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(82) Conflict Serializability, Precedence Graph :-

Q:-

T_1	T_2	T_3
R(x)		
		R(y)
		R(x)
	R(y)	
	R(z)	
		W(y)
	W(z)	
R(z)		
W(x)		
W(z)		

— Timeline.

→ First, we have to make precedence graph → (mean, just graph with edges & vertices).

Vertex → No. of Transac's (T_1, T_2 & T_3).

Now

* Edges:

Check the conflict pairs in other transactions and draw Edges.

Like * T_1 → (check in T_2 & T_3)

* Conflict pairs :-

R-W
W-R
W-W

of same variable. Let, (x).

* Start :-

Now, Start with first oper^n. i.e,

In T_1 → R(x)

& check the conflict pair of R(x) in other Transac's i.e. (T_2 & T_3).

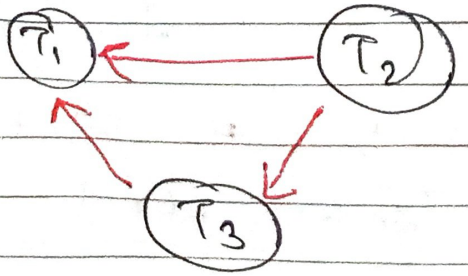
→ Conflict pair (C.P.) of R(x) → W(x)
&
now, Similarly,
conflict pair of W(x) → R(x), W(x).

→ Now, do check for every opera's in all transac's & after checking wrt those opera^. & If you find any conflict pair, then draw edge acc. to vertex (Transac^).

→

T_1	T_2	T_3	C.P. we find →
~~R(x)~~			
		~~R(y)~~	R(x) - W(x) ($T_3 \to T_1$)
		~~R(x)~~	R(y) - W(y) ($T_2 \to T_3$)
	~~R(y)~~		R(z) - W(z) ($T_2 \to T_1$).
	~~R(z)~~		W(z) - R(z) ($T_2 \to T_1$)
		~~W(y)~~	W(z) - W(z) ($T_2 \to T_1$)
	~~W(z)~~		
~~R(z)~~			
~~W(x)~~			
~~W(z)~~			

Precedence Graph:-



Now, Come on Graph :-

check that if there is any Loop/Cycle in the Graph.

How to check cycle :- अगर हम एक किसी भी Node से चलें, तो क्या हम घूम के वापस आ सकते हैं। If yes → Loop/Cycle Exists.

(It is not must that the cycle must covers all the nodes. May be possible, it comes just after visiting one node). → also a cycle.

(# In our graph, there is no loop / cycle.)

No Loop / Cycle → Conflict Serializable Schedule
If Loop / Cycle Exists → Not C.S.S.

→ Conflict Serializable → Serializable → Consistent
(Serial Schedule)

* Now, how to make Serializable ! →

$T_1 \rightarrow T_2 \rightarrow T_3$
$T_1 \rightarrow T_3 \rightarrow T_2$
$T_2 \rightarrow T_1 \rightarrow T_3$
✓ $T_2 \rightarrow T_3 \rightarrow T_1$
$T_3 \rightarrow T_1 \rightarrow T_2$
$T_3 \rightarrow T_2 \rightarrow T_1$

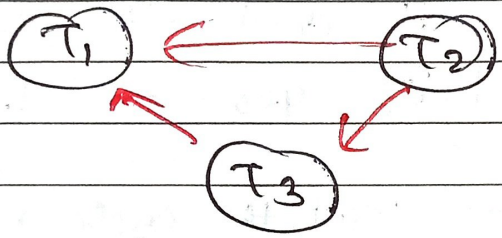
6 Cases → Now, which Case ?

Again, See the graph & check

Indegree = 0

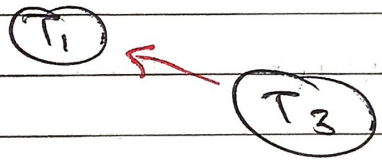
Indegree = 0, means a vertex with '0' indegree.

Mean, जहां i vertex पर कोई भी Edge (arrow) नहीं आ रहा हो।



T_2 has, Indegree = 0,

Now, remove T_2.



∴ $T_2 \rightarrow T_3 \rightarrow T_1$

T_1	T_2	T_3
	0	
		0
0		

---

83. View Serializability :→

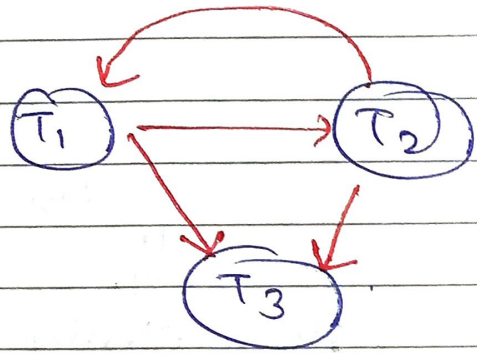
Q:- Check whether schedule is conflict Serializable or not?

→ first make Precedence graph.

Loop → No Answerable. then, view serializable Answers.

S

T_1	T_2	T_3
~~R(A)~~		
	~~W(A)~~	
~~W(A)~~		
		W(A)



∴ Here, we get a loop.

So,

It is Non Conflict Serializable.

↳ Here, we can't tell that it Serializable or not.

↳ Now,

(*) To check that, we use View Serializability.

