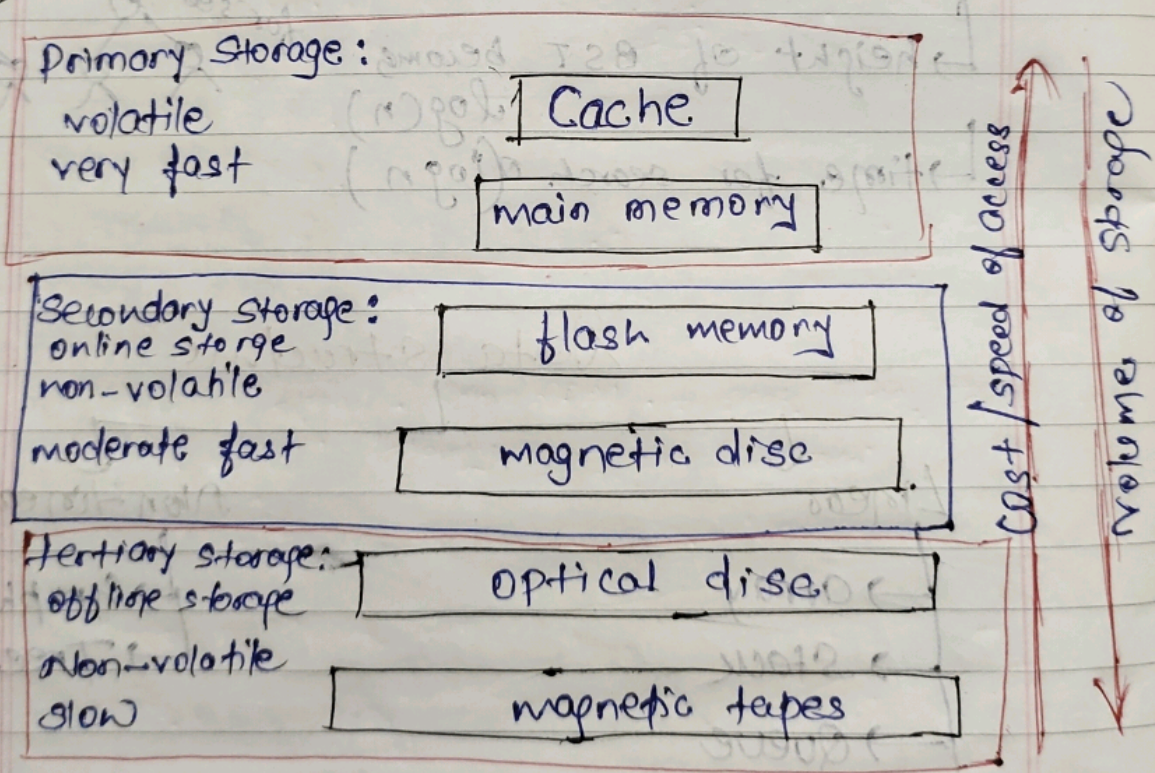
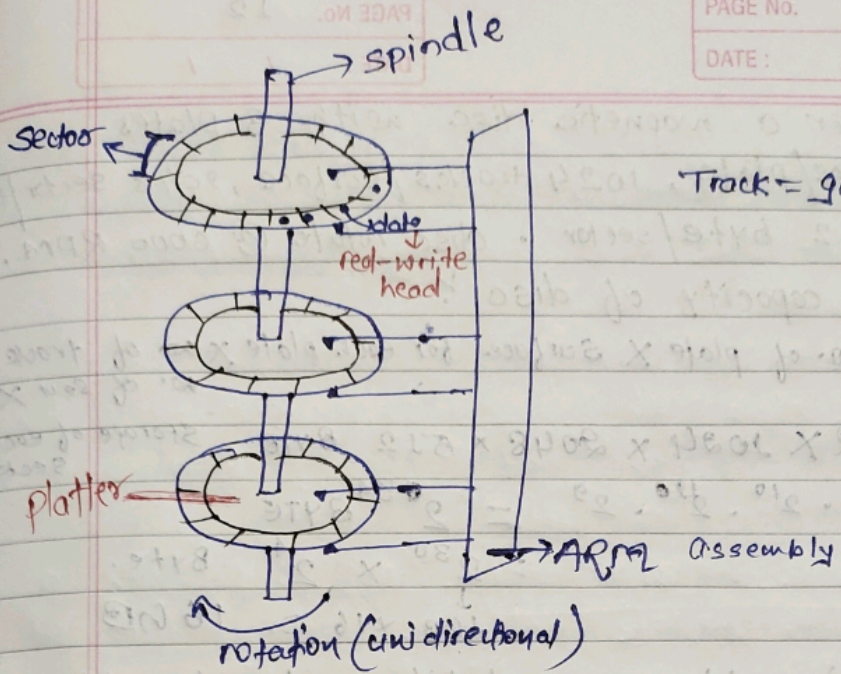
LDS	Non-LDS
→ elements are arranged in linear order	→ arranged in hierarchical or network manner.
→ single level involved	→ multiple level involved
→ implementⁿ is easy	→ implementatⁿ is complex
→ data can be traversed in one way only.	→ data transvered in multiple ways.
→ eg: array, stack, queue, linked list	→ Graph, tree, hash map

