CSIT113

Computer and Information Technology

L-T-P 2-0-2

MODULE 1

School of Engineering and Technology : ASETK

- Vision :

To emerge as the most preferred engineering institution with state of the art facilities, providing futuristic technical & value imparted education encouraging research, innovation and developing competent and socially sensitive leaders committed to excellence

- Mission

- To create state of the art facilities & ambience for advance level of teaching and practical training
- To make students socially inclusive individuals with conscience, commitment & education understanding the regard for human values, pride in their heritage and culture
- To strengthen industry-institute interface & promote Entrepreneurial development activities through research.

Department of Computer Science and Engineering

- Vision

To contribute effectively to the important national endeavor by producing quality professionals in the field of Computer Science and Engineering to meet the country's technology industry needs by working on recent research areas and publishing quality research works

- Mission

- To foster a learning environment that encourages robust understanding, innovation and application of computer science and artificial intelligence principles, enabling students to tackle complex computational problems and develop state-of-the-art solutions
- To inculcate professional ethics, effective communication skills, teamwork, and an understanding of societal and environmental responsibilities through industrial internship, projects and outcome based activities
- To encourage research-based activities and collaborations, both within the department and with external entities, contributing to the advancement of computer science and interdisciplinary areas

Course Outcomes

Syllabus

At the end of the course the students will be able to :

- Understand the basic knowledge of computer system, history and different units of a computer system
- Explain the architecture and operating system and different types of viruses
- Describe different number systems and their conversions
- Differentiate between various types of computer languages
- Explain concept of networking and data transmission concepts
- Use of editing, spreadsheet and presentation software

- Online Course
- https://www.coursera.org/learn/introduction-to-computers

COMPUTER

DEFINITION

A computer is an electronic machine, devised for performing calculations and controlling operations that can be expressed either in logical or numerical terms.

CHARACTERISTICS (AND ADVANTAGES) OF COMPUTER

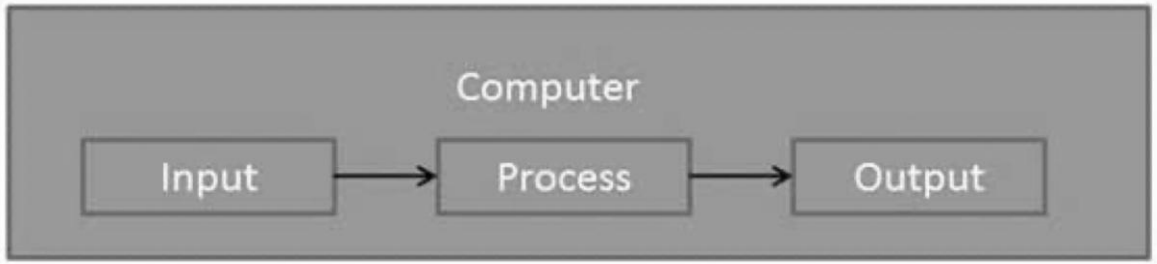
- **Speed**
- **Accuracy**
- **Diligence**
- **Reliability**
- **Storage Capabilities**
- **Versatility**
- **Resource Sharing**
- **Automation**
  Reduction in Paper Work
- **Reduction in Cost**

- **DISADVANTAGES OF COMPUTER**

FUNCTIONALITIES

Any digital computer carries out five functions in gross terms:

- Takes data as input.
- Stores the data/instructions in its memory and use them when required.
- Processes the data and converts it into useful information.
- Generates the output
- Controls all the above four steps.



COMPUTER GENERATIONS

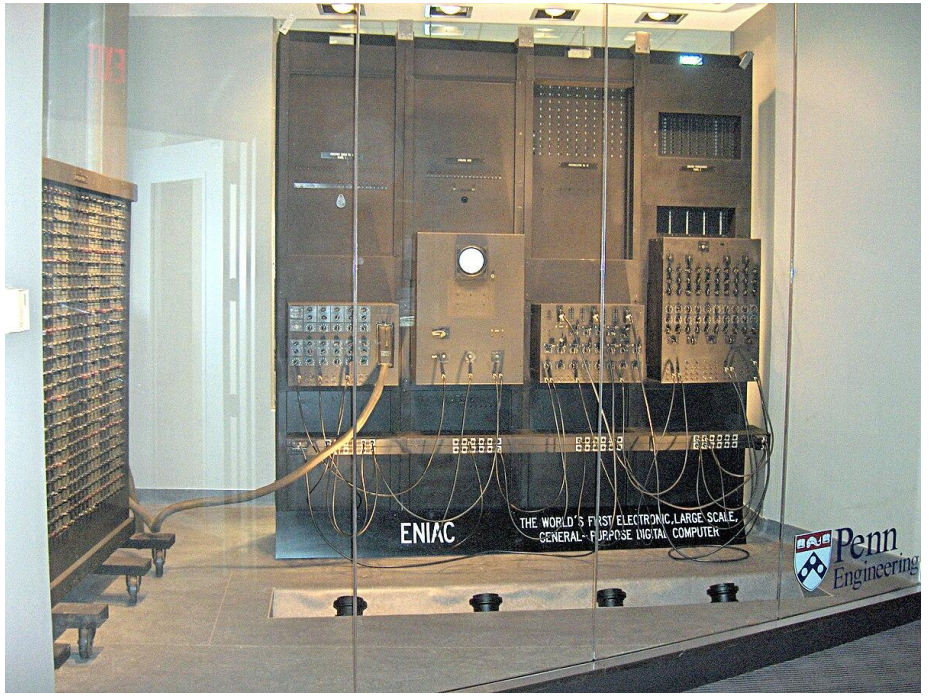
First Generation (1940-56) : Vacuum Tube

