the mouse.
- ✓ It was invented in 1960 A.D by Douglas Englebart.



COMMONLY USED INPUT DEVICES

Mouse

- ✓ Its movement and the direction of movement are detected by 2 rotating wheels on the underside of the mouse.
- ✓ These wheels have their axes at right angles where, in each wheel is connected to a shaft encoder which emits electrical pulses for every movement of the wheel.
- ✓ The pulses transmitted by the mouse determine the distance moved.

COMMONLY USED INPUT DEVICES

Mouse

✓ There are 3 types of mouse found in a market. They are:

- **a) Scroll mouse:** It is a type of mouse which comes with a scroll wheel perpendicular to its surface. This scroll wheel or a mouse wheel is made up of a rubbery disc or hard plastic on the computer mouse. It is generally located between the right and left mouse buttons.



COMMONLY USED INPUT DEVICES

Mouse

b) Optical mouse: It is a more advanced mouse which uses a light source, typically LED (Light Emitting Diode), a DSP (Digital Signal Processing) and an optical sensor instead of the regular mouse ball. It uses a light detector such as an image sensor or an array of photodiodes to detect any relative movement to a surface.



COMMONLY USED INPUT DEVICES

Mouse

c) Laser mouse: It is an even more advanced mouse which uses laser to detect movements on a surface. It can track more than 2,000 DPI (Dots Per Inch) whereas, a typical optical mouse can track between 400 and 800 DPI only.



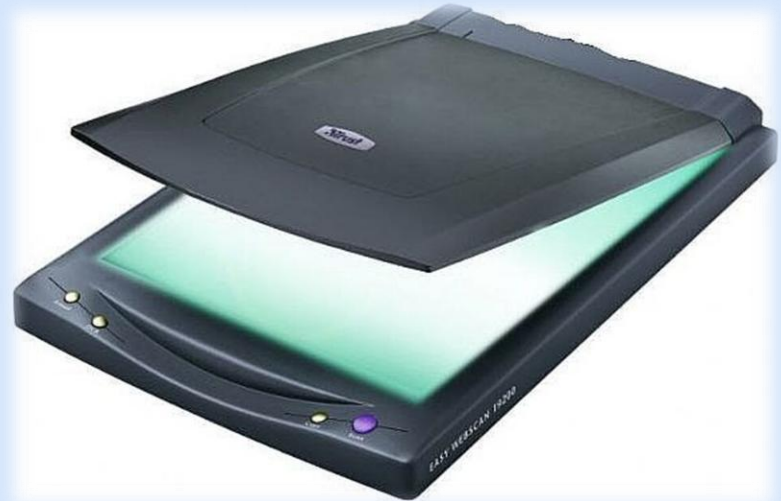
COMMONLY USED INPUT DEVICES

Scanner

The scanner is an input device that needs images or text and converts the data into digital signals.

The image is scanned and converted into a format that the PC can interpret.

- It was invented by Rudolph Hell, in 1963 A.D, in Germany.



COMMONLY USED INPUT DEVICES

Light Pen

- ✓ A light pen is a pencil shaped device which is used to select screen positions by detecting the light coming from points on a screen.
- ✓ Though the light pens are still in use, they are not as popular as they used to be as they have several disadvantages comparing to other input devices.



COMMONLY USED INPUT DEVICES

OMR (Optical Mark Reader)

- ✓ Optical Mark Reader is widely used device for scoring answers for multiple choice questions.
- ✓ It can sense the presence of a pen or pencil mark. Special marks such as squares or bubbles are prepared on examination answer sheets or questionnaires .
- ✓ The user fills in these squares or bubbles with soft pencil or ink to indicate their choice. These marks are detected by the Optical Mark Reader and the corresponding signals are sent to the processor.



COMMONLY USED INPUT DEVICES

OCR (Optical Character Reader)

Optical Character Reader (OCR) is the device that helps in the recognition of printed or written text characters by a computer.

This device is widely used in airlines, banks, postal offices (for reading postal code), etc.



COMMONLY USED INPUT DEVICES

Bar Code Reader

The Bar Code Reader is a device which is used to read a barcode field.

Bar Code is a technology that uses white spaces and black bars to represent encoded information.

This encoded information can be read with an optical device that converts the bars and spaces into an electrical signal which is then decoded into the original characters. The bar code was invented by Woodland.



COMMONLY USED INPUT DEVICES

MICR (Magnetic Ink Character Reader)

- ✓ Magnetic Ink Character Reader has been used to read documents that are written by a special ink made of a magnetic material called magnetic ink.
- ✓ MICR is capable of reading characters on a paper written with the magnetic ink which is magnetized during the input process.
- ✓ To identify the characters, these patterns are compared with a special pattern stored in the memory.
- ✓ It is mostly used in banks and postal services.



COMMONLY USED INPUT DEVICES

Touch Screen

- ✓ Touch screen is a kind of screen which is sensitive to user's touch. One can use a finger to point the command or menu displayed on the screen. Touch screen was invented in 2009 A.D, in Apple store.
- ✓ It is widely on laptops, smart phone, smart boards etc.



