BACHELOR OF COMPUTER APPLICATIONS

Introduction to Information Technology & PC Packages

(BCA –5000 T)

Department of Computer Science
Mohanlal Sukhadia University, Udaipur
(Formerly known as Udaipur University)
: Established by Ministry of Higher Education, Government of Rajasthan, India in 1962

About Me

Name:

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Qualification:

BCA, MCA

Areas of Interest:

C, C++, Data Structure, MS Office, Data Mining, System Analysis and Design, Networking, ITPC

Learning Outcome of this Subject

1. Learn basic information about the computer system.
2. Acquire knowledge about computer hardware and computer software.
3. Familiarize with the use of MS Windows, Internet and E-mail.
4. Familiarize with the use of MS Office - MS Word, MS Excel & MS PowerPoint.

SYLLABUS

UNIT-I Computer Basics and its generations:

- A Simple Model of a Computer
- Characteristics and classification of Computers
- Generations of Computers
- Basic Applications of Computer
- Components of Computer System
  - Central Processing Unit (CPU)
  - VDU, Keyboard and Mouse
  - Other input/output Devices
- Computer Memory organization and hierarchy
- Concepts of Hardware and Software
- Concept of Computing
- Data and Information
- Applications of ICT

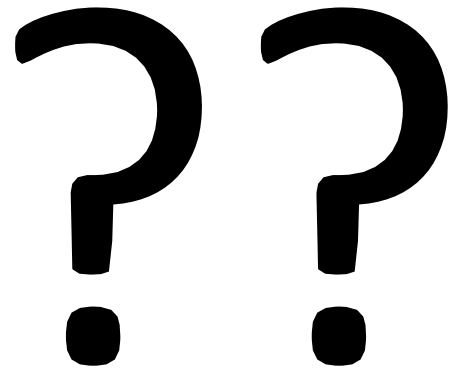
SYLLABUS

UNIT-II	**Operating Systems**
	DOS, Windows and Linux Operating System
UNIT-III	**Word Processing software**
UNIT-IV	**Using Spread Sheet and Presentations**
	Making Small Presentation
UNIT- V	**Introduction to Internet, WWW and**
	Web Browsers

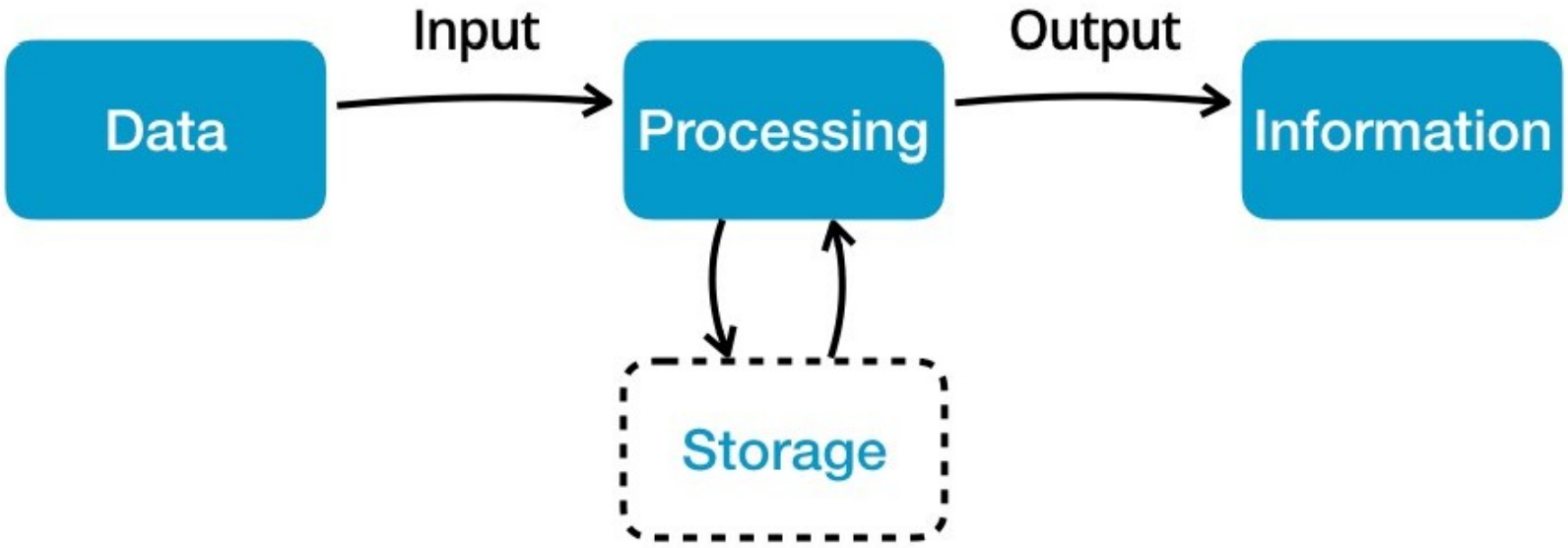
REFERENCE BOOKS

1. **P .K. Sinha** ,Fundamentals of Computers, BPB Publications
2. Fundamental of Computers By **R. Thareja**, Oxford University Press.
3. Introduction to Information Technology- **ITL Education** solutions limited, PEARSON.

What is a Computer?



Computer



Father of Computer??