1. Vacuum tubes/thermionic value based machines for circuitry and magnetic drums for memory.
2. A magnetic drum is a metal cylinder coated with magnetic iron-oxide material on which data and programs can be stored.
3. Input was based on punched cards and paper tape and output was in the form of printouts.

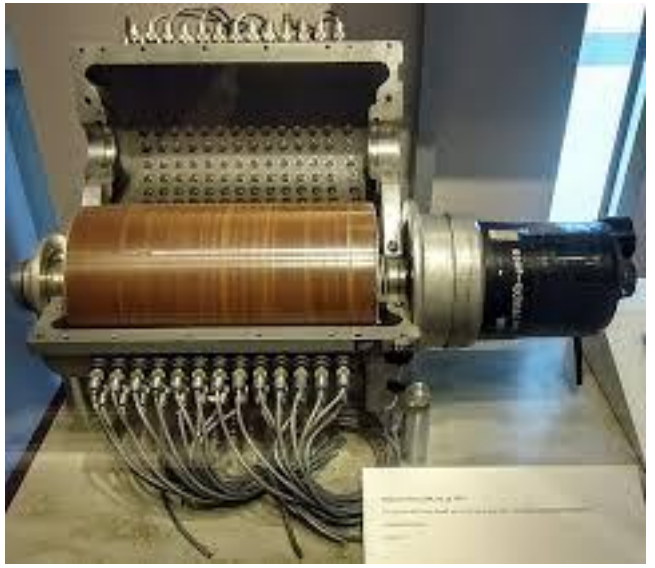
For example: ENIAC, EDVAC AND UNIVAC.

Characteristics of First Generation Computers.

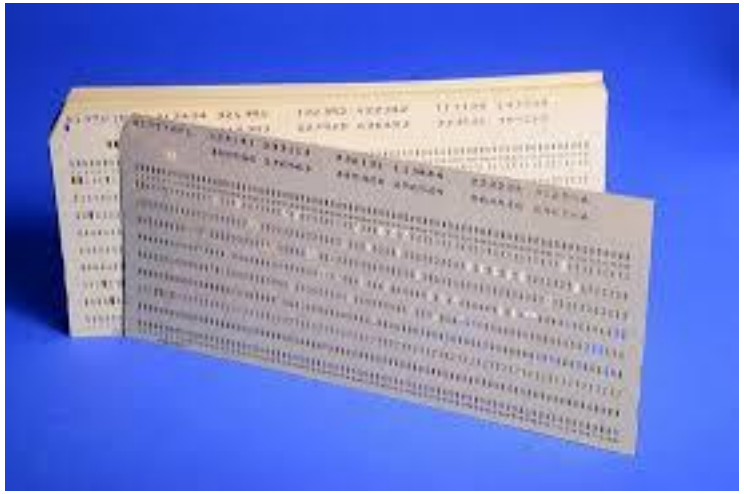
- Based on vacuum tube technology.
- Fastest computing devices of their time.
- Very large, and required a lot of space for installation.
- Non-portable and very slow equipment



Vacuum tubes



Magnetic Drums



Punch Cards

Punch Card Reader

COMPUTER GENERATIONS

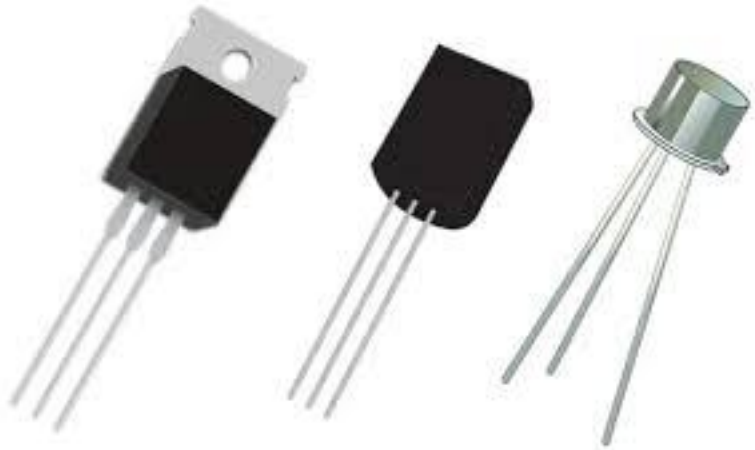
Second Generations (1956-63): Transistors

