

COMPUTER MEMORY

A memory is just like a human brain. It is used to store data and instructions.

Computer memory is the storage space in the computer.

Memory is the storage area of a computer where all the inputs als as instructions) are stored before processing and the outputs are after processing of inputs.

The memory of a computer can be divided into following categories:

- Primary Memory/Main Memory
- Secondary Memory

Primary Memory

- Primary memory, also known as main storage or main memory.
- Primary memory holds only those data and instructions on which computer is currently working.
- It has a limited capacity and data is lost when power is switched off.
- Each location in the storage has a unique number, called Storage Address. The system assigns a unique memory location data element is assigned to the location, the system accesses it direct means of the address of the particular storage location.

Characteristics of Primary Memory

- It is known as the main memory.
- Usually volatile memory.
- Data is lost in case power is switched off.
- It is the working memory of the computer.
- Faster than secondary memories.
- A computer cannot run without the primary memory.

The various types of primary memory are:

- i. RAM (Random Access Memory)
- ii. ROM (Read Only Memory)

i.RAM (RANDOM ACCESS MEMORY) - VOLATILE MEMORY

- It is also called as read write memory or the main memory or the primary memory.

- RAM is volatile in nature i.e. once the system is switched off, the contents of RAM will automatically be erased.
- RAM is small, both in terms of its physical size and in the amount of Data it can hold.
- RAM is also referred to as read and write memory of the computer i.e. user can read the data from RAM as well as write the data into RAM.
- The storage capacity of RAM varies. Today, it is available in
- Megabytes (MB). (Like - 512MB) and also in Gigabytes (GB) (Like - 1GB, 2GB, 4GB 8GB).
- Types of RAM There are mainly two types of RAM:
 - i. Static RAM
 - ii. Dynamic RAM

(i) Static RAM (SRAM)

- SRAM is called static as no change or action. The word **static** indicates that the memory retains its contents as long as power is being supplied.
- Static RAM is more expensive and holds less data than dynamic RAM.
- Static RAM consumes more power.

(ii) Dynamic RAM (DRAM)

- DRAM, unlike SRAM, must be continually **refreshed** in order to maintain the data.
- DRAM is called dynamic as constant change or action i.e. refreshing is needed to keep the data intact.
- DRAM is used for most system memory as it is cheap and small.
- The Dynamic RAM consumes less power and is cheaper than static RAM.

ii. ROM (READ ONLY MEMORY) - NON-VOLATILE MEMORY

- ROM stands for Read Only Memory.
- It is the read only memory i.e. user can only read the instruction but cannot write into it.
- ROM is non-volatile in nature i.e. data does not get erased when the computer's power is switched off.
- ROM chips are used not only in computers, but in most other electronic items as well (like: calculator).
- In ROM, it is not possible to randomly select and store the information.

Types of ROM

There are mainly three types of ROM:

- i. PROM (Programmable Read Only Memory)
- ii. EPROM (Erasable Programmable Read Only Memory)
- iii. EEPROM (Electrically Erasable Programmable Read Only Memory)

(i) PROM (Programmable Read Only Memory)

- PROM is read-only memory that can be modified only once by a user.
- PROM is also known as one-time programmable non-volatile memory.
- In PROM, user can design the instructions only for once; he cannot change the instructions later whenever required.

(ii) EPROM (Erasable Programmable Read Only Memory)

- EPROM is a type of ROM that can be reprogrammed and erased many times.
- While the contents are being written in EPROM, user cannot read any information.
- EPROM chips are used for research and development operations

(iii) EEPROM (Electrically Erasable Programmable Read Only Memory)

- EEPROM is programmed and erased electrically.
- It can be erased and reprogrammed about ten thousand times. Both erasing and programming take about 4 to 10 ms (millisecond).
- EEPROMs can be erased one byte at a time, rather than erasing the entire chip.

Difference between RAM and ROM

RAM	ROM
1. RAM stands for Random Access Memory.	1. ROM stands for Read Only Memory.
2. RAM data is volatile. Data is present till power supply is present	2. ROM data is permanent. Data remains even after power supply is not present.
3. It is read/write memory.	3. It is read only memory.
4. Information can be modified.	4. Information cannot be modified

5. RAM speed is quite high.	5. ROM speed is slower than RAM.
6. RAM memory is large and high capacity.	6. ROM is generally small and of low capacity.
7. It is possible to randomly select and store the information.	7. It is not possible to randomly select and store the information.
8. RAM is costly.	8. ROM is cheap.

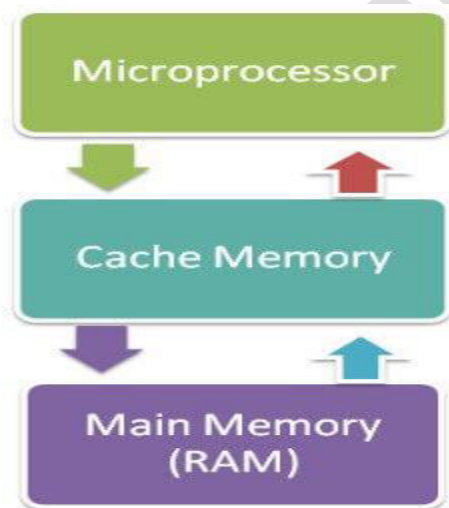
Cache Memory

Cache memory is a high-speed memory, which is small in size but faster than the main memory (RAM). The CPU can access it more quickly than the primary memory.