C= COMMONLY

O=OPERATED

M=MACHINE

P=PARTICULARY

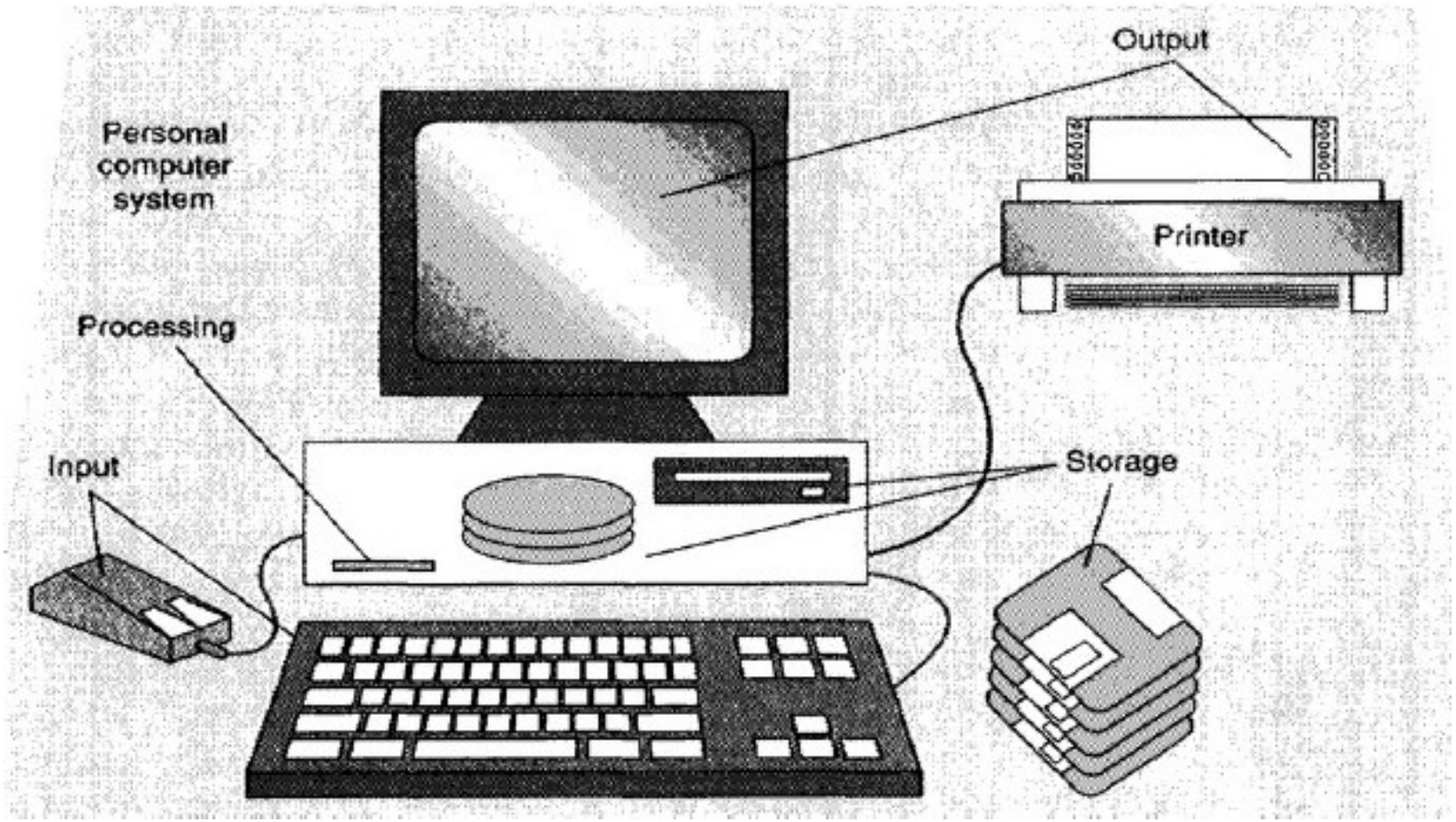
U=USED FOR

T=TRADE

E=EDUCATION AND

R=RESEACRH

Computer

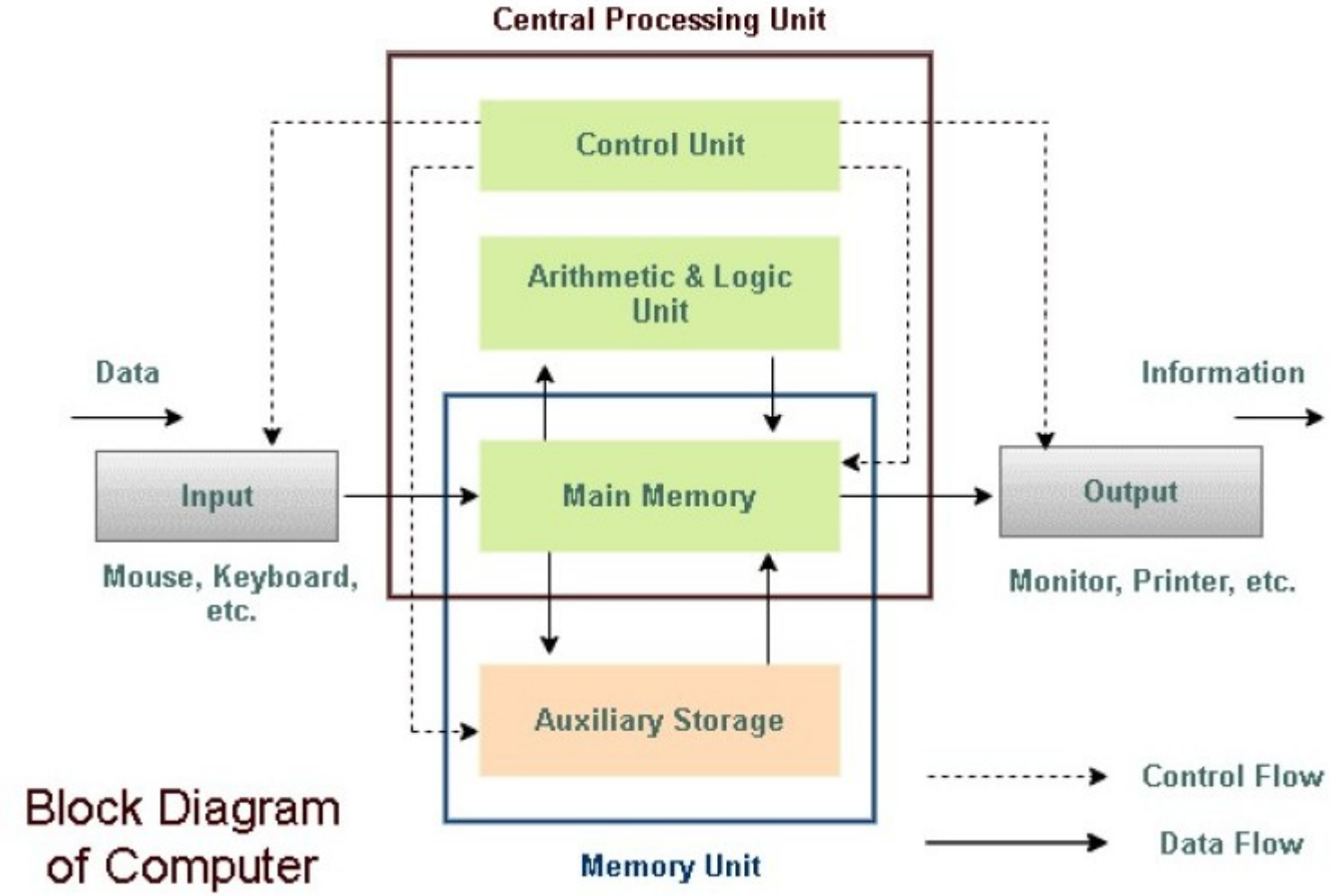


Model of Computer

Computer

- The word computer comes from the word "compute", which means, "to calculate"
- Thereby, a computer is an electronic device that can perform arithmetic operations at high speed
- A computer is also called a ***data processor*** because it can store, process, and retrieve data whenever desired.

Block Diagram of Computer



Block Diagram of Computer

- Mainly computer system consists of three parts as :
  - Input Devices, and
  - Output Devices.
  - Central Processing Unit (CPU),
  - Memory Unit

Working

- The data is entered through input devices such as the keyboard, mouse, etc.
- This set of instruction is processed by the CPU after getting the input by the user, and
- Then the computer system produces the output with the help of output devices to the user, such as monitor, printer, etc.
- A large amount of data is stored in the computer memory with the help of primary and secondary storage devices.

Characteristics of Computers

1) **Speed:** Computer can perform data processing jobs very fast, usually measured in **microseconds (10^{-6}), nanoseconds (10^{-9}), and picoseconds (10^{-12})**
2) **Accuracy:** Accuracy of a computer is consistently high and the degree of its accuracy depends upon its design.

Computer errors caused due to incorrect input data or unreliable programs are often referred to as ***Garbage-In-Garbage-Out (GIGO)***

Characteristics of Computers

3) **Diligence:** Computer is free from monotony, tiredness, and lack of concentration. It can continuously work for hours without creating any error and without grumbling.

4) **Power of remembering :** Computer can store and recall any amount of information because of its secondary storage capability. It forgets or looses certain information only when it is asked to do so.

5) **Versatility:** Computer is capable of performing almost any task, if the task can be reduced to a finite series of logical steps.

Characteristics of Computers

6) Automation

Computer performs all the tasks automatically i.e. it performs tasks without manual intervention.

7) Storage

It can store huge amount data.

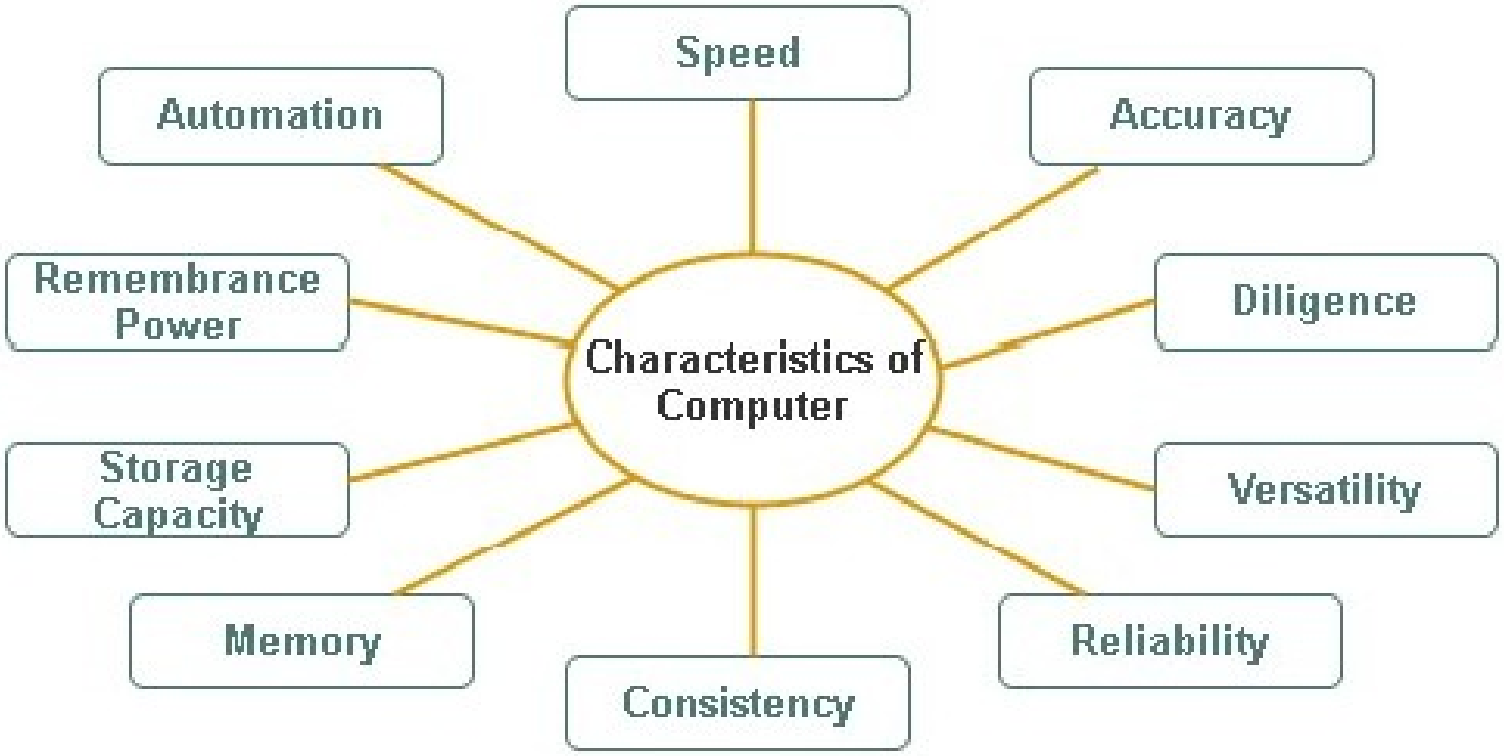
Characteristics of Computers

8) **No Feelings:** Computers are devoid of emotions. Their judgment is based on the instructions given to them in the form of programs that are written by us (human beings).

9) **Reliability**

A computer is reliable as it gives consistent result for similar set of data i.e., if we give same set of input any number of times, we will get the same result.

Characteristics of Computers



Characteristics of Computer

Limitations of Computer

1. **No I.Q.:** Computers rely on human instructions and data. They cannot think or make decisions independently without programming.
2. **Lack of Creativity:** While computers can generate content based on existing data, they do not possess true creativity or the ability to think outside the box like humans do.
3. **Security Vulnerabilities:** Computers are susceptible to malware, hacking, and other security threats, which can compromise data integrity and privacy.

Classifications of Computer

We can classify the computers according to the following three criteria:

1. Based on operating principles
2. Based on applications/ purpose
3. Based on size and capability

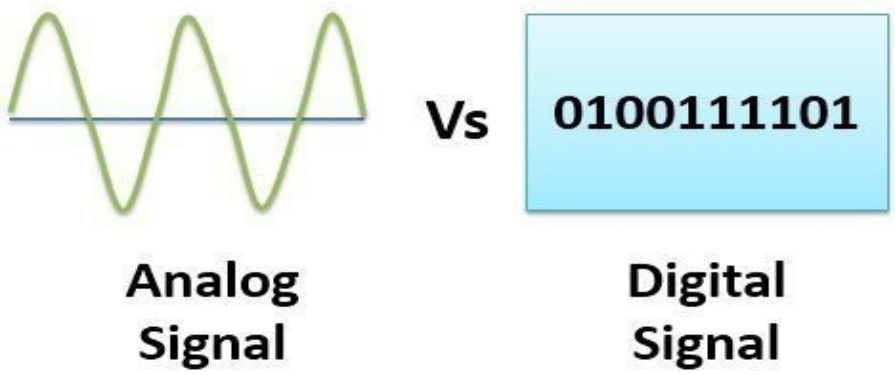
Based on Operating Principles

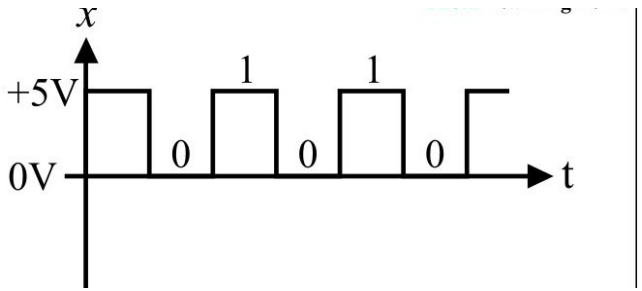
On the basis of operations performed computers can be classified into the following categories:

- Analog computers
- Digital computers
- Hybrid computers

Analog, Digital and Hybrid Computers

- **Analog Computers :-** The analog computers represent data in the form of continuous electrical signals having a specific magnitude. They are continuous in nature.
- **Digital Computers:-** The digital computer is a type of computer that stores and processes data in the digital form.
- **Hybrid Computers :-** The hybrid computer is a combination of analog computer and digital computer because it encompasses the best features of both these computers.