1. A transistor is made up of semiconductor material like germanium and silicon.
2. It usually had three leads and performed electrical functions such as voltage, current or power amplification with low power requirement.
3. Since transistor is a small device, the physical size of computers was greatly reduced.
4. Computers became smaller, faster, cheaper, energy-efficient and more reliable than their predecssors.
5. Magnetic cores- were used as primary memory and magnetic disks as secondary storage devices. However, they still relied on punched cards for input and printouts for output.

For example: PDP – 8 , IBM 1401 and IBM 7090

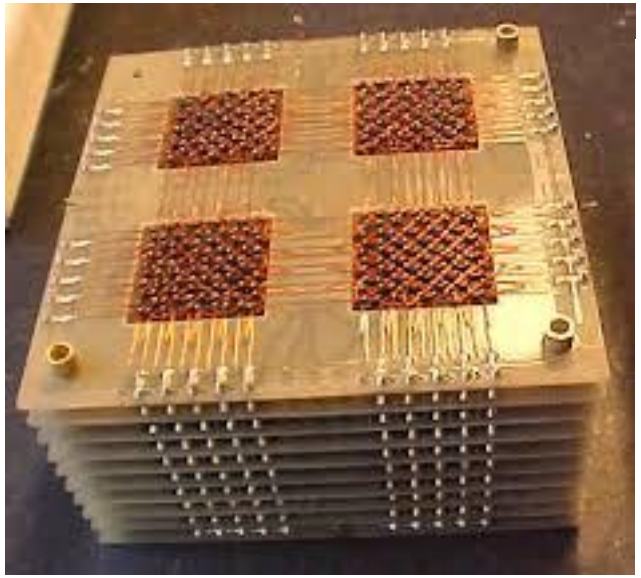
Characteristics of Second Generation Computer.

- Based on transistor technology
- Smaller as compared to the first generation computers.
- More portable and generated less amount of heat.



Transistors

PCB using transistors



Magnetic Core

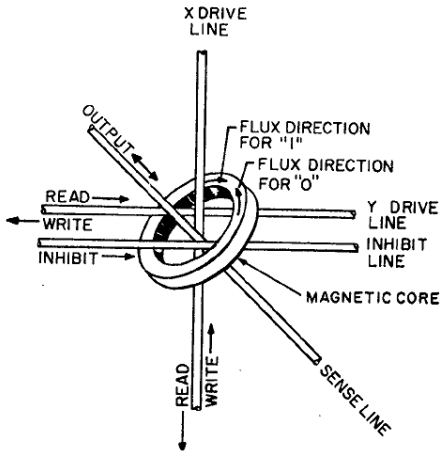


Figure 6-3.—Magnetic core showing "X," "Y," inhibit, and sense lines.

Magnetic Disk

COMPUTER GENERATIONS

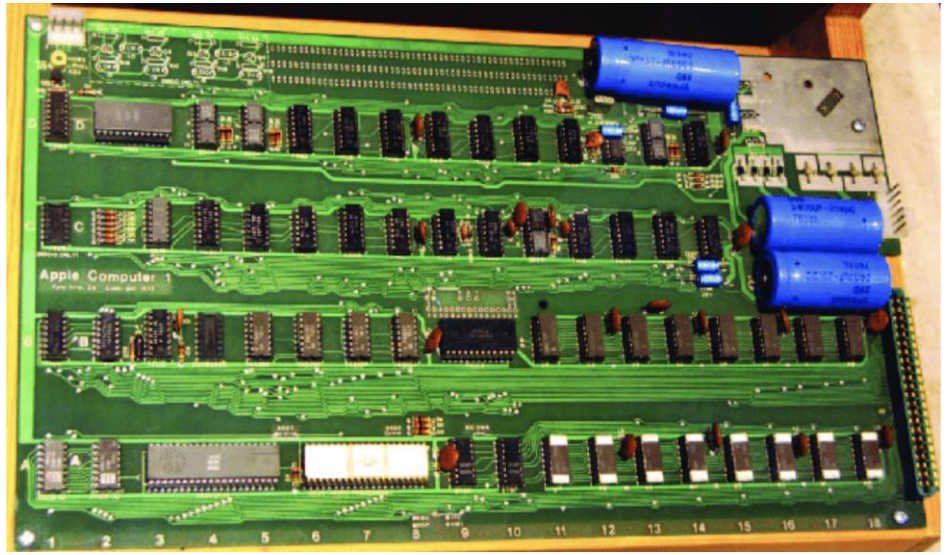
Third Generation (1964 – Early 1970), Integrated Circuits

