

Unit: 2

Coherence and locality properties

There are three important properties for maintaining consistency in the memory hierarchy :-

- 1) Inclusion
- 2) Coherence
- 3) Locality.

} Cache operation

Inclusion

Coherence property :-

The coherence property requires that copies of the same information items at successive memory level should be consistent. If a word is modified in the cache, copies of that word must be updated immediately at the higher levels.

There are two strategies for maintaining coherence in a memory hierarchy.

1) write through :- which demand immediate update through broadcasting $M_0 + 1$ level of memory if a word is modified in M_i .

2) write back :- the second method is ~~written~~ which delays the update write back method. In this method the delays in communicating the update to the immediate upper layers are recorded. in write back technology.

Locality property :-

The memory hierarchy was developed based on the program behavior known as locality of reference.

1) Temporal locality :- Recently referenced items like instructions or data are likely to be referred again shortly such as iterative loops, process, stacks, temporary variables or subroutines.

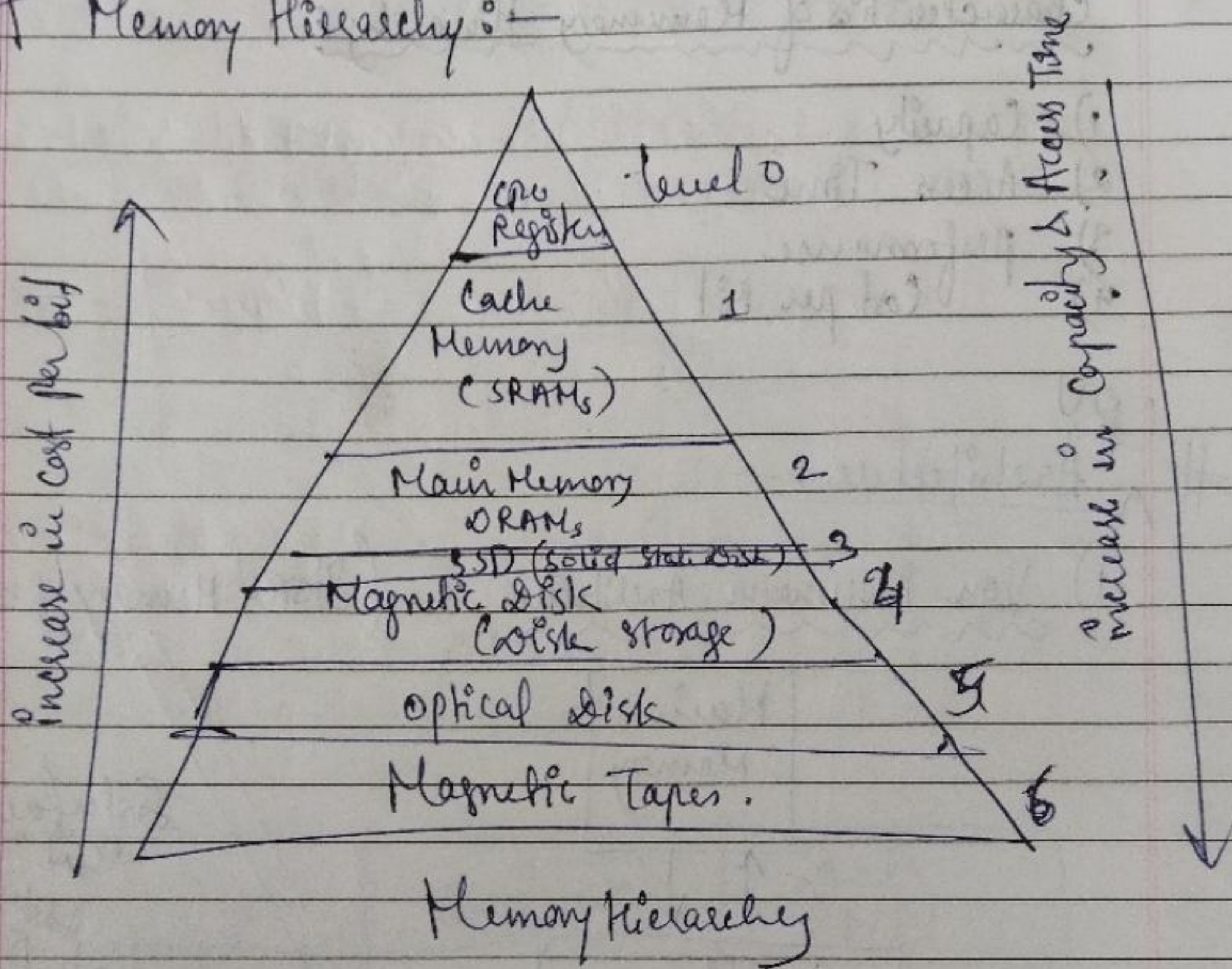
2) Spatial locality :- This refers to the tendency for

also
linked
list

a process to access items whose addresses are nearer to another. For example, operations on arrays involve access of certain clustered area in the address space.

3) Sequential locality :- In typical programs the execution of the program follows a sequential order unless branch instructions.

Memory Hierarchy :-



- 1) Registers :- capacity 16 - 64 bits • located in CPU.
- 2) Cache Memory :- Store frequently used data & instruction set that have been recently accessed ~~by~~ ^{from} Main Memory.
- 3) Main Memory :- RAM.
Larger storage capacity than Cache but slower.
Store instructions that are currently in use by the CPU.
- 4) SSD and HDD - (non-volatile memory)
Store data and instructions not currently in use by CPU.
- 5) Magnetic disks - circular plates.
- 6) Magnetic tape - Magnetic recording device.

Characteristics of Memory Hierarchy:

- 1) Capacity
- 2) Access Time
- 3) Performance
- 4) Cost per Bit.

Factors :-