→ Now, we arrange this Table,

T_1	T_2	T_3
R(A)		
	W(A)	
W(A)		
		W(A)

We change the position

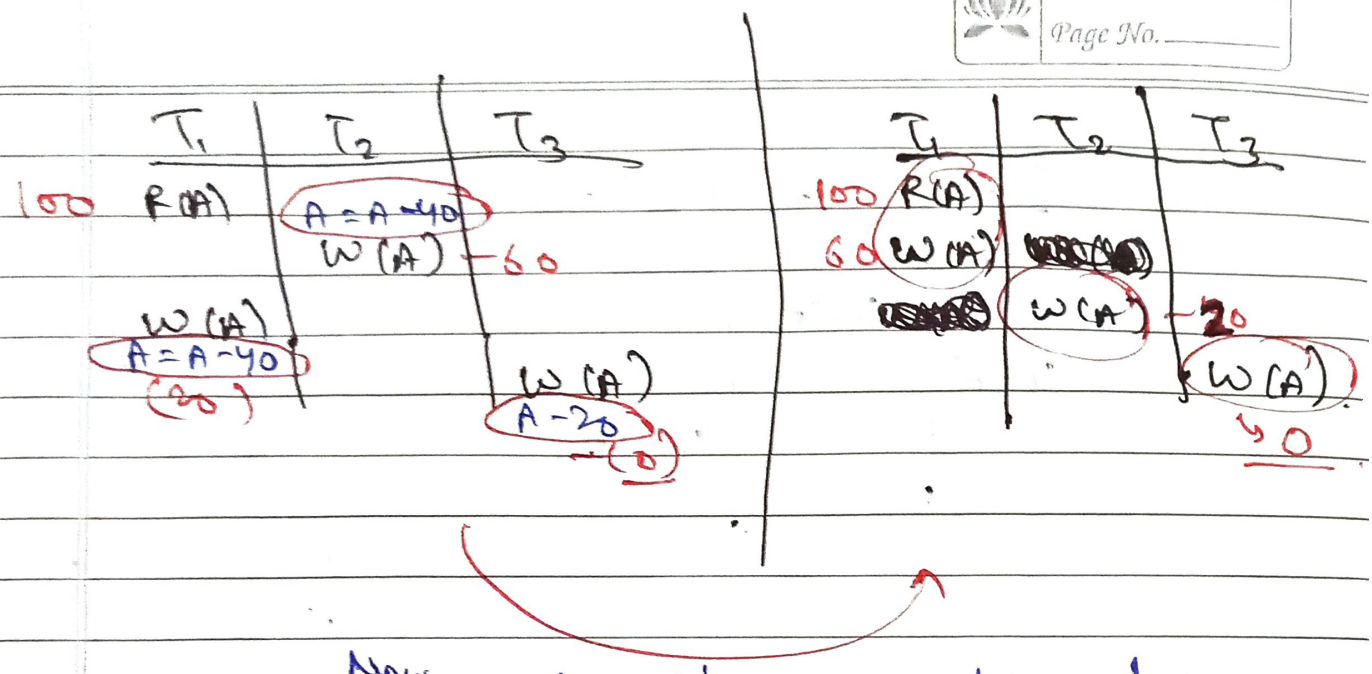
T_1	T_2	T_3
R(A)		
W(A)		
	W(A)	
		W(A).

Now this is a serial schedule. $T_1 \rightarrow T_2 \rightarrow T_3$.

But,

We have to check whether they match each other or not.

with A = 100.



Now, apply this same here.

Here, finally A value = 0

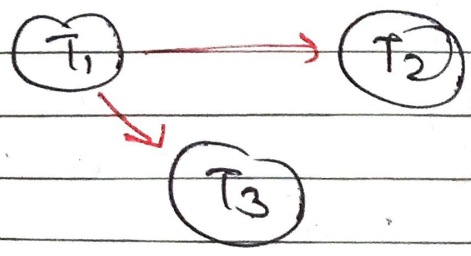
Here also finally A is '0'

Hence, Both are Equivalent.

They are View Equivalent (≡).

Note:- Bcz, finally output is given by A of T_3. So, if adjust the pos" of A. of T_1 & T_2. So, there is no problem.

Now,



(By : Reading of only T_1)

↳ Hence, $T_1 \longrightarrow T_2 \longrightarrow T_3$ (By Table).

Note:- Conflict Serializable tell that it is not Serializable (no ans.). But, View Serializable checks it & tell that it is Serializable.

(parallel schedule)

84. Concurrency Control Protocols :→ (C.C.P.)

(Shared - Exclusive Locking Protocol)

→ C.C.P. is that how to make them Serializable, or how to make them recoverable Schedule are concurrent, but how we can make them serializable & recoverable, this comes under Concurrency Control Protocol (C.C.P.).

→ We achieve this, By using Locking Protocols.

(#) 'Shared - Exclusive locking' :→

We use 2 locks here,

→ Shared lock (S) → if trans. locked data item in Shared mode, then allowed to Read only.

U → means unlock.

T_1	
S(A)	→ Shared lock.
R(A)	→ only Read
U(A)	→ Unlock.

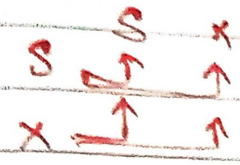
→ Exclusive lock (X) → if trans. locked data item in Exclusive mode then allowed to Read & write both.

T_2	
X(A)	→ Exclusive lock.
R(A)	
W(A)	
U(A).	→ unlock.

* Compatibility Table :- →

→ Request

grant ↓	S	X
S	Yes	No
X	No	No



Explo":-

S has only R(A)

X has both R(A), W(A)

⇒ S - S (No conflict) bcz R(A)-R(A).

⇒ S - X (Conflict).

R - R

R(A)	R(A)
	W(A)

⇒ X - S (Conflict)

R(A)	
W(A)	
	R(A)

⇒ X - X

R(A)	
W(A)	
	R(A)
	W(A)

→ conflict.

* Problems in S/X Locking :- →

1.) May not sufficient to produce only Serializable Schedule.

2.) May not free from Irrecoverability.

3.) May not free from deadlock.

4.) May not free from starvation.