- The development of the integrated circuit was the trait of the third generation computer. Also called an ic, an integrated circuit consists of a single chip with many components such as transistors and resistors fabricated on it.
- Integrated circuit replaced several individually wired transistor. This development made computers smaller in size, reliable and efficient.
- Instead of punched cards and printouts, users interacted with third generation computers through keyboards and monitors and interfaced with operating system.

For example : NCR 395 and B6500

- Characteristic of Third Generation Computer
- These computers were based on integrated circuit (ic) technology.
- They were able to reduce computational time from micro seconds to nano seconds.
- Extensive use of high – level language became possible

Integrated Circuit



First Apple computer boards with integrated circuits, bulk, and ceramic bypass capacitors

COMPUTER GENERATIONS

Fourth Generation (Early (1970 – Till Date) Microprocessors)

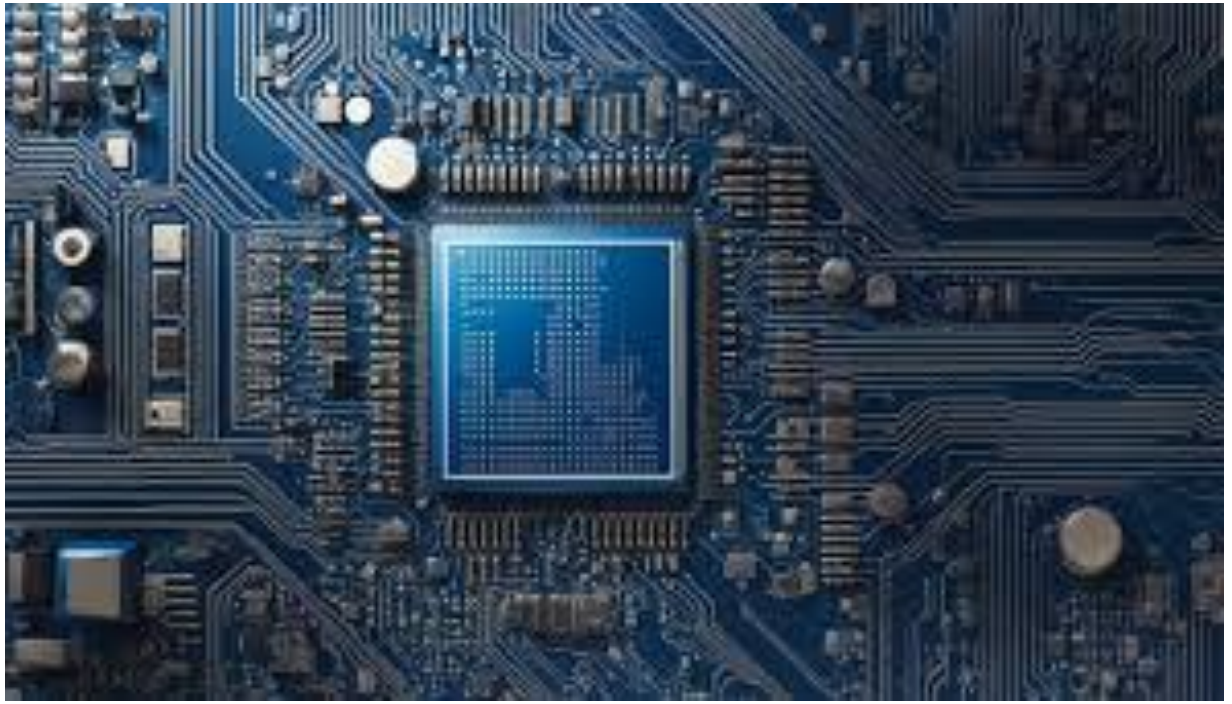
- The technology of this generation was still based on the intergrated circuit, these have been made readily available to use because of the development of the microprocessor.
- The fourth generation computers led to an era of large scale integration (LSI) and very large scale integration (vlsi) technology. LSI technology allowed thousands of transistors to be constructed on one small slice of silicon material whereas vlsi squeezed hundreds of thousands of components on to a single ewp
- ULTRA – large scale integration (ULSI) increased that number into millions the fourth generation computer became more powerful compact, reliable and affordable.