Based on Applications/ Purpose

On the basis of different applications or purposes, computers can be classified into the following categories:

1. General purpose computers

2. Special purpose computers

General & Special Purpose Computer

- General purpose computers:- These are versatile computing device designed to **perform a wide range of tasks and operations**, rather than being specialized for a specific applications.
- Special purpose computers:- They are designed in such a manner that they can perform only a **specified task**. The special purpose computers are **not versatile** and their speed and memory size depend on the task that is to be performed.

Based on Size and Capacity

On the basis of size and capability, computers can be classified into the following categories:

1. Microcomputers
2. Mini computers
3. Mainframe computers
4. Super computers

Microcomputers

A microcomputer is a small and cheap digital computer that is designed to be used by individuals.

Depending on the size, the microcomputer can be further classified into the following types:

- Desktop computer
- Laptop computer :-
- Hand-held computer It is also known as Personal Digital Assistant (PDA), palmtop or mobile device.

Mini Computer

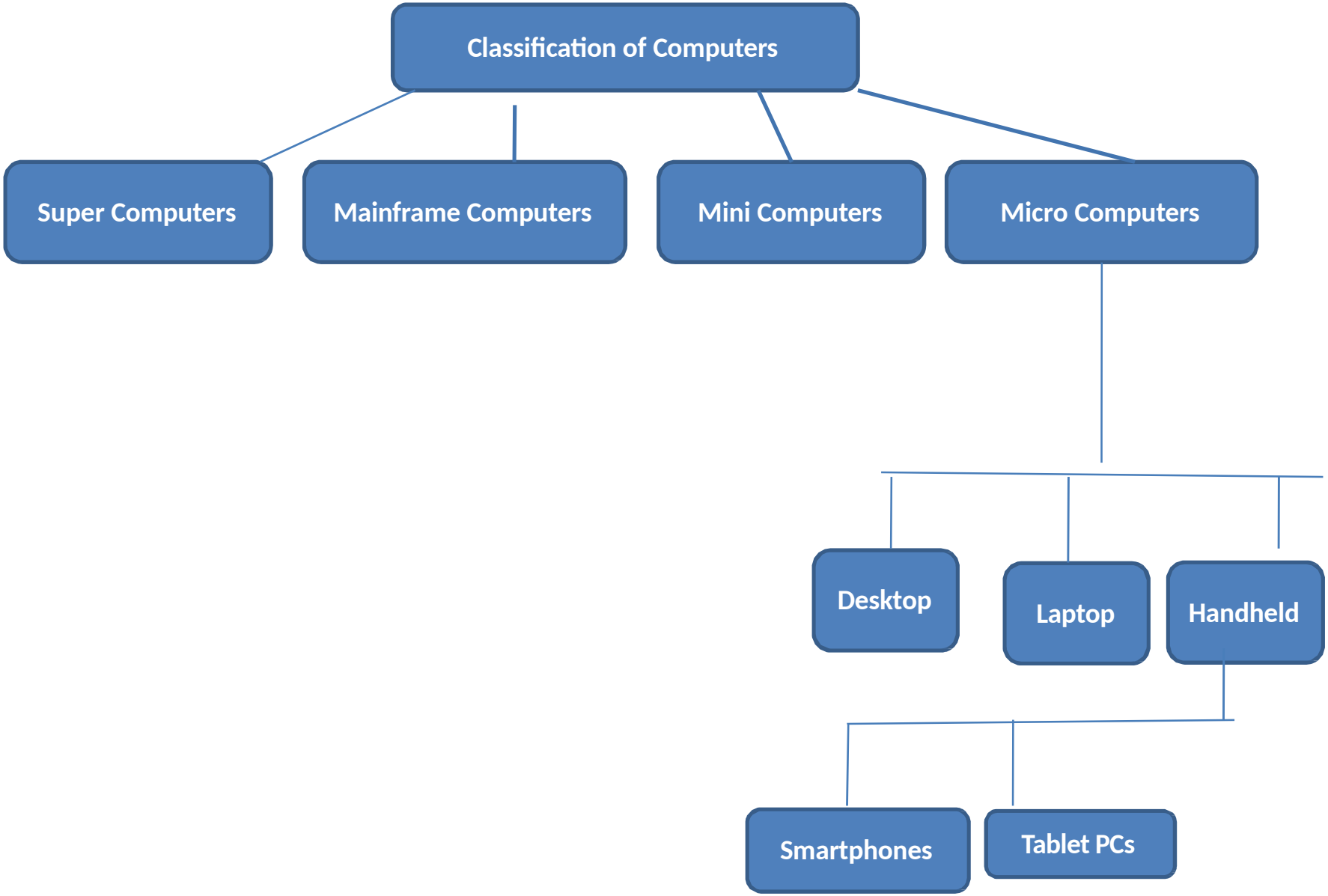
- They were called mini computers because of their **smaller size** than the other computers.
- Mini computers are less powerful than **mainframe** computers but more powerful than **micro** computers.
  - Users supported by mini computers may range between **4 and 200**.
- These computers are generally designed for **small and medium** sized business environments.
- Mini computers can be used as the web/ network servers that can handle thousands of transactions in a

Mainframe Computer

- A mainframe computer is a very large computer that is employed by large business organizations for handling major applications, such as:
  - financial transaction processing,
  - Enterprise Resource Planning (ERP),
  - Census etc.
- Eg:- Database servers (handles millions of instructions per second.)

Super Computer

- A super computer is the fastest type of computer that can perform **complex operations** at a very high speed.
- They are most expensive than the other categories of computers
- Examples of Super Computers are CRAY 3, Cyber 205, NEC SX-3 and **PARAM** from India.
- The various application areas of super computers are as follows:
  - Weather forecasting
  - Animated graphics
  - Fluid mechanics
  - Nuclear energy research
  - Petroleum exploration


Classification of Computers
Super Computers
Mainframe Computers
Mini Computers
Micro Computers
Desktop
Laptop
Handheld
Smartphones
Tablet PCs

DIFFERENTIATE

	MICRO	MINI	MAINFRAME	SUPER
COST				
SIZE				
USES				
SPEED				

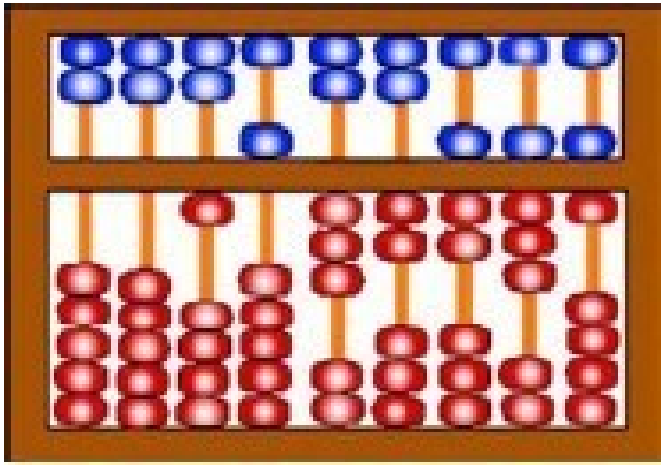
Applications Of Computers

- Word Processing
- Internet
- Digital Audio or Video Composition
- Desktop Publishing
- e-Business
- Bioinformatics
- Health care
- GIS and Remote Sensing
- Meteorology
- Multimedia and Animation
- Legal System
- Retail Business
- Sports
- Travel and Tourism

  Simulation
- Astronomy
- Education
- Industry and Engineering
- Robotics
- Decision Support Systems
- Expert Systems

Evolution of Computers

- People in Asia Minor built a counting device called **abacus**. This device allowed users to do calculations using a system of sliding beads arranged on a rack. The abacus was simple to operate and was used worldwide for centuries.



Generations of Computers

- Charles Babbage is known as the father of computer.
- "*Generation" in computer talk is a step in technology.* It provides a framework for the growth of computer industry
- Originally it was used to distinguish between various hardware technologies, but now it has been extended to include both **hardware and software**
- Till today, there are **five** computer generations

First Generation of Computers (1942-1955)

- The first generation computers used very large number of **vacuum tubes** for circuitry .
- The input and output medium for first generation computers was the **punched card** and **printout** respectively.
- They used Electromagnetic relay memory.
- Stored program concept was used.
- They used **Machine language (0 and 1)** .
- Mostly used for scientific calculations and were costly.
- Bulky in size and highly unreliable.
- Difficult commercial production and difficult to use
- Eg: **ENIAC, EDVAC , EDSAC, UNIVAC I and IBM 701**

Full Forms

- **ENIAC** (Electronic Numerical Integrator and Calculator)
- **EDVAC** (Electronic Discrete Variable Automatic Computer).

First Generation Computers

Advantage & Disadvantage

Advantages: Fastest calculating device of their time

Disadvantages:

1. Very bulky in size
2. Consume a lot of electricity.
3. Dissipate a lot of heat.
4. Frequently down due to hardware failures.
5. Needed constant maintenance because of low mean time between failures.
6. Limited commercial use because these computers were difficult to program.
7. Very expensive.

Second Generations of Computer (1955-1964)

- The main characteristic of these computers was the use of transistors.
- The input and output medium was the **punched card** and **printout** respectively.
- At this time, high-level programming languages like **COBOL, FORTRAN, ALGOL and SNOBOL** were also being developed .
- They used **Batch operating system**.
- They are used for scientific and **commercial** applications.
- Faster, smaller, more reliable and easier to program than previous generation systems.
- Commercial production was still difficult and costly.

Second Generation

- Eg:- Honeywell 400, IBM 7030, CDC 1604, UNIVAC, LARC

Advantage & Disadvantage

Advantages:

1. Consumed less electricity and thus dissipated less heat as compared to first generation computers.
2. Faster, cheaper smaller and more reliable than first generation computers.
3. Could be programmed using assembly language and high level languages.
4. Had faster primary memory and a larger secondary memory.