(85.) Drawbacks in Shared | Exclusive :→
S/X locking protocol

⇒ locking gives us Serializable Schedule.
→ Consistent

1.) May not sufficient to produce only Serializable Schedule.
→ हो भी सकती, नहीं भी।

Ex.→

T_1	T_2
R(A)	
W(A)	
	R(A)
R(B)	
W(B)	

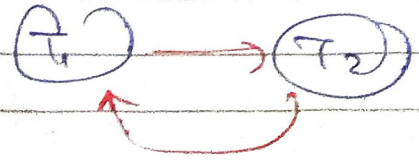
concurrent (parallel) →

try to Convert to → $T_1 \to T_2$ (or) $T_2 \to T_1$

T_1	T_2
X(A)	
R(A)	
W(A)	
U(A)	S(A)
	R(A)
X(B)	U(A)
R(B)	
W(B)	
U(B)	

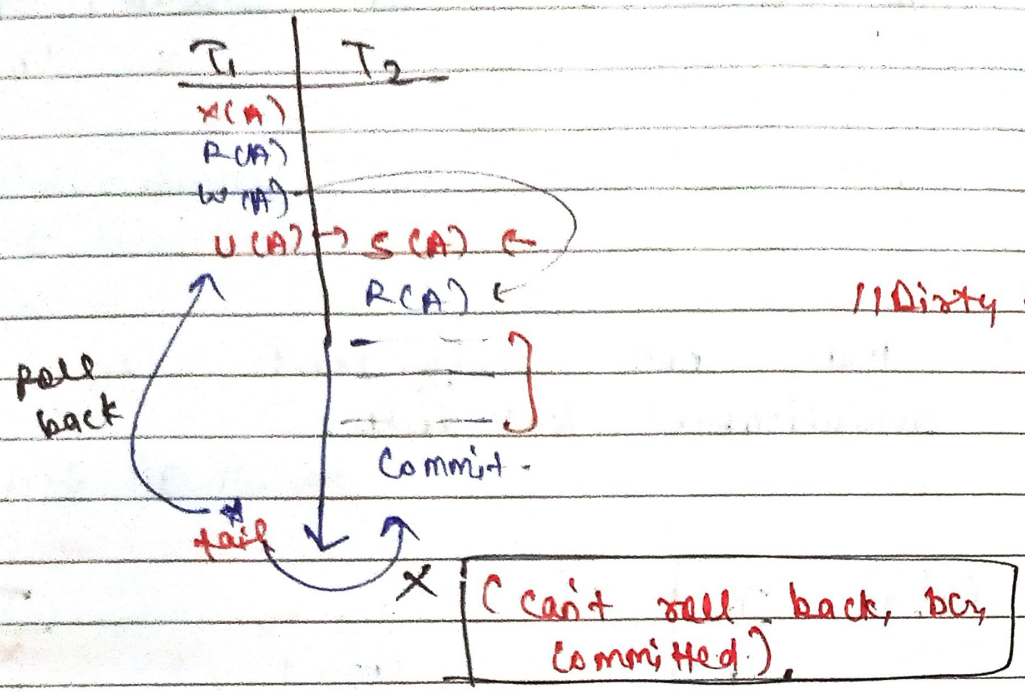
Note:→ Until, we do unlock, U(A) in T_1, we don't be able to put Shared lock S(A) on T_2. bcz by Compatibility Table. [(X-S) → No], so first we unlock X(A). & then, use S(A) on T_2 data.

2) Here, we don't get Serializable Schedule even after appling S/X locking. As u can see in Table.



2.) May not free from irrecoverability.

Ex:-



(can't roll back, bcz, committed).

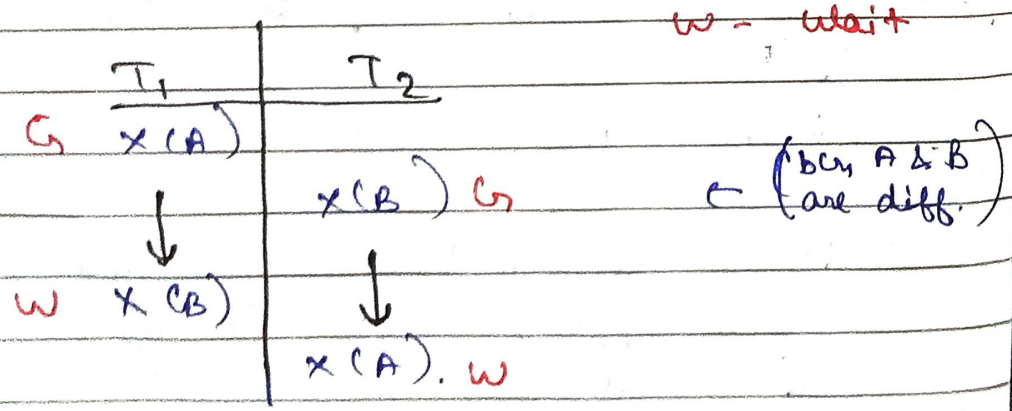
∴, It can't recover here.

3.) May not free from deadlock.

⇒ Deadlock :- When 2 person wait for resources, & they both are waiting in an infinite loop, so, when we wait infinitely, it is called Deadlock State.

G - Grant
W - Wait

Ex :-



2) Here, both are in waiting bcz, They are not unlock after use. So,

→ T_1 also waits that when T_2 unlocks, he can use on X(B).

Same

→ T_2 also waits that when T_1 unlocks, he can use on X(A).

So, Both are waiting in an Infinite loop.

4.) May not free from starvation.

In deadlock, waiting upto Infinite time
But,
In starvation, waiting not upto the Infinite time.

5) Shared के ऊपर Shared दे सकते हैं without unlock by compatibility Table.

Ex:-

	T_1	T_2	T_3	T_4
		S(A)		
W	X(A)			
			S(A) G	
Waiting Time		U(A)		
				S(A) G
			U(A)	
				U(A)

S → Shared Lock
X – Exclusive "
U – Unlock.