For example: Apple ii, Attair 8800 and CRAY-1

Characteristics of Fourth Generation Computers

- Fourth generation computers are microprocessor based systems
- These computers are very small
- GUI an d pointing devices enable users to learn to use the computer quickly
- Interconnection of computers leads to better communication and resource sharing

Microprocessor



Computer circuit (Motherboard) using microprocessor

COMPUTER GENERATIONS

Fifth Generation (Present and Beyond): Artificial Intelligence

- A computer would learn from its mistakes and possess the skill of experts the starting point for the fifth generation of computers has been set in the early 1990. The expert system it defined as a computer information system that attempts to mimic the thought process and reasoning of experts in specific areas three characteristics can be identified with the fifth generation computer these are.

Mega chips

- Fifth generation computers will use super large scale integrated (SLSI) chips, which will result in the production of microprocessor having millions of electronic components on a single chip

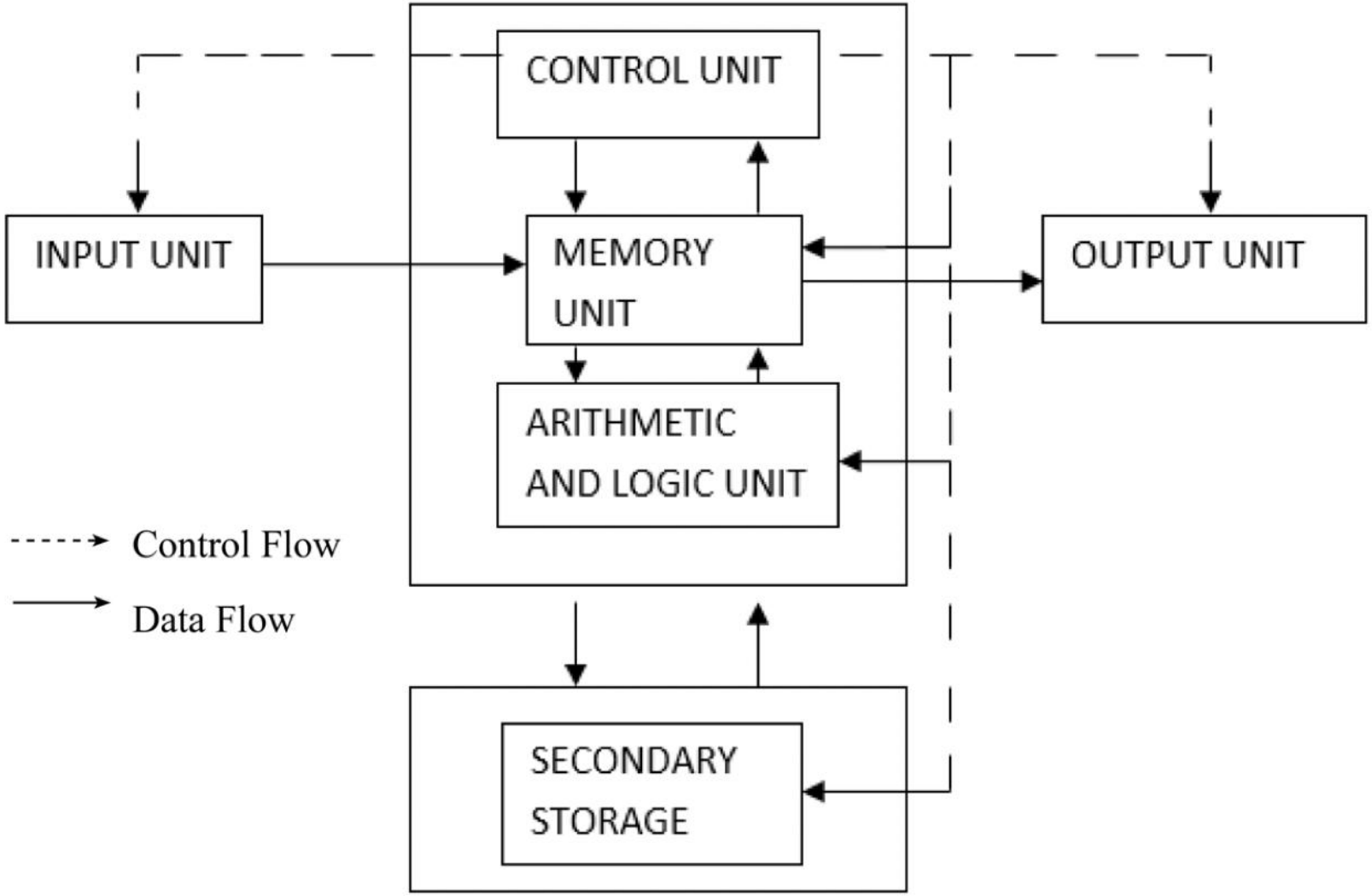
Parallel processing

- A computer using parallel processing accesses several instructions at once and works on them at the same time through use of multiple central processing units.