Disadvantages:

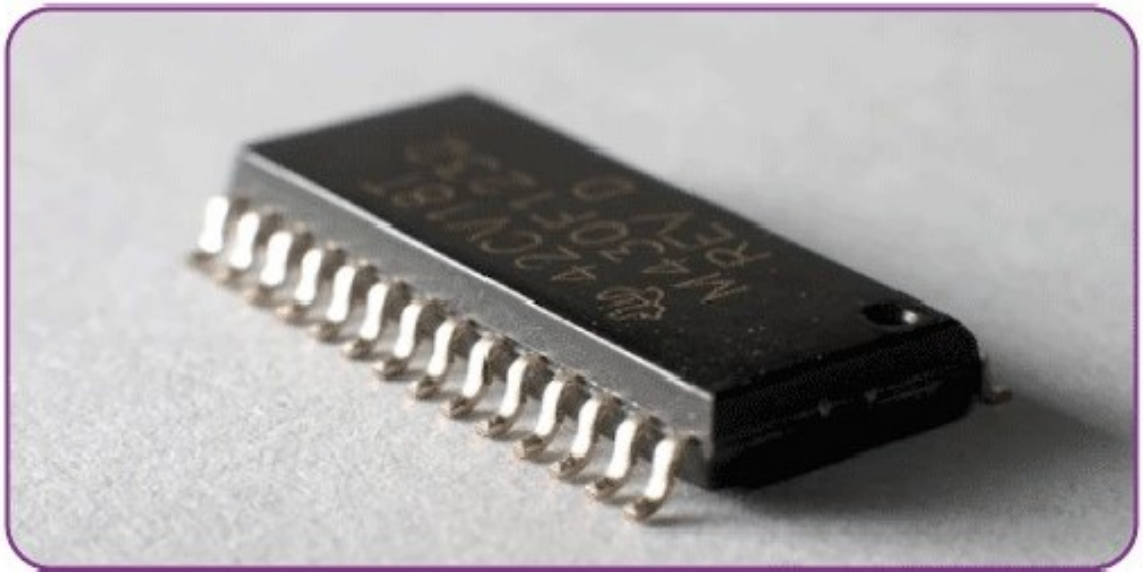
1. Second generation computers were manufactured using transistors that had to be assembled manually. This made commercial production of computers difficult and expensive.

Third Generation of Computer (1964-1975)

- The development of the **Integrated Circuit (IC**) was the hallmark of the third generation of computers.
- These computers had few megabytes of main memory and magnetic disks which could store few tens of megabytes of data per disk drive.
- High level programming languages like COBOL and FORTRAN were standardized by ANSI.
- Some more high level programming languages like PL/I PASCAL and BASIC were introduced at this time.
- Third generation computers were the first to implement **time sharing operating systems.**
- Input to these computers could now be provided using **keyboards and mouse**.

Third Generation

Eg:- IBM 360/370, PDP-8, PDP-11, CDC 6600



Advantage

Advantages:

1. Faster than second generation computers and could perform 1 million transactions per second.
2. Smaller, cheaper and more reliable than their predecessors.
3 These computers ha faster and large primary memory and secondary storage.
4. Widely used for scientific as well as business applications.
5. During this generation of computers, standardization of existing high level languages and invention of new high level languages was done.
6. Had **time sharing operating system which allowed interactive use of computer by one or more users simultaneously** thereby improving the productivity of the users.

Fourth Generation of Computer (1975-1989)

- The fourth generation of computers with thousands of integrated circuits (IC's) built onto a single silicon chip named as **Very large Scale Integrated Circuits(VLSI)**
- Microprocessors, Semi-conductor memories were used which were very fast, even the hard disks became cheaper, smaller in size and larger in capacity.
- During this period many new operating systems were developed like **MS-DOS MS-Windows, UNIX and Apple's proprietary operating system.**
- **C** programming language evolved in this duration.
- Development of **GUIs**, the mouse and handheld devices.
- For secondary storage, **Magnetic tapes** were used and **floppy disks** as portable storage media
- Personal computers and Supercomputers based on parallel vector processing and symmetric multiprocessing technologies.
- Spread of high-speed computer networks.

Fourth Generation

- Eg:-IBM PC, Apple II, TRS-80, VAX 9000,CRAY-1, CRAY-2, CRAY-X/MP

Advantage

Advantages:

1. Smaller, cheaper, faster and more reliable .
2. Consumed less electricity and therefore dissipated less heat.
3. Had faster and larger primary memory and secondary storage.
4. Could be used as **general purpose computers**.
5. GUIs enabled people to learn to work with computers very easily. So the use of computers in both **office and home** became widespread.
6. **Networks** allowed sharing of resources thereby efficient utilization of computer hardware and software.

Fifth Generation of Computer (1989- Present)

- ICs with ULSI (Ultra Large Scale Integrated Circuits) technology and are moving towards completely on a new concept of Artificial Intelligence (AI).

  (Although such computers are still in development, there are certain applications like **voice recognition** which is widely being used today.)
- Larger capacity main memory and hard disks.
- Optical disks as portable read-only storage media.
- Notebooks, powerful desktop PCs and workstations
- Powerful servers, supercomputers.
- Internet

Fifth Generation Computers

Three characteristics of the fifth generation computers are:

- Parallel Processing
- Artificial Intelligence

Advantage

- Portable computers.
- Powerful, cheaper, reliable, and easier to desktop use machines.
- Powerful supercomputers.
- High uptime due to hot-pluggable components.
- Totally general purpose machines.
- Easier to produce commercially, easier to upgrade.
- Rapid software development possible.

Vacuum Tube

Transistors

Integrated Circuit

Microprocessor

Quantum Computer

1st Generation Computer

2nd Generation Computer

3rd Generation Computer

4th Generation Computer

5th Generation Computer

Brief Recap of Generations of Computer

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some representative systems
First (1942-1955)	▪ Vacuum tubes ▪ Electromagnetic relay memory ▪ Punched cards secondary storage	▪ Machine and assembly languages ▪ Stored program concept ▪ Mostly scientific applications	▪ Bulky in size ▪ Highly unreliable ▪ Limited commercial use and costly ▪ Difficult commercial production ▪ Difficult to use	▪ ENIAC ▪ EDVAC ▪ EDSAC ▪ UNIVAC I ▪ IBM 701
Second (1955-1964)	▪ Transistors ▪ Magnetic cores memory ▪ Magnetic tapes ▪ Disks for secondary storage	▪ Batch operating system ▪ High-level programming languages ▪ Scientific and commercial applications	▪ Faster, smaller, more reliable and easier to program than previous generation systems ▪ Commercial production was still difficult and costly	▪ Honeywell 400 ▪ IBM 7030 ▪ CDC 1604 ▪ UNIVAC LARC

Recap Contd…

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Third (1964-1975)	▪ ICs with SSI and MSI technologies ▪ Larger magnetic cores memory ▪ Larger capacity disks and magnetic tapes secondary storage ▪ Minicomputers; upward compatible family of computers	▪ Timesharing operating system ▪ Standardization of high-level programming languages ▪ Unbundling of software from hardware	▪ Faster, smaller, more reliable, easier and cheaper to produce ▪ Commercially, easier to use, and easier to upgrade than previous generation systems ▪ Scientific, commercial and interactive on-line applications	▪ IBM 360/370 ▪ PDP-8 ▪ PDP-11 ▪ CDC 6600

Recap….

Generation (Period)	Key hardware Technologies	Key software technologies	Key characteristics	Some rep. systems
Fourth (1975-1989)	▪ ICs with VLSI technology ▪ Microprocessors; semiconductor memory ▪ Larger capacity hard disks as in-built secondary storage ▪ Magnetic tapes and floppy disks as portable storage media ▪ Personal computers ▪ Supercomputers based on parallel vector processing and symmetric multiprocessing technologies ▪ Spread of high-speed computer networks	▪ Operating systems for PCs with GUI and multiple windows on a single terminal screen ▪ Multiprocessing OS with concurrent programming languages ▪ UNIX operating system with C programming language ▪ Object-oriented design and programming ▪ PC, Network-based, and supercomputing applications	▪ Small, affordable, reliable, and easy to use PCs ▪ More powerful and reliable mainframe systems and supercomputers ▪ Totally general purpose machines ▪ Easier to produce commercially ▪ Easier to upgrade ▪ Rapid software development possible	▪ IBM PC and its clones ▪ Apple II ▪ TRS-80 ▪ VAX 9000 ▪ CRAY-1 ▪ CRAY-2 ▪ CRAY-X/MP

Recap….

Generation (Period)	Key hardware technologies	Key software technologies	Key characteristics	Some rep. systems
Fifth (1989-Present)	▪ ICs with ULSI technology ▪ Larger capacity main memory, hard disks with RAID support ▪ Optical disks as portable read-only storage media ▪ Notebooks, powerful desktop PCs and workstations ▪ Powerful servers, supercomputers ▪ Internet ▪ Cluster computing	▪ Micro-kernel based, multithreading, distributed OS ▪ Parallel programming libraries like MPI & PVM ▪ JAVA ▪ World Wide Web ▪ Multimedia, Internet applications ▪ More complex supercomputing applications	▪ Portable computers ▪ Powerful, cheaper, reliable, and easier to use desktop machines ▪ Powerful supercomputers ▪ High uptime due to hot-pluggable components ▪ Totally general purpose machines ▪ Easier to produce commercially, easier to upgrade ▪ Rapid software development possible	▪ IBM notebooks ▪ Pentium PCs ▪ SUN Workstations ▪ IBM SP/2 ▪ SGI Origin 2000 ▪ PARAM 10000

Basic Operations Of Computer

A computer is an electronic device which basically performs five major operations which includes:

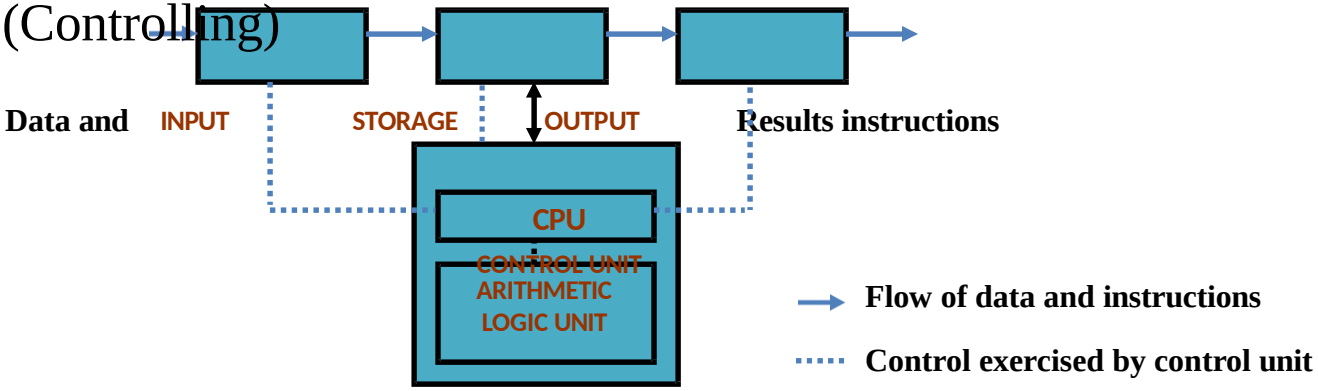
1) Accepts data or instructions (inputting)

2) Stores data (Storing)

3) Process data (Processing)

4) Displays results (output) (Controlling)and

5) Controls and co-ordinates all operations inside a computer (Controlling)



The Computer System

- A computer can be viewed as a system, which consists of a number of interrelated components that work together with the aim of converting data into information. To attain information, data is entered through **input unit, processed by central processing unit (CPU), and displayed through output unit.** In addition, computers require **memory** to process data and store output. All these parts (the central processing unit, input, output, and memory unit) are referred to as the **hardware of the computer**.