So, here, T_1 waits for X(A) until T_4 unlocks.
So, here starvation also. (by Shared के ऊपर Exclusive, बिना unlock के grant नहीं होता।)

— x — x — x —

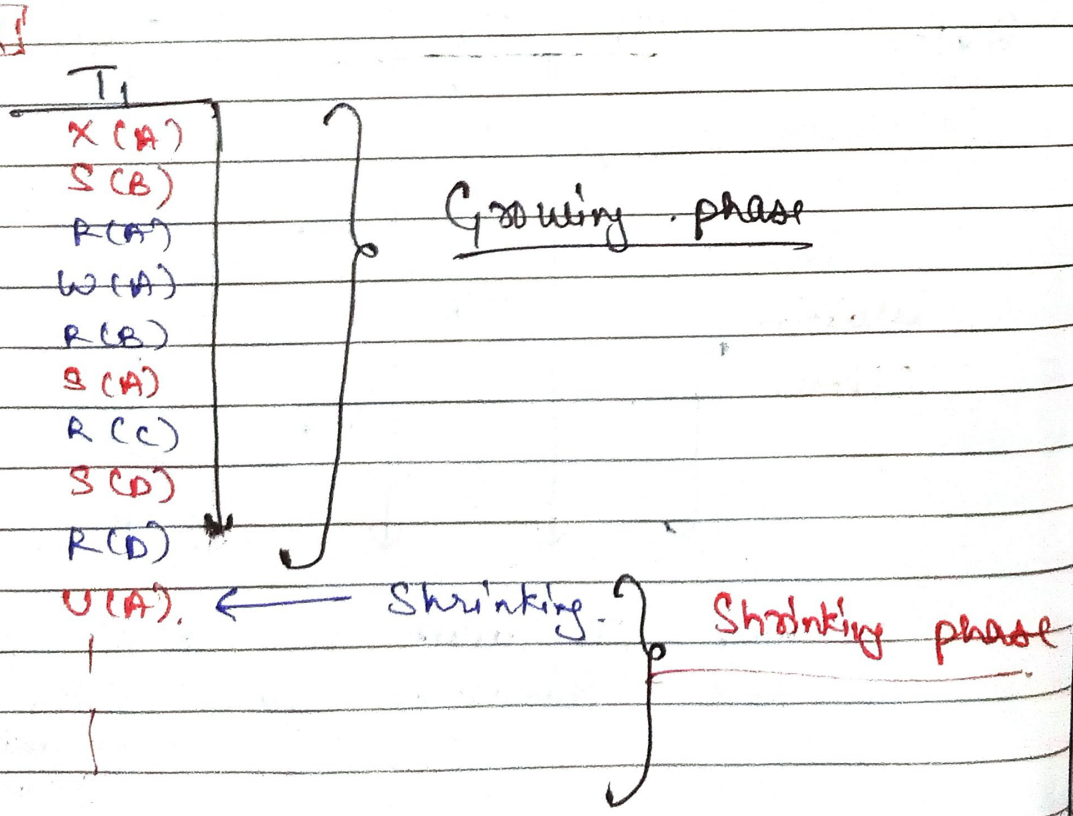
86. **Phase Locking (2PL) protocol in Transaction Concurrency Control :→**

⇒ 2PL (2 phase locking) is just the extension of simple Shared/Exclusive locking. We just do modifications in them.

(#) **2-Phase locking (2PL) :→**

→ Growing phase :→ locks are acquired & no locks are released.

→ Shrinking phase :→ locks are released & no locks are acquired.



Note! When Growing phase starts, then only apply locks.

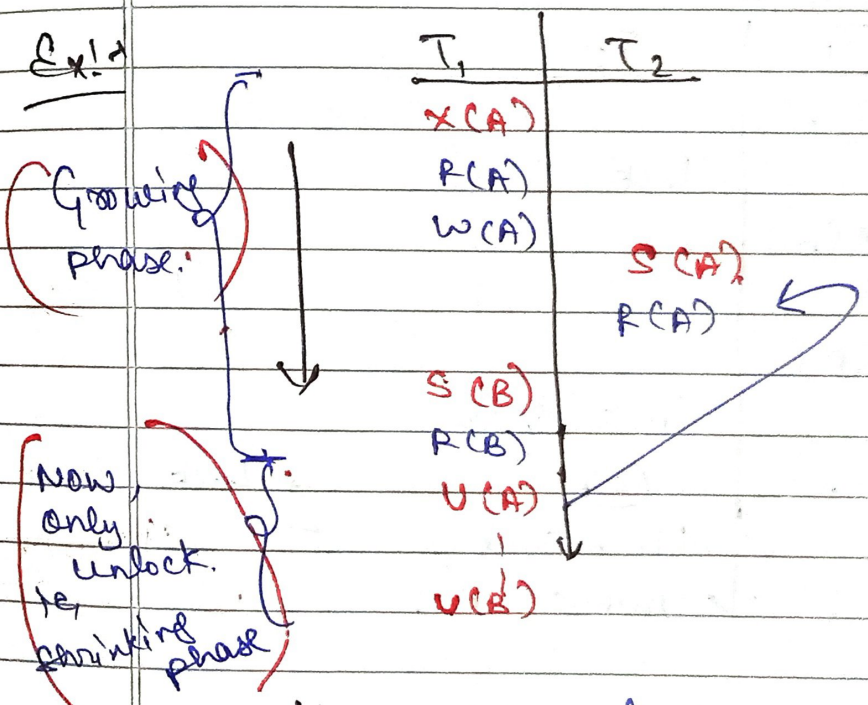
and,

When we first unlock, i.e, Shrinking phase starts, then we only unlock. (and not able to apply any lock).

⇒ We achieve Serializability by this, that we don't achieve in simple shared/exclusive protocol.

So,
we made (2-PL) protocol for this.

Ex!-



Hence, we first starts T_1, & if T_2 comes in b/w then we don't entertain him. First, we complete T_1 & then goes to T_2.

$T_1 \rightarrow T_2$,

Serializability Achieved.

↓

Consistency automatically achieved.

Note:- The transaction which follow (2-PL), then it is always serializable.

Ex:- यहाँ पर भी Shared के अलावा Shared तो दे ही सकते हैं। Means,

While T_1 is in growing phase by using S(A) [Shared lock], then at same time T_2 also starts its growing phase by using S(A). bcz by Compatibility Table.