Artificial intelligence: (AI)

- AI comprises a group of related technologies expert systems (ES), natural language processing (NLP) speech recognition, vision recognition and robotics.

Basic Computer Architecture



Input Unit

- Accept data and instructions from the outside world.
- Convert it to a form that the computer can understand
- Supply the converted data to the computer system for further processing
- The input unit is used to send information or instructions or commands to the computer. The data received from the input input unit is immediately stored in main memory and then processed.
- Following are the some of the input devises:
  - Keyboard
  - Mouse
  - Light pen
  - Joystick
  - OCR (optical character recognizer)
  - MICR (magnetic ink character recognizer)
  - OMR (optical mark recognizer)
  - Camera
  - Microphone

Central Processing Unit (CPU)

It performs all calculations and all decisions.

- It controls and co-ordinates all units of the computer
- It interprets instructions of a program
- It stores data temporarily and monitors external requests.
- The CPU is sub-divided into the following sub-system.
  - (i) Control unit
  - (ii) Arithmetic and logical unit
  - (iii) Memory unit
    - (a) Primary storage
    - (b) Secondary storage.

Parts of CPU


System Fan
Floppy
Heat Sink
Hard Drive
Power Supply
Optical Drive
Motherboard
Processors (CPU)
RAM Moduels

Control unit

1. The control unit instructs the computer how to carry out program instructions. It directs the flow of data between memory and arithmetic logical unit.
2. The control unit instructs the input unit where to store the data after receiving it from the user.
3. In the same way, it controls the flow of data and instructions from the storage unit to ALU during program execution. The control unit fetches instructions from the primary memory, decodes them to determine the operations required, and then sets up instructions execution.

Eg. To add two numbers or to read a character from a keyboard. A number registers are associated with the control unit.

Arithmetic And Logical Unit

- Arithmetic and logical unit performs all the arithmetic and logical operations. Arithmetic operations like addition, subtraction, multiplication and logical operations, such as comparisons are performed in ALU.
- All calculations are performed in the arithmetic and logical unit (ALU) of the computer. ALU also does comparisons and takes decision .

Example: It can check if the number A is less than equal to or greater than the number B. Once the calculations or the logical operation is performed by ALU, then the result is transferred to the storage unit.

Memory unit

Memory is the part of computer which holds data for processing and other information it is also called as ***main memory*** or ***primary memory***.

- A device that stores program instructions or data used by the CPU when performing a given function.
- Memory is a device, which is used to store information temporarity/permanently, It is the place where the information is safely kept. Secondary memory, such as disk storage, is functionally considered I/O because it is accessed through the I/O system.

Two types of Memory :

- Primary Storage
- Secondary Storage

Primary storage

- The primary storage is also called as ***"main memory"*** stores and access information very fastly. This is generally used to hold the program being currently executed in the computer, the data being received from the input unit, the intermediate and final results of the program.
- Primary storage is also known as ***system memory, internal, temporary*** and ***"RAM"***
  - Installed on the main computer board (motherboard)
  - Typically comprised of ICs (integrated circuits)
  - Fast access – usually in the order of nano seconds

RAM

RAM and ROM

RAM stands for Random Access Memory, and ROM stands for Read Only Memory.

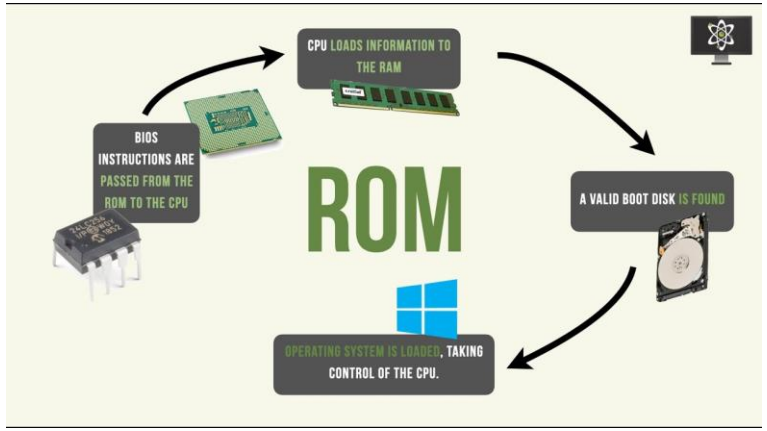
RAM is memory that stores the data that you're currently working with, but it's volatile, meaning that as soon as it loses power, that data disappears.

ROM refers to permanent memory. It's non-volatile, so when it loses power, the data remains.