- Any hardware device connected to the computer or any part of the computer outside the CPU and working memory is known as a peripheral. Some examples of peripherals are **keyboards, mouse, and monitors**.

The Computer System

How Does a Computer Work?

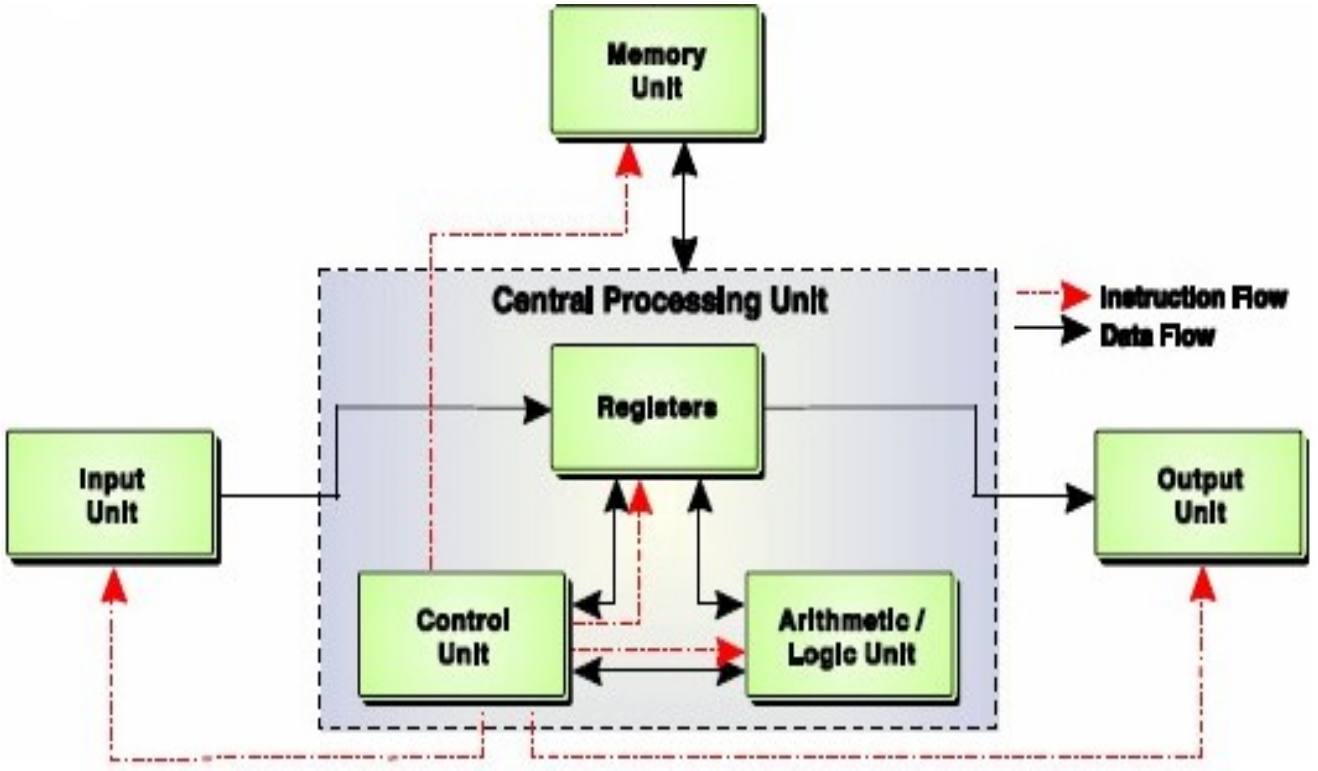
- ✓ A computer performs three basic steps to complete any task: input, processing, and output.

- ✓ A task is assigned to computer in a set of step-by-step instructions, which is known as program. These instructions tell the computer what to do with input in order to produce the required output. A computer functions in the following manner:

1. The computer accepts the input. The computer input is whatever entered or fed into a computer system.
2. The computer processes the input data according to the instructions by the user. Examples of processing include calculations, sorting list of words or numbers, etc.
3. The computer produces output. Computer output is the information that has been produced by a computer.

The Computer System

Components of a Computer System



Input Unit

An input unit of a computer system performs the following functions:

- It accepts (or reads) instructions and data from outside world.
- It converts these instructions and data in computer acceptable form.
- It supplies the converted instructions and data to the computer system for further processing.

Input Devices

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Input Devices

Input devices are hardware components used to enter data and commands into a computer. Common input devices include:

- **Keyboard** - Allows users to input text, numbers, and commands.
- **Mouse** - A pointing device used to interact with graphical elements on the screen.
- **Touchpad** - A touch-sensitive surface on laptops used for pointing and scrolling.
- **Trackball** - A pointing device where the user rolls a ball to move the cursor.
- **Scanner** - Converts physical documents and images into digital form.
- **Microphone** - Captures audio input for recording or communication.
- **Webcam** - Captures video and images for video conferencing or streaming.
- **Joystick** - Used primarily in gaming and simulations to control movement.
- **Digital Pen** - Used for writing or drawing on a digital surface, often with a graphics tablet.
- **Touch Screen**
- **MICR (Magnetic Ink Character Recognition)-** It is a technology used primarily in banking to read and process paper documents, such as cheques.
- **Bar Code Reader**
- **OCR (Optical Character Recognition)**
- **Digital Camera**


Input Devices
Mouse
OCR
Keyboard
Scanner
Trackball
Bar Code Reader
Joystick
Touch Panel
Touchpad
MICR

Output Unit

An output unit of a computer system performs the following functions:

- It accepts the results produced by the computer, which are in coded form and hence, cannot be easily understood by us.
- It converts these coded results to human acceptable (readable) form.
- It supplies the converted results to outside world.

Output Devices

Output Devices

Output devices are hardware components that convey information from a computer to the user. Common output devices include:

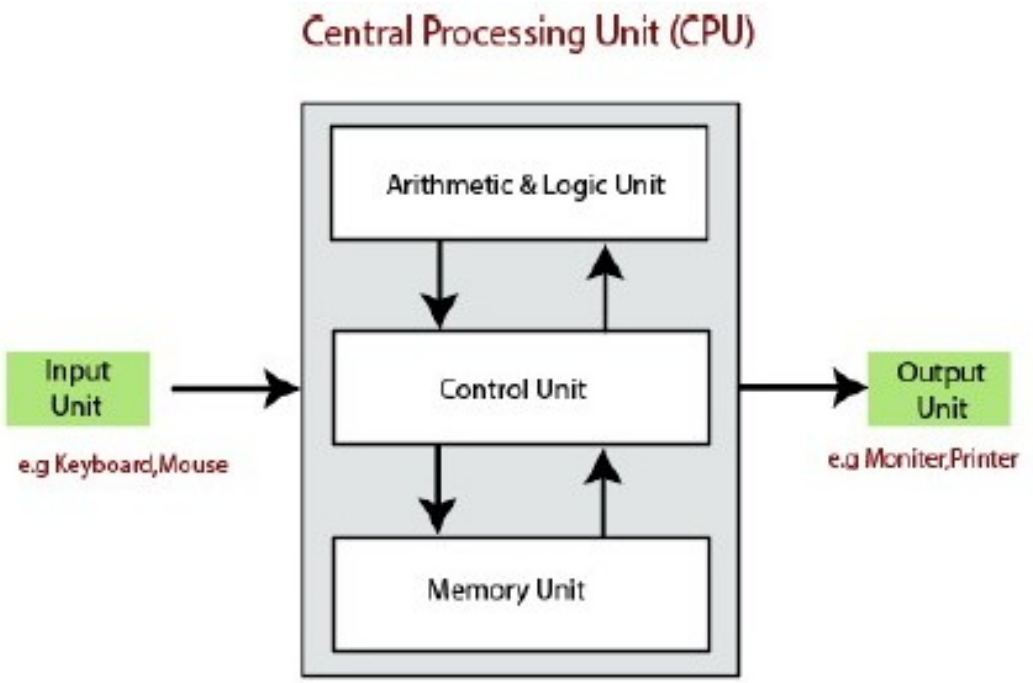
- **Monitor** - Displays visual output, such as the user interface, images, and videos.
- **Printer** - Produces hard copies of digital documents, images, and graphics.
- **Speakers** - Output audio signals, allowing users to hear sound, music, and other audio.
- **Headphones** - Provide personal audio output for listening to sound without disturbing others.
- **Projector** - Projects visual output onto a larger screen or surface, useful for presentations and large displays.
- **Plotter** - Creates large-scale graphics and detailed drawings, often used in engineering and architecture.

CPU

- The CPU is like the heart/ brain of the computer.
- It is responsible for the processing of all the instructions which are given by the user to the computer system.
- The CPU is an electronic hardware device which can perform different types of operations such as arithmetic and logical operation

CPU

- It is divided into two parts as:
  - Arithmetic logic unit (ALU) and
  - Control Unit (CU)



Arithmetic Logic Unit

- **Arithmetic and Logical Unit (ALU)**
  - The arithmetic and logical unit is the combinational digital electronic circuit that can perform arithmetic operations on integer binary numbers.
  - It presents the arithmetic and logical operation. The outputs of ALU will change asynchronously in response to the input. The basic arithmetic and bitwise logic functions are supported by ALU.