Ex:-

S

T_1	T_2
Lock S(A)	
	Lock S(A)
Lock X(B)	
→ Unlock (A)	
Unlock (B)	
	Lock X (B)
	→ Lock point
	Unlock (A)
	Unlock (B)

Growing
Lock point
Shrinking
Growing
Lock point
Shrinking

Now,

* Serializability Schedule, How formed?

i.e., $T_1 \rightarrow T_2$ (OR)

$T_2 \rightarrow T_1$

So, This is done by (Lock Point).

[Commit के बाद Roll back नहीं कर सकते।]

⇒ [**Lock Point** :→ where trans. is taking the last lock. (or) where trans is unlock first time.]

⇒ जिसका Lock Point पहले आ जाएगा । वो trans. पहले आ जाएगी ।

i.e, [$T_1 \rightarrow T_2$]

(87.) Drawbacks in (2-PL) protocol :→

→ Advantage : Always Ensures Serializability.

⇒ **Drawbacks** :→

(1.) May not free from Ir-recoverability.

T_1	T_2
X(A)	
R(A)	
W(A)	
U(A) →	S(A)
→	R(A)
	Commit
fail	

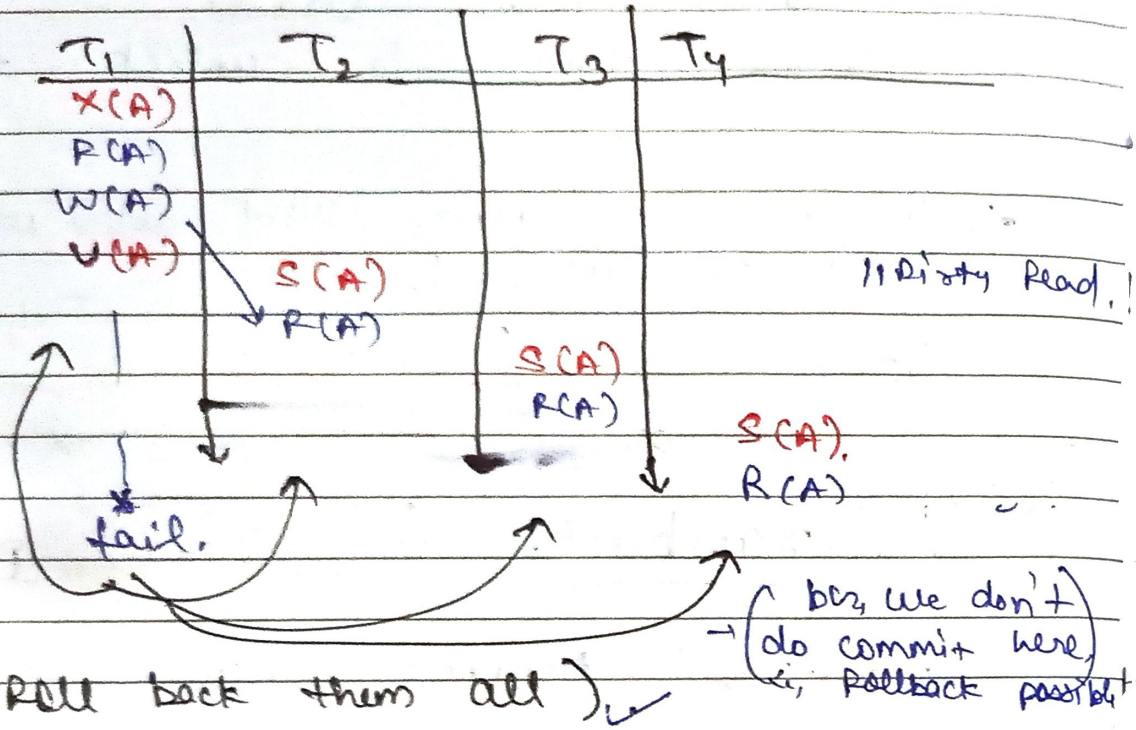
Roll back (of T_1) → (we can't roll back it, bcz, it is already commited)

Hence,

It is Ex. of Ir-recoverable Schedule. We can't recover it (Roll back it) (normal).

(2.) Not free from Cascading Rollback →

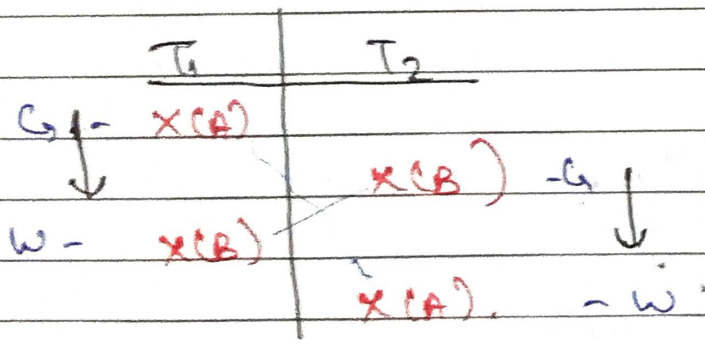
Ex:-



Bad performance & Cascading Rollback is possible here.

(3.) Not free from Deadlocks.

G - Grant
W - Wait



(किसी ने भी unlock नहीं किया अभी, ∴, दूसरी waiting में ही है)

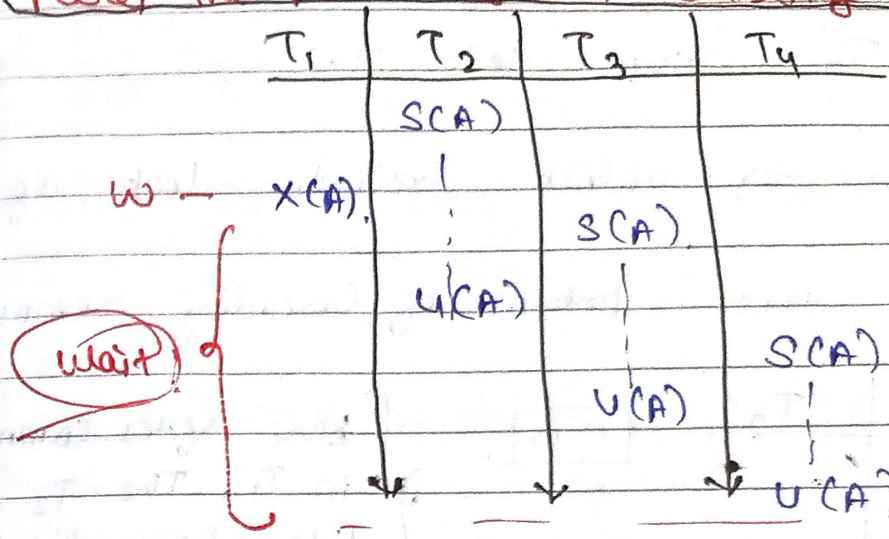
Infinite waiting here

(T1 & T2 both waiting here to complete their transac's).