COMMONLY USED INPUT DEVICES

Microphone

The input system which is used to give the instruction to the computer invoice, without using the keyboard i.e. without typing is called Voice Input System. In Voice Input System, the speech is converted into electrical signals employing a microphone.



COMMONLY USED INPUT DEVICES

Digital Camera

A digital camera captures photos and videos using an electronic image sensor instead of film, and stores them in digital memory. It allows users to instantly view, edit, and transfer images to computers or other devices.



1.2.8 Output Devices

Output Device

- ✓ The device which displays meaningful information from the computer is called an **output device**. So, an output is the result produced by processing unit.
- ✓ The common output devices are **monitor and printer**.

COMMONLY USED OUTPUT DEVICES

Monitor

- ✓ Monitor is the most common output device.
- ✓ It is also called **VDU (Visual Display Unit)** in computer system.
- ✓ The output displayed on monitor's screen in the form of text, videos and graphics is called soft copy output.
- ✓ On the basis of colour the monitors are of two types:
 - i. Monochrome monitor and
 - ii. Colour Monitor

COMMONLY USED OUTPUT DEVICES

Monitor

Monochrome Monitor: The monitor which display output in one colour like green, white, black, blue, etc. is called monochrome monitor.

- **Colour monitor:** The monitor which displays output in different colours (more than sixteen) is called colour monitor.

COMMONLY USED OUTPUT DEVICES

Monitor

The information displayed on the screen is made of combination of small **tiny dots**. The small tiny dots are called **pixel**.



COMMONLY USED OUTPUT DEVICES

Monitor

The clear screen consists of three terms as **screen resolution, dot pitch and refresh rate**.

- i. **Screen Resolution:** It represents the number of horizontal and vertical pixels. The clear screen is due to the **high resolution** of the monitor. The common resolution ranges are 640x480, 1024x768, 1600x1200 etc.
- ii. **Dot Pitch:** The dot pitch is a measure of how close the pixels or dots are to create an image on the monitor. So, it is measured in millimeter. The clear screen is due to the **low dot pitch** of the monitor.
- iii. **Refresh Rate:** The refresh rate is the rate due to each pixel on screen re-drawn. A low refresh rate results in a poor image on the screen. It is measured in **hertz**. So, the clear image is due to the **high refresh rate**.

COMMONLY USED OUTPUT DEVICES

Monitor

On the basis of technology, monitors are classified into three types as:

i. **CRT Monitor (Cathode Ray Tube)**

- ✓ CRT monitors use a big glass tube called a cathode ray tube.
- ✓ An electron gun inside the monitor shoots a beam of electrons toward the screen.
- ✓ The screen is coated with phosphor, which glows when the electron beam hits it.
- ✓ The glowing spots form the picture you see on the screen.
- ✓ The beam moves very fast across the screen to redraw the image again and again.



COMMONLY USED OUTPUT DEVICES

Monitor

ii. LCD Monitor (Liquid Crystal Display)

- ✓ LCD monitors are lightweight, thin, and use less electricity than CRT monitors.
- ✓ They have two layers filled with liquid crystals that help form the image.
- ✓ These monitors are used in laptops, desktops, calculators, and digital watches.
- ✓ They give a clear and sharp image but are usually more expensive than CRT monitors.
- ✓ LCD screens need fluorescent lamps behind them for backlighting.



COMMONLY USED OUTPUT DEVICES

Monitor

iii. LED Monitor (Light Emitting Diode)

- ✓ LED monitors are lighter and thinner than both LCD and CRT monitors.
- ✓ They use even less power than LCD monitors.
- ✓ They have a longer lifespan, so they last for many years.
- ✓ The picture quality is better and brighter compared to other monitors.
- ✓ These monitors use LED lights for backlighting.
- ✓ Both LCD and LED monitors are called flat-panel displays.



COMMONLY USED OUTPUT DEVICES

Printer

- ✓ Printer is a hard copy output device.
- ✓ It prints text & graphics on paper.
- ✓ There are many different types of printers available in market.
- ✓ Its speed is measured by **CPS (Character per second), LPM (Line per minute) and PPM (Page per minute)**.
- ✓ The printers are classified in two types on the basis of printing quality. They are:
 1. Impact printer
 2. Non-impact printer

COMMONLY USED OUTPUT DEVICES

Printer

1. Impact Printer :

- i. An impact printer is a type of printer that operates by striking a metal or plastic head against an ink ribbon.
- ii. Its structure is like a typewriter. It uses small pin-like objects or hammers that strike on the inked ribbon and characters are formed on the paper.
- iii. These printers are slow and noisy.
- iv. These printers use black or blue or red colour.
- v. The printing quality of impact printer is lower than non-impact printer.

The three main types of impact printer are following:

- i. Dot Matrix Printer
- ii. Daisy Wheel Printer
- iii. Line Printer

COMMONLY USED OUTPUT DEVICES

Printer

i. **Dot Matrix Printer** : The printer head contains a number of pins. The printer head strikes on the inked ribbon, the striking forms dotted characters on the paper. The speed of Dot-matrix printers ranges from *50 to 400 CPS* (Character Per Second).