lec. 04





Track = group of sector

Platters → Surface → Track → sector → data

multiply
divide

Disc size = P × S × Track × Sect. × data

1K = 2^{10} byte
1M = 2^{20} byte
1G = 2^{30}
1T = 2^{40}

* Seek Time: time taken by r/w head to reach desired track.
* Rotat" Time: time taken for one complete rotat".
* Rotat" latency: time taken to reach desired sector (half of rotat" time)
* Access time = Seek Time + Rotat" latency
  seek time + $\frac{1}{2}$ rotat" time (360°)
* Disk capacity = total no. of sector present × no. of byte present in 1 sector

Cost / speed of access
Volume of storage

Q Consider a magnetic disc with 8 plates 2 surface/plate, 1024 tracks/surface, 2048 sector/track and 512 byte/sector. disc rotate @ 6000 RPM.

i) find capacity of disc?

Capacity = no. of plate × surface for each plate × no. of track × no. of sect × storage of each sector.

$8 \times 2 \times 1024 \times 2048 \times 512$ BYTE

$2^3 \cdot 2 \cdot 2^{10} \cdot 2^{11} \cdot 2^9 = 2^{34}$ BYTE

$= 2^{30} \times 2^4$ Byte.

$1\text{GB} \times 16 = 16\text{GB}$

ii) What is minimum no. of bits require for addressing all the sectors?

total no. of sector $= 8 \times 2 \times 1024 \times 2048$

$= 2^{25}$ sector.

1 bit → 1 elem

2 → 2^2 elem

3 bit → 2^3 elem

n bit → 2^{25} elem

$\log_2(2^{25}) = 25$ bit

minimum 25 bit require to cover all 2^{25} sector

iii) rotat speed = 6000 RPM & seek time = 3milisec.

find rotat latency $= \frac{1}{2}$ Rotat time 360°

Seek Time = time to reach desire track.

~~6000 rot in 1 min~~

~~100 — 1 sec~~

~~1 milisec~~

6000 rot in 1 min

1 rot in $\frac{60 \times 10^3}{6000}$ ms

$= 10$ ms

rotat latency $= \frac{1}{2} \times 10\text{ms} = 5\text{ms}$

5/9.

PA - Q 2.

Q. file size = 1000 KB, seek time = 3ms, rot^n speed = 30,000 RPM
disc have 200 sector/track. sector size = 512 Byte.

i) find transfer rat (in KB/ms)

time for 1 rotat^n = $\frac{60 \times 10^3}{30000}$ = 2ms

total byte present in 1 track = 200 × 512 Bytes
= 102400 Byte
= 100 KB.