(4.) Not free from Starvation.

(wait for limited time)

In 2PL
Here, the problem of Serializability removed.



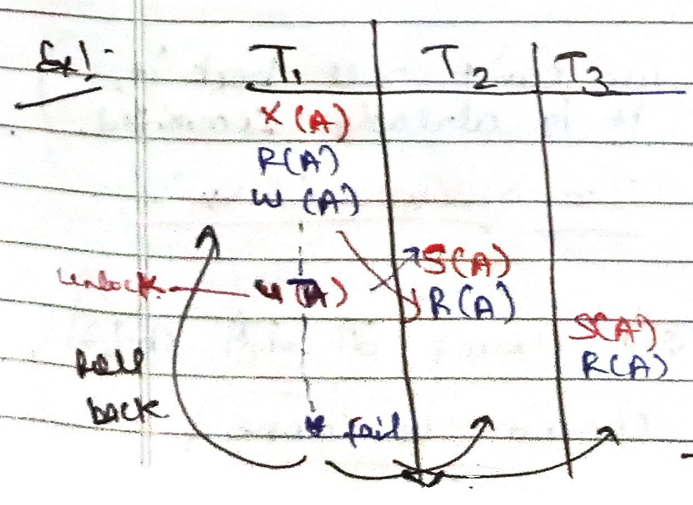
88. Strict 2PL, Rigorous 2PL & Conservative 2PL Schedule :→

→ These are the Extension (Advance) of 2PL :→ basic.

Strict 2PL :→
It should satisfy the basic 2PL and all exclusive locks should hold until commit/Abort.

Rigorous 2PL :→ It should satisfy the basic 2PL and all shared, exclusive locks should hold until commit/Abort.

Ex!-

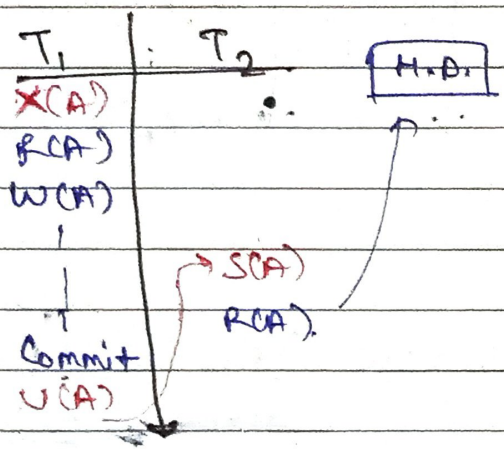


→ (also have to roll back T2 & T3 i.e. (Cascading roll backs)

So, To stop this →.

→ (We have to unlock Exclusive lock after Commit.
then, this problm of Cascading removed.

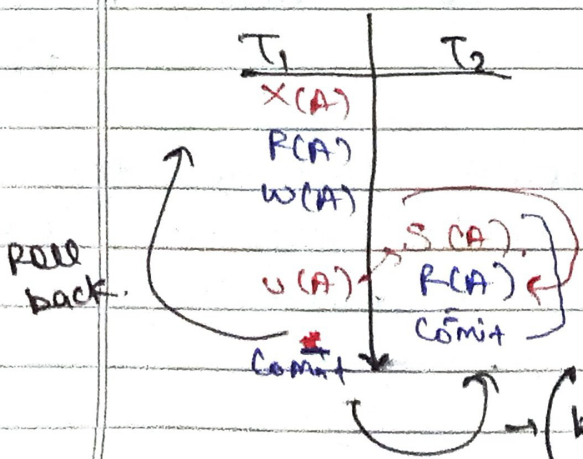
⇒



(bcz, after Commit in T_1. The T_2 takes data from database (H.D.) is not from W(A) of T_1 so, no dirty Read.

Hence, Here, Cascading Rollback is Removed,
∴ It will always produce Cascadeless.

⇒ Now, ∀ Irrecoverability :→



→ (Same data i.e, A)

→ (but we can't roll back it, bcz it is already committed.

∴, Irrecoverability.

→ Hence, हम इसको पहले unlock ही नहीं करेंगे।
We unlock it after commit is done.

⇒ (Hence, T_2 को S/X कुछ भी नहीं मिलेगा, जब तक T_1 commit नहीं हो जाता।)

और अगर commit होने के बाद S/X मिल रहा है (T_2 को), than No problem.

⇒ (Hence, Irrecoverability remains here.)

commit → U(A) → unlock

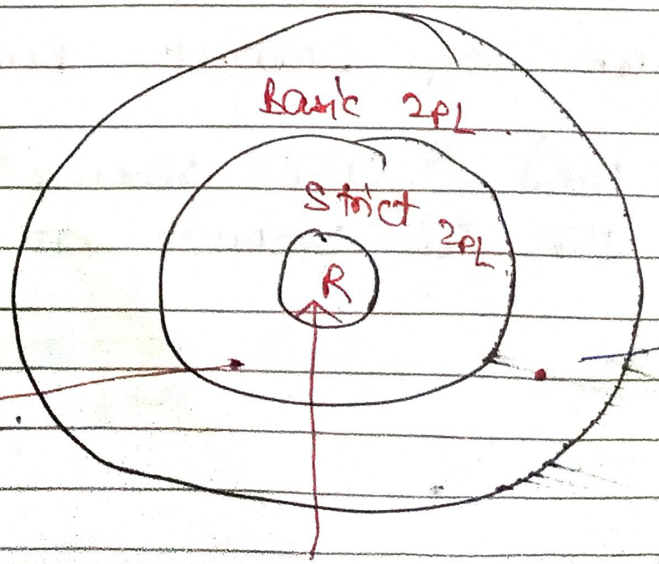
फिर वो (T_2) Database (H.D.) से ही Read करेगा।

⇒ It produce Strict Recoverable Schedule.