Control Unit

- **Control Unit (CU)**
  - The control unit (CU) controls all the activities or operations which are performed inside the computer system. It receives instructions or information directly from the main memory of the computer.
  - When the control unit receives an instruction set or information, it converts the instruction set to control signals then; these signals are sent to the central processor for further processing.
  - The control unit understands which operation to execute, accurately, and in which order.

VDU

- VDU is an abbreviation for **Visual Display Unit,** which is a device that displays information from a computer on a screen. It's also commonly known as a computer **monitor**.

Memory/ Storage Unit

- **Memory Unit**
  - A memory unit is not part of the CPU, but it works closely with it.
  - The information are stored in the storage/ memory unit of the computer system.
  - The memory unit provides the space to store the data or instruction of processed data.
  - The data storage is the core function and fundamental of the computer components.

* The CPU processes instructions and performs calculations, while the memory unit (often referred to as RAM or Random Access Memory) stores data and instructions that the CPU needs to access quickly.

Memory/ Storage Unit

- Computer memory refers to the electronic holding place for instructions and data where the processor can reach quickly. It can be classified into two broad categories: **primary memory** (to process the data and hold the intermediate results) and **secondary memory** (to store the output).
- The **primary memory** allows the computer to store data for immediate manipulation and to keep track of what is **currently** being processed. It is **volatile**. It means that when the power is turned off, the contents of primary memory are lost forever.
- To store the data **permanently**, a computer requires some non-volatile storage medium like **hard disk**. This kind of storage is known as **secondary memory**. It is **non-volatile**. Such memories store all the data (files) and instructions (computer programs) even after the power is turned off.
- **When we talk about memory, we generally refer to the primary memory only, and when we talk about storage, secondary memory is referred.**

Memory Representation

- As we know that digital computers work on only two states: **ON (1) and OFF (0).** These two values are represented by two different **voltages** within the circuit. Each of these values (either 0 or 1) is called **a binary digit or bit** and can be considered a symbol for a piece of information.

- Various units used to measure computer memory are as follows:

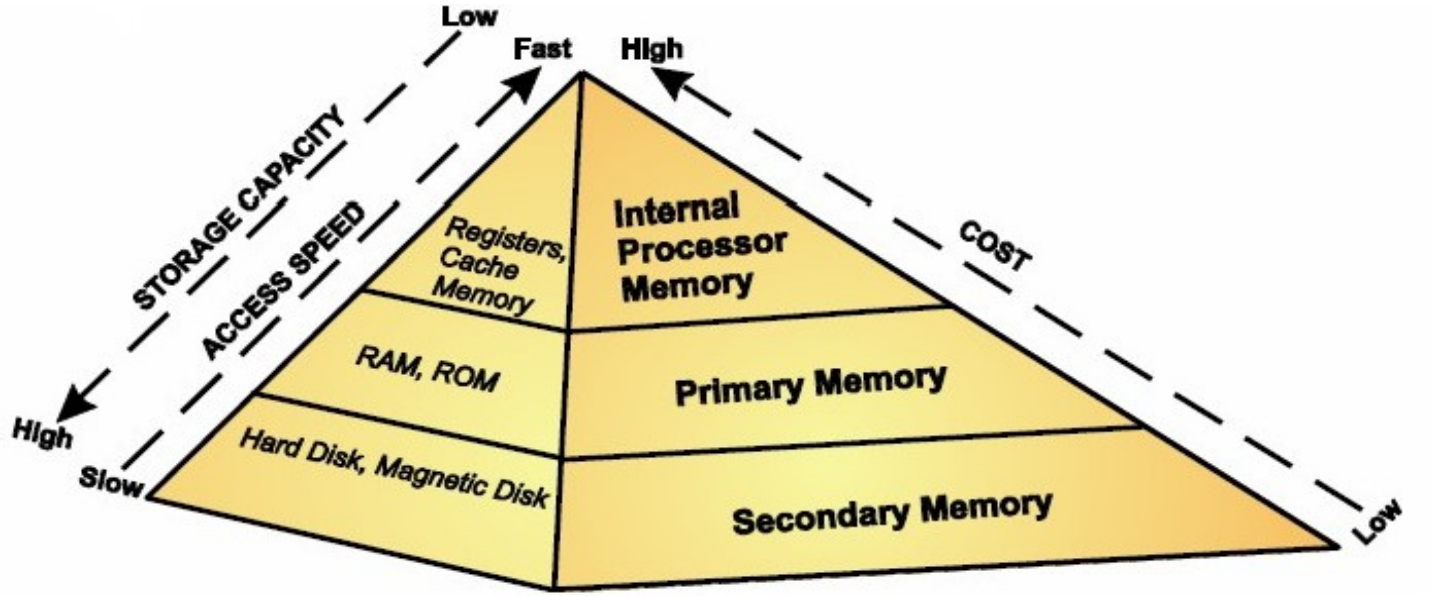
  - **Bit:** It is smallest unit of data and can hold only one of two values: 0 or 1.

  - **Byte:** A unit of **eight bits** is known as a byte.

Memory Representation Contd…

- **Kilobyte(KB):** A kilobyte is equal to 1024 bytes.
- **Megabyte (MB):** It comprises 1024 kilobyte
- **Gigabyte(GB):** It consists of 1024 megabytes and and is the standard unit of measurement for RAM.
- **Terabyte (TB):** It refers to 1024 gigabytes is the standard unit of measurement for hard disks.
- **Petabyte (PB):-** It refers to 1,024 terabytes (TB).
- **Exabyte(EB): -**It is equals to 1024 petabytes.
- **Zettabyte(ZB):-** It is equals to 1024 exabytes.
- **Yottabyte(YB):-** It is equal to 1024 zettabytes.
- **Brontobyte(BB):-** It is equal to 1024 yottabyte.

Memory Hierarchy



Internal Processor Memory

- Internal process memory usually includes **cache memory and registers** both of which store data temporarily and are accessible directly by the CPU.

- This memory is placed inside or near the CPU for the fast access of data.

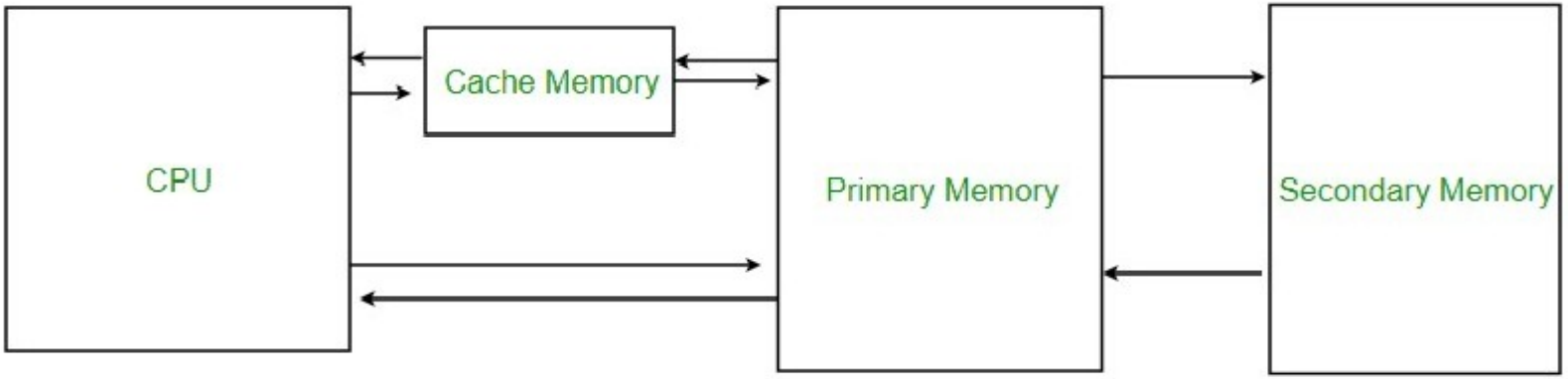
Registers

Registers are high-speed memory locations used for holding instructions, data and intermediate results that are currently being processed. Various types of registers are as follow:

- **PC (Program Counter)**: This register is used to keep track of the next instruction to be executed.
- **Instruction Register (IR)**: Holds the current instruction being decoded and executed.
- **Data Register (DR)**: Stores data that is being transferred to or from memory.
- **Address Register (AR)**: Contains the address in memory where data or instructions are stored.
- **Accumulator**: This register is used to store the intermediate results produced by arithmetic and logic units.

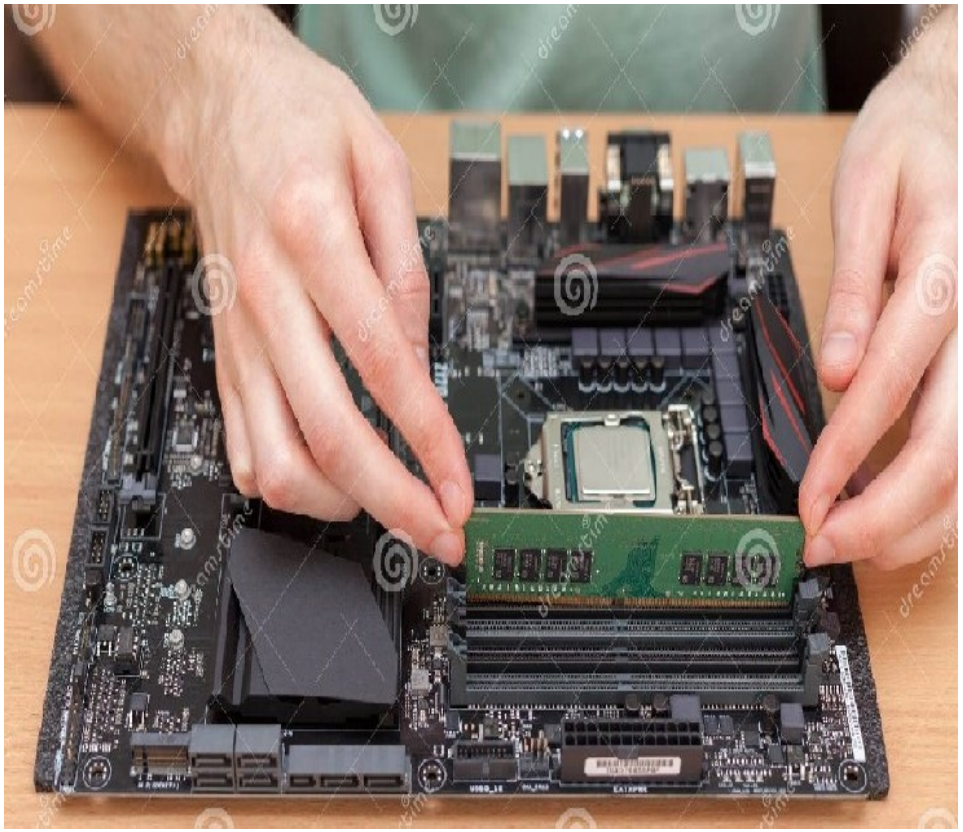
Cache Memory

- It is a small, fast and expensive memory that stores the copies of the data that needs to be accessed frequently from the **main memory**

