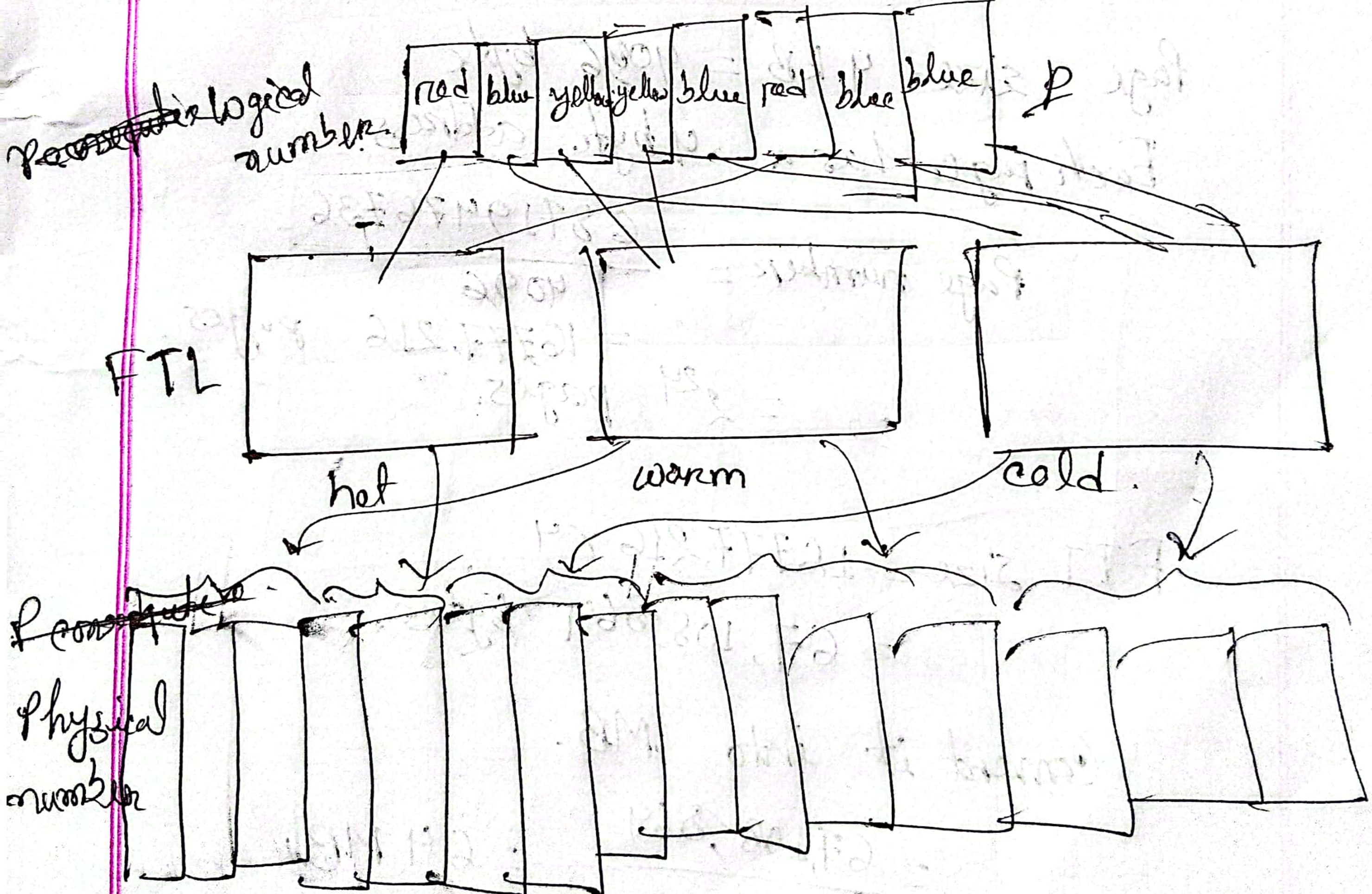
DBMS. 12.1.

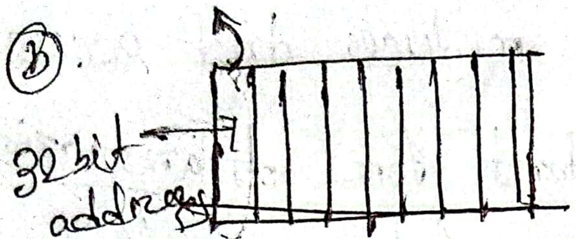
12.2: Ans: Outer track reduces disk access latency. This aspect is important for transaction processing systems, where latency affects the transaction processing rate.

12.3. a) Flash Translation Table.



This representation gives an Overhead equal to the size of the page address for each page.

4096-byte



64 gigabyte.