Note:- 2 problms remains here →
1.) Cascadeless
2.) Strict Recoverable

- Rigorous 2PL (R), बस और Strict हो गया। BC, इसमें S/X दोनों आ गए।
(इसमें हम Shared lock को भी Release नहीं कर सकते।)

(H)



Date / /
Page No.

- But, problm of deadlock & starvation still are there.

1)

T_1	T_2
X(A)	
	X(B)
W - X(B)	
	X(A) - W

→ Still, Deadlock.
→ Infinite waiting.

2)

T_1	T_2	T_3
	S(A)	
W - X(A)		
waiting	C	S(A)
		C

⇒ finite waiting
→ Still, Starvation.

Conservative 2PL' →
practically, it is not possible. In this, कि कोई भी trans. start होने से पहले ही सारे lock लेले। (A, B, C → सब ये लेले।).

⇒ इससे T_2, T_3 को एक भी lock नहीं मिलेगा।
i, problem of Deadlock Removes here.

- (T_1 को पहले ही सारी resource दे दो, बाकी T_2 को एक भी resource न मिले।).

T_1	T_2
G - X(A)	
	X(B) - W
G - X(B)	
	X(A) - W

G - Grant
W - waiting.

↳, T_1 completes here first. So, no infinite waiting here.
(T_1 के comp. होने पर T_2 use कर लेगा।)

↳ No Deadlock here.

(T.S.)

89. Basic Timestamp Ordering Protocol :→

→ unique value assign to every transaction.
→ Tells the order (when they enters into System)

Let,

10:00	10:10	10:15 → Time
T_1	T_2	T_3
100	200	300 → Timestamp
↓ older (पहले आई)	↓ younger (बाद में आई)	↳ youngest.

T.S. (T_i)

→ Read_Ts (RTS) = last (latest) transaction no. which performed Read successfully
→ Write_Ts (WTS) = last (latest) transaction no. which performed write successfully

Ex:→

10	20	30
T_1	T_2	T_3
R(A)		
	R(A)	
		R(A)

T.S. (T_i)

⇒ RTS(A) = 30

↳ bcz, latest Read us of T_3 & Time Stamp (T.S) of T_3 is 30.

Ex:-

10	20	30
T_1	T_2	T_3
W(A)		
		W(A)
	W(A)	

⇒ WT(A) = 20

(ii) Rules :→

In Timestamp, let,

(जो Trans. पहले उतरे, वही पहले complete होगी).

Serializability : Older → Younger. → follows conflict Serializability

1. Trans. T_i issues a Read (A) operation

a) If WTS (A) > TS (T_i), Rollback T_i.

b) otherwise Execute R(A) operation

Set RTS (A) = Max { RTS (A), TS (T_i) }

(0, 100 ; 200, 300) → in next undo use

2. Trans. T_i issues Write (A) operation

a) If RTS (A) > TS (T_i) then Rollback T_i.

b) If WTS (A) > TS (T_i) then Rollback T_i.

c) otherwise execute write (A) operation.

Set WTS (A) = TS (T_i).

(iii) Understanding these :→

Ex → (old) 100 T_1 | 200 T_2 (young)

T_1	T_2
R(A)	
	W(A).

✓ (NP).
(No Conflict).

T_1	T_2
W(A)	
	R(A)

✓

T_1	T_2
W(A)	
	W(A).

✓

bcz,
(old → young) as (T_1 → T_2). So,
(T_1 पहले Execute हो जाएगी, तो T_2 में कोई दिक्कत नहीं आएगी।)

Case I

Ex'
(old) 100 T_1 | 200 T_2 (young)

T_1	T_2
	R(A) → 10.
(20) W(A).	
commit	

Roll back.

(✗) (Not possible)

(T_1 को होने नहीं देना।)

→ (bcz, now यं T_2 में A → 10, कोन सी value Read करके बैठी है। bcz, T_1 ने तो Database में 20 update कर दिया।)

Case II

T_1	T_2
	W(A) - (20).
20 → R(A)	
commit	

Roll back.

(Hence, यं 20 आगे कहीं पे है ही नहीं। i.e, T_1 गलत Data पे काम कर गया।).

// Dirty Read

(हम T_1 को Read नहीं करने देंगे।)

Case III.

100 T1	200 T2
	W(A) - 20
40 - W(A)	
commit	
	Roll Back.

∴, Roll back.

(∴, इस T_1 को allow नहीं करेंगे).

→ (Let, If T_2 fails, then, our updation will be lost).

// Lost updation.

---

90. Solve Ques^n on Timestamp Ordering Protocol:

We have 2 Rules →.

1.) 1st Rule is of Read → has only 1 cond^n bcz, only (R-W) conflict

2.) 2nd Rule is of Write → has 2 cond^n's, bcz (W-R, W-W) → 2 conflicts.

Now, Q -

(100) T1 oldest	T2 (200)	T3 (300) youngest
R(A)		
	R(B)	
W(C)		
		R(B)
R(C)		
	W(B)	
		W(A)

Roll back.

0 > 100
0 > 200
0 > 100
0 > 100
0 > 300
100 > 100
[300 > 200] ↳ Roll back.

100 > 300.
0 > 300.

	A	B	C
RTS	~~0~~ 100	~~0~~ ~~300~~ 300	~~0~~ 100
WTS	~~0~~ 300	0	~~0~~ 100

⇒ Initially, all values are 'zero'.

(Final Table) ✓

(Trans.)