RAM	ROM
Definition of RAM is Random Access Memory	Definition of ROM is Read-only Memory
Random Access Memory (RAM) is expensive when compared to ROM	ROM is cheaper when compared to RAM.
The speed of Random Access Memory (RAM) is higher when compared to ROM	The speed of Read-only Memory (ROM) is slower when compared to RAM.
Random Access Memory (RAM) has a higher capacity when compared to ROM	ROM has a lower capacity compared to RAM
Data in RAM can be modified, erased, or read.	Data in ROM can only be read, it cannot be modified or erased.
The data stored in RAM is used by the Central Processing Unit (CPU) to process current instructions	The data stored in ROM is used to bootstrap the computer.
Data stored on RAM can be accessed by the Central Processing Unit.	If the Central Processing Unit (CPU) needs to access the data on ROM, first the data must be transferred to RAM, and then the Central Processing Unit (CPU) will be able to access the data.
Data of RAM is very volatile, it will exist as long as there is no interruption in power.	Data present in Read-Only Memory (ROM) is not volatile, it is permanent. Data will remain unchanged even when there is a disruption in the power supply.

Types of ROM

ROM is primarily used to store firmware, such as the BIOS(basic input/output system) or UEFI(Unified Extensible Firmware Interface), which is essential for booting up the computer. It also stores other low-level software that rarely needs to be changed, including: Initial boot instructions. Hardware initialization routines. Self-test procedures.



Types:

- Masked ROM
- Programmable Read-Only Memory(PROM)
- Erasable Programmable Read-Only Memory(EPROM)
- Electrically Erasable Programmable Read-Only Memory(EEPROM)

Cache Memory

- Cache memory is a small amount of very fast memory that is built into the CPU. It acts like a **buffer** (a temporary store) between the CPU and RAM.
- Rather than access instructions and data from RAM one at a time, **whole blocks** of instructions and data that are in use by the CPU are copied into the cache memory, **along with the associated memory addresses**.
- Many CPU designs have two levels of cache memory, the fastest (L1) is divided into a data cache and an instruction cache. The second (L2) cache is slightly slower and sits between the L1 cache and RAM. The L1 cache and L2 cache can be clearly seen on this enlarged labelled image of a CPU.

Flash Memory

- Flash memory is a special type of RAM that, unlike normal RAM, is **non-volatile** (it does not need a power supply to preserve the memory contents). Flash memory cannot however replace RAM in a computer as the read/write speeds are too slow. Typical storage sizes range from 1GB to 16GB and higher.
- **Examples of flash memory in use**:
  - Compact Flash™ and Secure Digital™ (SD) memory cards in digital cameras.
  - Mini and Micro SD cards in Smartphones.
  - Memory cards in MP3 music players.
  - Memory cards for video game consoles.
  - USB memory sticks.
  - Solid state drives

Secondary storage

- The secondary storage is also known as ***Auxiliary Storage*** it may store several programs, documents, databases etc.
- The program that we want to run on the computer is first transferred to the primary memory before it can run. Similarly, after running the program if need to save the result, we will transfer them to the secondary storage.
- The secondary memory is slower and cheaper than the primary memory. Some of the commonly used secondary memory devices are ***Floppy diskette, Zip diskette, Hard disk and Magnetic disks*** and ***Tapes*** etc.

HDD

Output Unit

- Devices used to get the response or result of a process from the computer is called output output unit is the communication between the user and the computer.
- The output unit of a computer provider the information and results of a computation to the outside world.
- Computers do not work in the decimal system, they work in the binary system. Therefore if required, the output unit also converts the binary data into a form that users can understand.
- Commonly used output devices are.
    - Printer
    - Visual display unit (VDU) or monitor
    - Computer output microfilm
    - Plotter.

Storage Devices & Technology

- Magnetic Disks
- Magnetic Tapes
- Sequential access devices
- Direct access devices
- Optical disks
- Virtual memory

Magnetic disks

- **Magnetic Disk** contains circular disk made of metal or plastic. Both sides of the disk are usually used for storing data. The disk is coated with magnetic oxide. The disk is divided into multiple concentric circles known as tracks and tracks are divided into sectors in which data are stored.
  - Stores data on a rotating circular platter coated with a magnetic material.
  - Random access: Data can be accessed directly by moving the read/write head to the desired location on the disk.
  - Commonly used for storage in computers due to fast access speeds.

Magnetic Tapes

- Magnetic tape is a serial storage medium that, is made up of a thin strip of plastic coated with a magnetic material. This is one of the oldest formats of storage
  - Stores data on a long, thin plastic strip coated with a magnetizable material.
  - Sequential access: To access specific data, the tape needs to be moved to the correct position.
  - Often used for backup and archiving due to its low cost and durability.
  - Can be less convenient for frequent data access.