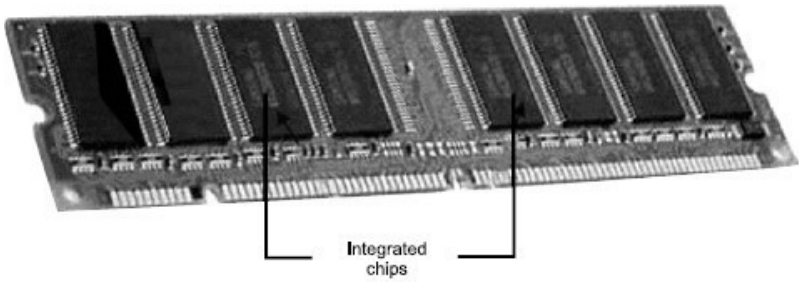


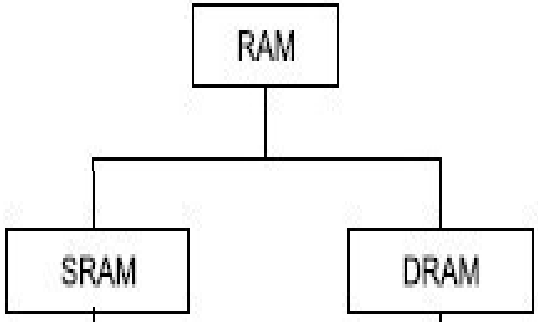
Random Access Memory (RAM)

- ✓ RAM allows the computer to store data for immediate manipulation and to keep track of what is currently being processed.
- ✓ It is the place in a computer where the operating system, application programs, and data in current use are kept so that they can be accessed quickly by the computer's processor.
- ✓ RAM is **much faster** to read from and write to than the other kinds of storage in a computer like the hard disk.



Types Of RAM





Static Random Access Memory (SRAM)

Static Random Access Memory (SRAM) is a type of random access memory (RAM) that stores data bits as long as power is supplied:

Working

- SRAM are circuits made of four to six transistors, to store data bits.

Uses

- SRAM is used in a computer's CPU for small amounts of memory called **registers and for fast cache memory**.
- Differences from DRAM
- SRAM is different from dynamic RAM (DRAM), which must be continuously refreshed. SRAM has better performance and lower power usage than DRAM, but it's also more expensive and requires more space.

Dynamic Random Access Memory (DRAM)

- ✓ DRAM stores the binary information in the form of electric charges applied to **capacitors**.
- ✓ The stored information on the capacitors tends to lose over a period of time and thus the capacitors must be periodically **recharged/ refreshed** to retain their usage.
- ✓ DRAM requires refresh time.
- ✓ The **main memory** is generally made up of DRAM chips.

SRAM and DRAM

SRAM (Static Random Access Memory) and **DRAM (Dynamic Random Access Memory)** are both types of volatile memory used in computers, but they have different characteristics, advantages, and uses.

1. Data Storage Mechanism:

SRAM:

- Stores data using **transistors** which are stable circuits that do not need to be refreshed. Data is retained as long as power is supplied to the SRAM.

DRAM:

- Stores data in **capacitors**. Each cell holds a bit of data as an electric charge in a capacitor.
- Requires **periodic refreshing** to maintain the data because the charge leaks away over time.

2. Speed and Performance:

SRAM:

- **Faster** than DRAM because it does not need to refresh and has a simpler design for accessing data.
- Provides quick access times, which makes it suitable for use in cache memory where speed is critical.

DRAM:

- **Slower** compared to SRAM due to the need for refreshing and the more complex access mechanism.
- Despite being slower, it is still adequate for main memory in most systems.

SRAM and DRAM

3. Cost:

SRAM: More expensive

DRAM: Less expensive

4. Power Consumption:

SRAM:

- Generally consumes more power when active due to its complex circuitry but consumes less power in standby mode.

DRAM:

- Consumes less power per bit compared to SRAM during active use but requires power for periodic refreshing.

5. Use Cases:

SRAM:

- Commonly used for **cache memory** in CPUs (L1, L2, and L3 caches) and other high-speed applications where fast access is essential.

DRAM:

- Widely used for **main memory** (RAM) in computers and other devices where large amounts of memory are needed at a lower cost.

Conclusion

- SRAM is faster, more reliable, and more expensive, suitable for applications requiring high speed and quick access times, such as CPU caches.
- DRAM is slower, cheaper, and more dense, making it ideal for main memory where cost and capacity are more critical than speed.
- Both types of memory serve important roles in computing, balancing speed, cost, and capacity according to their intended uses.

Read Only Memory (ROM)

- ROM is **non-volatile** in nature, that is, its contents are not lost when the power is switched off.
- The data and instructions stored in ROM can only be read but cannot be altered thereby making ROM much safer and secure than RAM.
- ROM performs the necessary BIOS (Basic Input Output System) function.
- ROM comes in following varieties:

  - **Programmable ROM (PROM)**
  - **Erasable Programmable ROM (EPROM)**
  - **Electrically Erasable Programmable ROM (EEPROM)**
  - **Flash ROM**

Programmable Read Only Memory (PROM)

- PROM is a memory chip on which the write operation of data can be performed only once.
- The data is stored on this chip permanently, i.e., once a program is written on the PROM, it cannot be erased or destroyed.
- It is mostly used in Product ID Storage.

Erasable Programmable Read-Only Memory(EPROM)

- EPROM can be erased and reprogrammed multiple times using ultraviolet (UV) light.

- It is used in:
  - **Firmware** Updates where firmware might need periodic updates but not frequently.
  - **Prototyping:** Useful in the development phase for testing and debugging new firmware or software.

EEPROM (Electrically Erasable Programmable Read-Only Memory)

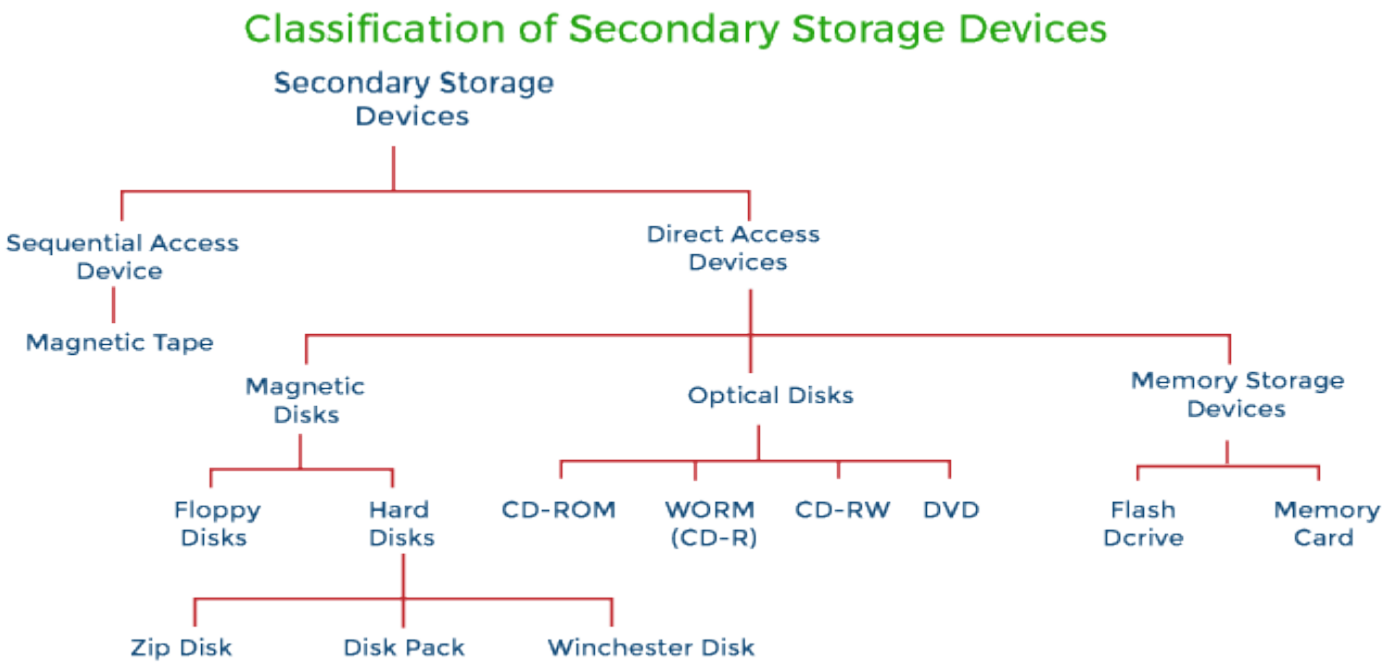
- **EEPROM** can be erased and reprogrammed electrically.
  - It allows for byte-level erasing and rewriting.
  - **It is used in BIOS Chips** where system firmware and settings that may need occasional updates.
  - **Configuration Data**: Used in devices like routers, printers, and industrial equipment to store configuration settings that might need to be changed or updated.

Flash Memory

- It is a type of EEPROM that can be erased and rewritten in larger blocks, with faster access times.
- Applications:
  - **USB Drives and SD Cards**: Used for portable data storage due to its compact size and high capacity.
  - **SSDs (Solid State Drives)**: Provides high-speed storage for computers and other devices.