Flash size = 64 GB.

$= 64 \times 2^{30} = 68,719,476,736$ bytes.

Page size = 4 KB = 4096 byte

Each page has a 4 byte address.

$$\text{Page number} = \frac{68719476736}{4096}$$

$= 16777216$ pages

$= 2^{24}$ pages.

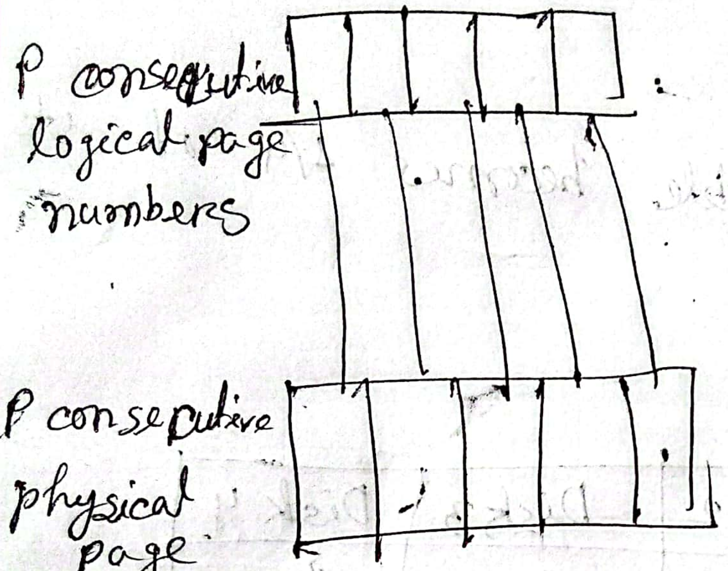
FTT size $= 16777216 \times 4$

$= 67,108,864$ bytes.

Convert it into MB.

$$= \frac{67,108,864}{2^{20}} = 64 \text{ MB}.$$

© How to reduce the size of the flash translation table (FTT)



For example, suppose, P=4.

- Logical page 0-3 → physical pages 100-103
- logical page 4-7 → Physical pages 200-203.

~~using~~ the We can store the mapping of the first page of every P pages.

instead of storing:

0 → 100

1 → 101

2 → 102

3 → 103

+ I can store

0 → 100

and the next 3 logical pages follow consecutively.

So, the total entries reduce by a factor of p.

If p = 4, the table becomes 1/4 of its original size.

12.4

Disk 1	Disk 2	Disk 3	Disk 4
B1	B2	B3	B4
P1	B5	B6	B7
B8	P2	B9	B10
⋮	⋮	⋮	⋮

Parity block P_i is the parity block for data blocks $\boxed{B_{4i-3} \text{ to } B_{4i}}$.

This arrangement has the problem that P_i and B_{4i-3} are on the same disk. So if that disk fails, reconstruction of B_{4i-3} is not possible, since data and parity are both lost.

12.6 RAID-1 (mirroring)

ⓐ if mirroring happen replace

This recovery procedure ensures that a write to stable storage ~~storage~~ either succeeds completely or results in no change.

The requirement of comparing every corresponding pair of blocks during recovery is expensive to meet. We can reduce the cost greatly by keeping track of block writes that are in progress, using a ~~non~~ small amount of nonvolatile RAM. In recovery, only blocks for which writes were in progress need to be compared.

ⓑ RAID-5 contents are re-constructed using other blocks.

If parity block itself don't agree with the block info the parity block's contents are reconstructed.

Physical Storage Media

a) Cache.
b) Main Memory.
c) Flash Memory
d) Magnetic Disk.
e) Optical Disk
f) Magnetic Tapes.

Storage Medium	Type/Technology	Typical Access time
1. Cache Memory	Semiconductor (SRAM)	~(1-5) ns.
2. Main Memory (RAM)	Semiconductor (DRAM)	~(50-100) ns
3. Flash Mornery (SSD)	Non-volatile flash storage	~(0.1-1) ms
4. Magnetic Disk (HDD)	Magnetic Storage	~(5-10) ms.
5. Optical Disk (CD, DVD)	Optical laser storage	~(80-150) ms
Magnetic Tapes	Magnetic sequential storage	~ (10-100) sec.

RAID 6 (Double parity) data rebuild without heavy read load.

RAID 10 (mirroring + striping) : ~~d. repl~~ rebuild can be, because data can be copied directly from a mirror without reconstructing parity. improves speed

use SSD based RAID 10

Data Scrubbing:

Is a background process that periodically reads all disks in a RAID array to verify data integrity and correct any errors using redundancy (parity/mirrors).

1) Detects latent sector errors before any data loss.
2) Ensures redundant data remains consistant.
3) Ensures reliability and data availability.