COMMONLY USED OUTPUT DEVICES

Printer

ii. **Daisy Wheel Printer:** It uses hammer-like object to hit on the ink ribbon and a character is formed on the paper.



Printer Head

COMMONLY USED OUTPUT DEVICES

Printer

iii. **Line Printer:** Its printing quality is better than that of Daisy wheel printer and Dot matrix printer. It prints text line by line. So, it is called a line printer.

COMMONLY USED OUTPUT DEVICES

Printer

ii. Non-Impact Printer:

- ☺ The non-impact printer does not use the printing head to strike against ribbon and paper. Instead, small drops of ink are sprayed onto the paper.
- ☺ So non- impact printers are faster and are of high quality than impact printer.
- ☺ It does not produce sound while printing.
- ☺ Inkjet printer, laser printer, 3D printer are the popular types of non- impact printer.

COMMONLY USED OUTPUT DEVICES

Printer

1. Inkjet printer :

- ✓ Inkjet printer prints text and graphics on paper by spraying small drops of ink into paper.
- ✓ The speed of inkjet printer is generally 1 to 4 pages per minute.
- ✓ It uses an A4 size paper.
- ✓ The liquid colour-filled cartridge is used instead of ink ribbon.
- ✓ Four colour-CMYK (Cyan, Magenta, Yellow, Black) cartridges are used for colour printout.



COMMONLY USED OUTPUT DEVICES

2. Laser Printer

A laser printer is a type of printer which makes use of a laser beam to produce an image on the drum.

- ✓ It was first developed by Gary Starkweather at Xerox PARC in 1971.
- ✓ Laser printer makes use of laser technology for the printing of copies onto the paper. Its printout technology is like a photocopy machine.
- ✓ It uses colour powdered toner to print text and graphics on paper.
- ✓ Its printing quality is high.



COMMONLY USED OUTPUT DEVICES

3D – Three Dimensional Printer

- ✓ Impact printer & non-impact printer prints text on paper but 3D printer prints an object.
- ✓ For example, any playing toys or any machinery parts are printed through the 3D printer.
- ✓ 3D printing builds parts out of plastic, metal and other materials directly from CAD (Computer-Aided Design) drawings that have been cross-sectioned into thousands of layers.
- ✓ This technology helps to build a 3D object by modelling.
- ✓ This technology is called additive manufacturing.

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COMMONLY USED OUTPUT DEVICES

Speaker

- ✓ Speaker is a common audio output device.
- ✓ It is used to receive sound or music from computer system.
- ✓ It is used to covert digital data into audio analog data which user can understand.
- ✓ The quality of sound output depends on the speaker's quality.
- ✓ For example, loud speakers, sub woofers, in- wall/ceiling speaker, outdoor speaker, etc. are the different types of speakers.



COMMONLY USED OUTPUT DEVICES

Important Questions:

1. Write Advantages (4) and Disadvantage(4) of following:
 - a. *Dot Matrix Printer*
 - b. *Inkjet Printer*
 - c. *Laser Printer*
2. Write the differences between Impact printer & Non-Impact Printer.

1.2.9 Hardware Interfaces: Parallel Port, Serial Port, USB Ports, HDMI and Expansion Slots



Hardware Interfaces

- ✓ A hardware interface/port is a socket on the outside of the system unit that is connected to an expansion board on the inside of the system unit.
- ✓ A port allows connecting a peripheral device such as a monitor, printer, or modem, so that it can communicate with the computer system.

Hardware Interfaces

Function of Hardware Interface

1. Connecting peripheral devices.
2. Transmitting data to and from peripheral devices.
3. Providing electrical power to those devices having low power requirement such as mouse, keyboard, pen drive.

Parallel Port

Parallel port is a type of interface which is used for connecting peripherals in computer.

- It transfers multiple bits (8/16 bits) at the same time.
- Commonly used in older computers.
- Example using: Old Printers ,Scanners
- Faster data transfer than serial ports but limited cable length.



Serial Port

Transfers data one bit at a time.

Uses serial communication.

Slower than parallel port but supports longer distances.

Example use: Modem, Networking devices (RS-232) etc



USB (Universal Serial Bus) Port

- Most common modern interface for connecting devices.
- Transfers data, power, or both.

Main Features:

1. Plug and Play
2. Supports hot-swapping
3. High-speed data transfer

Versions: *USB 1.1, USB 2.0, USB 3.0, USB Type-C*

USB Used for: Keyboard, mouse, pen drive, webcam, mobile charging, printer etc.



HDMI (High Definition Multimedia Interface) Port

- ✓ Used to transfer high-definition audio and video.
- ✓ Digital interface (no signal loss).

HDMI Used for: *Monitor, TV, Projector etc.*

HDMI Supports: 1080p, 4K, 8K video, Multi-channel audio



Expansion Slots

Expansion slots allow adding extra hardware to a computer motherboard.

Common types:

a) **PCI** (Peripheral Component Interconnect)

→ Used for older network cards, sound cards, modems.

b) **PCIe** (PCI Express)

→ Modern high-speed slot.

c) **AGP** (Accelerated Graphics Port)

→ Old slot used only for graphics cards (before PCIe).

Expansion Slots