Types of Secondary Storage Devices

- ✓ There are two methods of accessing data from the secondary storage devices: **sequential and direct.**
- ✓ Based on access secondary storage devices can be classified as:



Magnetic Tape

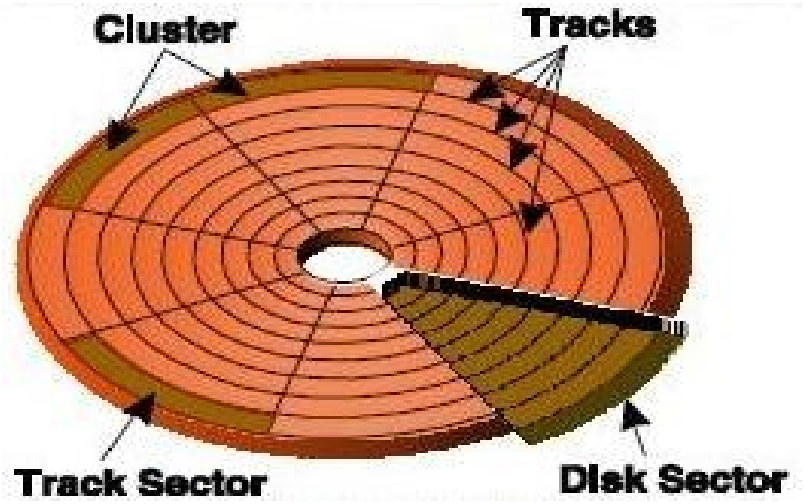
- **Magnetic tape** looks like the tape used in **music cassettes**. It is a plastic tape with magnetic coating on it. The data is stored in the form of ti ed and demagnetised portions on the surface of the material.

- **Advantages of Magnetic Tapes**
  - Magnetic tapes are **very durable and can be erased as** well as reused. They are the least expensive and a reliable storage medium for organizing archives and taking backups.
  - Magnetic tapes have virtually **unlimited storage capacity** because as many tapes as required can be used to store a large amount of data.
  - Magnetic tapes are **portable** because they are compact in size, lightweight, and

- **Disa[r]d[e]v[m]a[o]n[v]t[a]a[b]g[l]e[e]s· of Magnetic Tapes**
  - Since magnetic tapes are **sequential** in nature, they are not suitable in situations where data access is required in a random order.
  - Since magnetic tapes use parity bit to check the data, the data on such devices are difficult to recover even if a minor bit error occurs.

Magnetic Disk

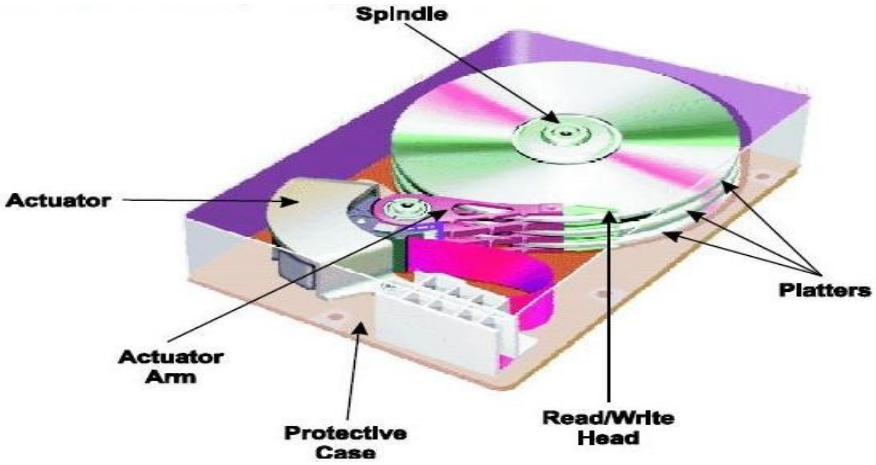
- ✓ A magnetic disk comprises a thin piece of plastic/metal circular plate/platter, which is coated with magnetic oxide layer. Data is represented as **magnetized spots** on a disk.
- ✓ To read the data, the magnetized **spots on the disk are converted into electrical impulses**, which are then transferred to the processor.
- ✓ The data in a magnetic disk can be **erased and reused virtually infinitely**. The disk is designed to reside in a protective case or cartridge to shield it from the dust and other external interference.



Types of Magnetic Disk

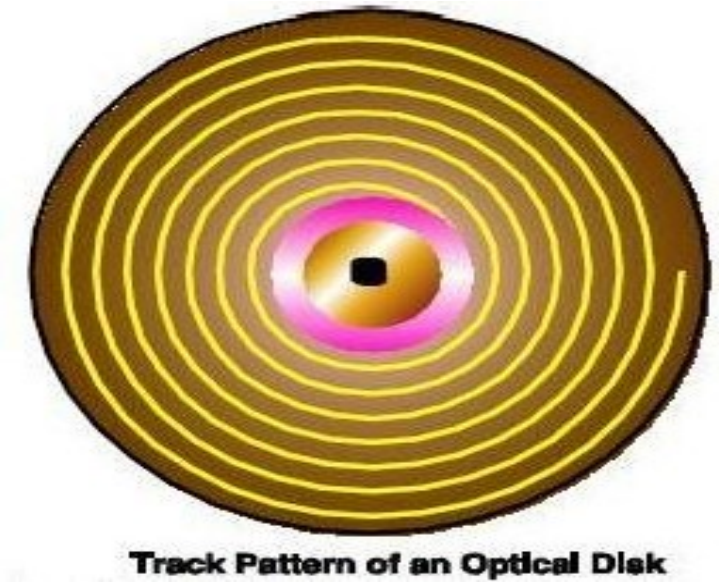
- **Floppy Disk:** A floppy disk or diskette is a round, flat piece of Mylar plastic coated with ferric oxide (a rust like substance containing tiny particles capable of holding a magnetic field) and encased in a protective

- **Hard Disk:** The hard disk, also called the hard drive or fixed disk, is the primary storage unit of the computer. It consists of a stack of disk platters that are made up of aluminium alloy or glass substrate coated with a magnetic material and protective layers.



Optical Disk

- ✓ An optical disk is a flat, circular, plastic disk coated with material on which bits may be stored in the form of highly reflective areas and significantly less reflective areas, from which the stored data may be read when illuminated with a narrow-beam source, such as **a laser diode.**
- ✓ These disks are capable of storing enormously high amount of data in a limited amount of space.



Track Pattern of an Optical Disk

Optical Disk (Contd.)

Types of Optical Disks

- **Compact Disk (CD)**
  A CD is a shiny, silver colour metal disk of 12 cm in diameter. A typical optical disk is made up of three layers: a polycarbonate plastic through which light can pass, a layer of aluminium, and a protective layer of acrylic on top of that. Compact disks are available in various formats: CD-ROM (Compact Disk-Read Only Memory), CD-R (Compact Disk-Recordable), and CD-RW (Compact Disk-ReWritable) disks.

- **Digital Versatile Disk (DVD)**
  DVD, initially called Digital Video Disk, is high-capacity data storage medium. In DVD, the tracks are placed closer together, thereby allowing more tracks per disk. The DVD's track pitch (the distance between each) is reduced to 0.74 micron, less than half of CD's 1.6 micron. The pits, in which the data is stored, are also a lot smaller, thus allowing more pits per track. The minimum pit length of a single layer DVD is 0.4 micron as compared to 0.834 micron for a CD.

Optical Disk (Contd.)

- **Blu-ray Disk**
  Blu-ray disk is an optical storage device, which is used to record and playback high definition video and audio as well as store images and other data. It uses **blue-violet laser** having shorter wavelength (405 nm) than a **red laser** (650 nm) used by **DVDs.** Due to this shorter wavelength, the laser can be focused more precisely on the small spot thereby resulting in storage capacity ten times than DVD.

A Blu-ray Disk

Universal Serial Bus (USB)

- **Pen Drive**
  A pen/flash drive is a removable storage device that is frequently used nowadays to transfer audio, video, and data files from one computer to another. A pen drive consists of a small printed circuit board, which is fitted inside a plastic, metal, or rubber casing to protect it.

Pen Drive


An External Hard Disk Drive with USB Connector

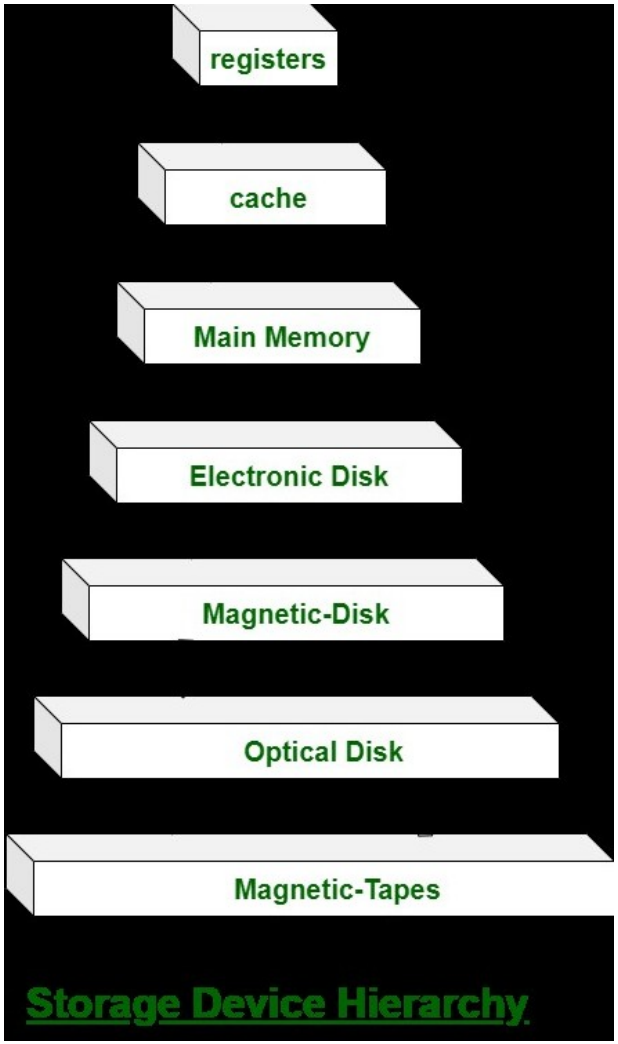
- **External Hard Disk**
  connected to the system through interfaces like USB. The storage capacity of external hard disk ranges from 20 GB to several TBs.

Memory Card

- ✓ Memory Card is a digital storage device, which is designed to be used with **portable electronic devices** such as mobile phone, digital camera, PDA, iPod, etc.
- ✓ Though original Memory card provided storage capacity of up to 128 MB, nowadays Memory Card with storage capacity up to 32 GB is available in the market.
- ✓ Nowadays, several different standards or formats of Memory Card are available in the market.

Memory Stick

Storage Device Hierarchy



Data, Information & Program

- Data: It is raw details that need to be processed to generate some useful information and is used as input
- Information is processed data useful for the user and is obtained as output of data processing.
- The activity of processing data using a computer is called data processing.
- Program: The set of instructions that can be executed by the computer in sequential or non-sequential manner.