Cache memory can only be accessed by CPU. Cache memory is small, fast and expensive type of storage that is placed between the CPU and main memory.

If the CPU finds the required data or instructions in the cache memory, it doesn't need to access the primary memory (RAM). Thus, by acting as a buffer between RAM and CPU, it speeds up the system performance.

It is very expensive as compared to cache memory and hence its size is normally very small.



Advantages

The advantages of cache memory are as follows –

- Cache memory is faster than main memory.
- It consumes less access time as compared to main memory.
- It stores the program that can be executed within a short period of time.
- It stores data for temporary use.

Disadvantages

The disadvantages of cache memory are as follows –

- Cache memory has limited capacity.
- It is very expensive.

Auxiliary Memory (Secondary Memory)

- **Auxiliary memory** (also referred to as secondary storage) is the non-volatile memory lowest-cost, highest-capacity, and slowest-access storage in a computer system.
- Auxiliary memory may also refer to as auxiliary storage, secondary storage, secondary memory, external storage or external memory.
- Auxiliary memory holds data for future use, and that retains information even the power fails.
- Auxiliary memory is much larger in size than main memory but is slower. It normally stores system programs, instruction and data files. It is also known as secondary memory.

Characteristics of Auxiliary Memory are following –

- **Non-volatile memory** – Data is not lost when power is cut off.
- **Reusable** – the data stays in the secondary storage on permanent basis until it is not overwritten or deleted by the user.
- **Reliable** – Data in secondary storage is safe because of high physical stability of secondary storage device.
- **Capacity** – Secondary storage can store large volumes of data in sets of multiple disks.

- **Cost** – It is much lesser expensive to store data on a tape or disk than primary memory.

Secondary Memory

- This type of memory is also known as external memory or non-volatile. It is slower than the main memory.
- These are used for storing data/information permanently.
- The user can access the data from secondary memory whenever required.
- The secondary storage devices offer huge storage volume with high speed and reliability.

Examples:

- Hard Disk
- Floppy Disk,
- Magnetic Tapes, etc.

Characteristics of Secondary Memory

- It is known as the backup memory.
- It is a non-volatile memory.
- Data is permanently stored even if power is switched off.
- It is used for storage of data in a computer.
- Computer may run without the secondary memory.
- Slower than primary memories.

Hard Disk

- Hard disk another type of magnetic disk on which we can store data and information permanently.
- Hard disk usually installed in Computer.
- A hard disk drive is also known as a hard drive.
- Hard disk hold more data and faster than floppy disk i.e. data operations like cut, copy, paste etc. are performed at a higher speed.

- A hard disk drive (HDD) is a non-volatile computer storage device; Non-volatile means data is retained when the computer is turned off.
- For Example, can store anywhere from 10 TO 2048 GB of data whereas most floppies can store only 1.44mb.

Advantages of Hard Disk

- Hard disk offer large storage capacity.
- Stores and retrieves data much faster data than a floppy disk.
- Data is not lost when you switch off the Computer.
- Usually fixed inside the Computer.

Disadvantages of Hard Disk

- **Hard disks** can crash which stop the computer from working
- The disk is fixed inside the computer and cannot easily be transferred to another computer.

Optical Disk

- An optical disk is primarily used as a portable and secondary storage device. It can store more data than the previous generation of magnetic storage media, and has a relatively longer lifespan.
- Alternatively referred to as a **disc drive, optical media, optical storage, Optical disc drive.**
- An optical disc is an electronic data storage medium that can be written and read from using a low-powered laser beam.
- Optical storage devices are non-volatile i.e. they retain their contents if power supply is off.
- The storage devices that use laser technology to save retrieve data.
- Originally developed in the late 1960's the first optical disc created by James T. Russell.

Types of Optical Storage

- CD-ROM
- DVD

Advantages of Optical Disk

- Optical disks are easy to carry.
- It is capable to store vast amount of data.
- Affordable price
- It can be recycled (Re-used).
- It has ultra data stability.
- Countable/uncountable storage units

Disadvantages of Optical Disk

- Optical disk is expensive than other storage devices.
- Some traditional PCs are not able to read these disks.
- Optical disk expensive than other storage devices.

Difference between Primary memory and Secondary memory:

Primary Memory	Secondary Memory
1. Primary memory is temporary.	1. Secondary memory is permanent.
2. Nature of Parts of Primary memory varies, RAM- volatile in nature. ROM- Non-volatile.	2. It's always Non-volatile in nature.
3. Primary memory devices are more expensive than secondary storage devices.	3. Secondary memory devices are less expensive.
4. Primary memory is also known as main memory.	4. Secondary memory is also known as Auxiliary memory.
5. Primary memory is directly accessible by CPU.	5. It is not directly accessible by CPU.
6. Examples: RAM, ROM, Cache memory, PROM, EPROM,	6. Examples: Hard Disk, Floppy Disk, Magnetic Tapes, etc.