Optical Storage System

- Optical disks are a type of electronic data storage device that use light to read and write data.
- In optical storage technology, a laser beam encodes digital data on an optical disc or laser disc in the form of tiny bits arranged in a spiral pattern on the surface of the disc. Digital Versatile Disk (DVD), Compact Disk (CD) and Blu-Ray Disk are the examples of optical storage device.
- It can store large amounts of text of data in limited space.
- An optical-disk storage system consists of a rotating disk, which is coated with a thin metal or any other material that is highly reflective

Optical Storage System

Advantages of Optical Storage Systems

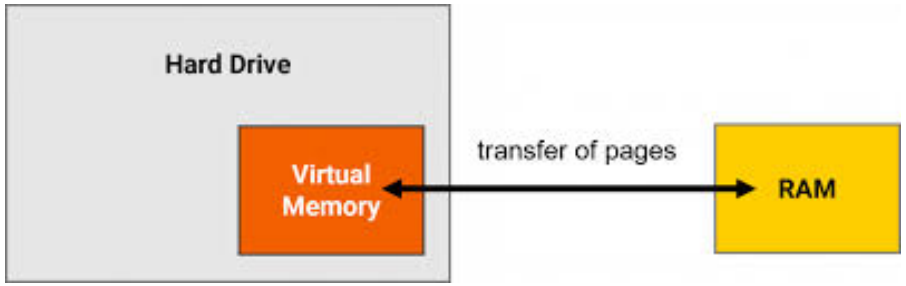
- The cost-per-bit of storage for optical disks is very low.
- The use of a single spiral track optical disks an ideal storage medium for reading large blocks of sequential data such as music.
- Due to their compact size and light weight, optical disks are easy to handle, store, and port from one place to another.

Disadvantages of Optical Storage Systems

- It is read-only (permanent) storage medium. Data once recorded, cannot be erased and hence, the optical disks cannot be reused.
- The data access speed for optical disks is slower than magnetic disks.
- It requires a more complicated drive mechanism than magnetic disks.

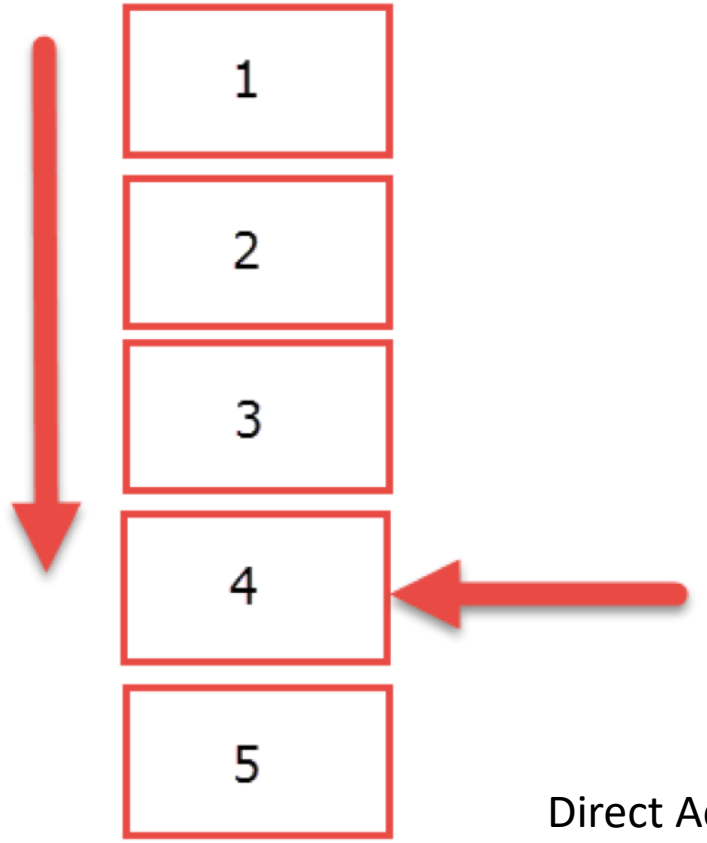
Virtual Memory

- Virtual memory is a memory management technique where secondary memory can be used as if it were a part of the main memory. Virtual memory is a common technique used in a computer's operating system (OS)
- User can load the bigger size processes than the available main memory by having the illusion that the memory is available to load the process
- Demand Paging is a popular method of virtual memory management. In demand paging, the pages of a process which are least used, get stored in the secondary memory.



Direct Access *vs.* Sequential Access

With **sequential access,** elements #1,2, 3 must be processed before element #4 can be processed.



With **direct access**, element #4 in the list can be accessed without having to process the elements before it.

Sequential Access devices- Magnetic Tapes

Direct Access devices- Magnetic Discs, optical discs