Transfer Rate = $\frac{\text{Capacity of 1 Track}}{\text{time for 1 rotat}^n}$

= $\frac{100}{2\text{ ms}}$ KB = 50 KB/MS

iii) find Access time + Transfer time

→ Transfer time = $\frac{\text{File size}}{\text{transfer rate}}$ = $\frac{1000\text{ KB}}{50\text{ KB/MS}}$ = 20ms

→ Access time = Seek time + Rot^n latency for 1 sector
3ms + $\frac{1}{2}$ × 2ms = 4 ms

→ no. of sector in which file is stored = $\frac{1000\text{ KB}}{512\text{ Byte}}$
= 2000

Total access time = 2000 × 4ms = 8000ms
for all sector
(2000 ↓ no. of sector; 4ms ↓ time to access 1 sector)

→ Access time + transfer time = 8000ms + 20ms
= 8020 ms.

12, 13

Q) a disc with 10 platters, 64 track/surface, 256 sector/track & 512 byte/sector. 4 byte/sector is reserved for file system info.

i) How much free space available for use (in MB)

10 × 2 × 64 × 256 × (512 − 4)
(2 = surface)

$10 \times 2^{15}(2^9 - 2^2)$ Byte

$\frac{10}{2^5} 2^9 - \frac{10}{2^5} \cdot 2^2$ MB

$= 10 \times 2^4 - 1.25$ MB $= 160 - 1.25 = 158.75$ MB

Disc Controller: interface b/w computer system & disk drive hardware.
→ accept high-level command to read/write a sector.

- Storage Area Network (SAN): connect disk by high speed network to a number of servers.
- Network Attached Storage (NAS): provides a file system interface using networked file system protocol.

Magnetic Tapes:

→ Hold large volumes of data.
→ provide high transfer.
→ very slow access time in comparison to magnetic and optical disk.
→ Tapes are cheap, but cost of drive is very high.
→ used maily for backup.

Flash storage:

NOR flash vs NAND flash
→ much better.
→ NAND have faster write/erase speed
→ NAND is much cheaper than NOR.

Parameters	Cloud storage	Traditional storage
→ Cost	Cheaper per GB than external drive	→ High cost on adding more space
→ Reliability	High reliable	→ less reliable
→ File sharing	Support file sharing, Can be shared from anywhere	→ req. physical drives to share data
→ Accessibility	can access from anywhere	→ restricted to local access
Backup / recovery	very safe, if PC ~~do~~ distroy	→ lost all data

SSD vs HDD

Parameter	SSD	HDD
Technology	→ Integrated circuit	→ mechinical parts, platters
Access Time	→ 0.1 ms	→ 5 - 8 ms
Backup rate	→ 6 hr	→ 20 - 24 hr
Reliability	→ failure rate < 0.5 y.	→ failure rate 2 - 5 y.
power consume	→ 2 - 5 watt	→ 6 - 15 watt

lec. 8-9

Organisation of Records in file:

Heap: a record can be placed anywhere in the file, where it is space.
- Sequential: Store record in sequential order.

Hashing: to quickly locate a data in a large dataset.

File ORGANISATION:

A database ⟶ collection of FILES

file is sequence of Records

Record is sequence of fields

- A database file is partioned into fixed-length storage unit called Blocks.

Data Dictionary storage:

- stores metadata (data about data)
- user & accounting info, including password
- physical file organisation informat"
- info about indices.

STORAGE Access

→ database system seeks to minimize the no. of block transfers for b/w disc & memory.
→ we can reduce it by keeping as many blocks in main memory.

Buffer: portion of main memory available to store copies of disc blocks.

Buffer Manager: subsystem responsible for allocating buffer space.

→ programmer calls to Buffer manager when they need a block from disc.
→ if block is already ~~there~~ in buffer, buffer manager return adress of block in main memory.
→ if block is not in buffer, then buffer
→ replacing some other block.

→ Most operating system replace the blocks least recently used (LRU)

pinned block: memory block that is not allowed to be written back to disc

Toss-immediately strategy: free the space occupied by block as soon as process end.

Most recent used: Show most recent used files.