⇒ Check, for every values in the Table & put that values in Rules & then make the Table.

- for R(A) use 1st Rule of Read
- for W(B) use 2nd Rule of Write.

⇒ first check R(A) of T_1, then
R(B) of T_2, then
W(C) of T_1, then.
R(B) of T_3, then,
R(C) of T_1, then
Here Roll back. ← W(B) of T_2, then
W(A) of T_3

i.e, pattern wise as in Table

&

then, make the final Table of (RTS) & (WTS) ✓.

OR

We also do the Ques^n direct, without using these 2 Rules with just the [older → younger] concept & cases (we discussed in prev. video).

[Volatile – इनशील, परिवर्तनशील]

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Q1. INDEXING :→

⇒ CPU → processor (who process).

→ Query comes to CPU. CPU process them.

⇒ Ex:

Select * from Student where Roll no = 1;

⇒ CPU has to execute it, But Data is in the memory.

⇒ In general architecture, we only let, 2 types of Memory →

1. RAM – primary memory
2. H.D. – Secondary memory.

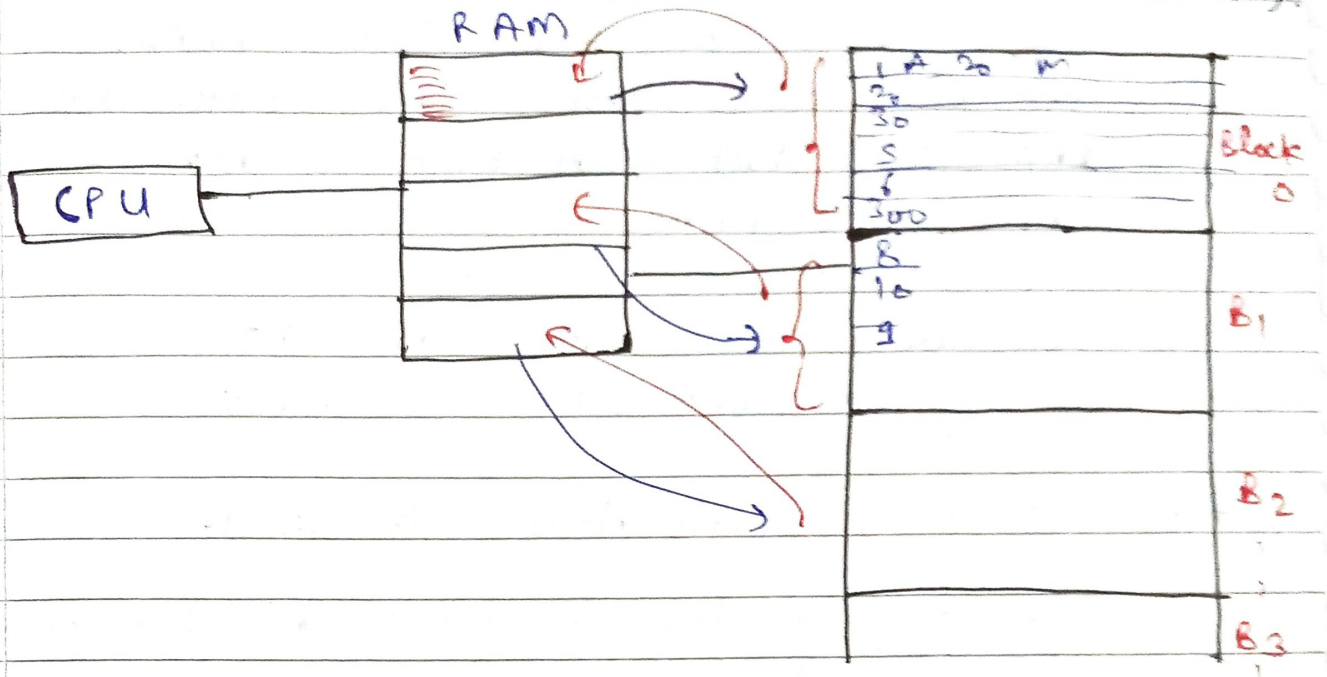
⇒ Ram is volatile, Ram works directly with CPU.

• CPU Speed → In MIPS (Million Instrn per Second)
⇒ H.D. speed ⇒ 10/20 Instruc^n per second.

∴, these both are not compatible with each other.

So,
⇒ Ram comes b/w them.

⇒ Hard speed counts in miliseconds.
CPU ——"—— nano/pico seconds



We divide Hard Disk in Blocks.
Logical Blocks (& not physical Blocks)

Ex:-
Logical Drives → C Drive, D Drive, — etc.

O.S. divides hard drive into fixed sized blocks & then Insert Data. (Blocks / pages)

Ex:-) If we have record of 10K students
&
Block size is of 100 Records in Hard Disk.
So,
we need 100 Blocks in H.D. ($100 \times 100 = 10k$)

⇒ Now, data may also be stored in 2 ways -
1.) Sorted (ordered) 2.) Unsorted (unordered)

⇒ Let,

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⇒ Unordered Data! → then, we send 1-by-1 every block of H.D. into RAM. & if we get our data, then okk. Otherwise, RAM send back that block & next blocks come into RAM. & so on.

If we get data → HIT &
If we don't get → miss

(#) ⇒ So, Here, INDEXING is used.

(ई॰ Ram में H.D. के Block का Searching time को नहीं करते,).

⇒ We transfer data from H.D. to Ram. So, there is a transfer cost. i.e,

[I/O cost]

↓ → Input/ out-put.

ई॰ Data को call कर रहे, इसको बोलते I/O cost.

⇒ & If call more blocks, then I/O cost more. & then time also increases of searching.

(*) ⇒ Indexing, that we have to call min^m no. of blocks. i.e, I/O cost is reduced.

Ex!→ Let, a book has 1000 pages. & we have to search a page.

Worst Case → 1000 (find in last).
Best Case → 1 (find on 1st page).

Block/pages

Average → 500 pages.

→ If we use Index, then the no. of pages we shuffle are decreases.

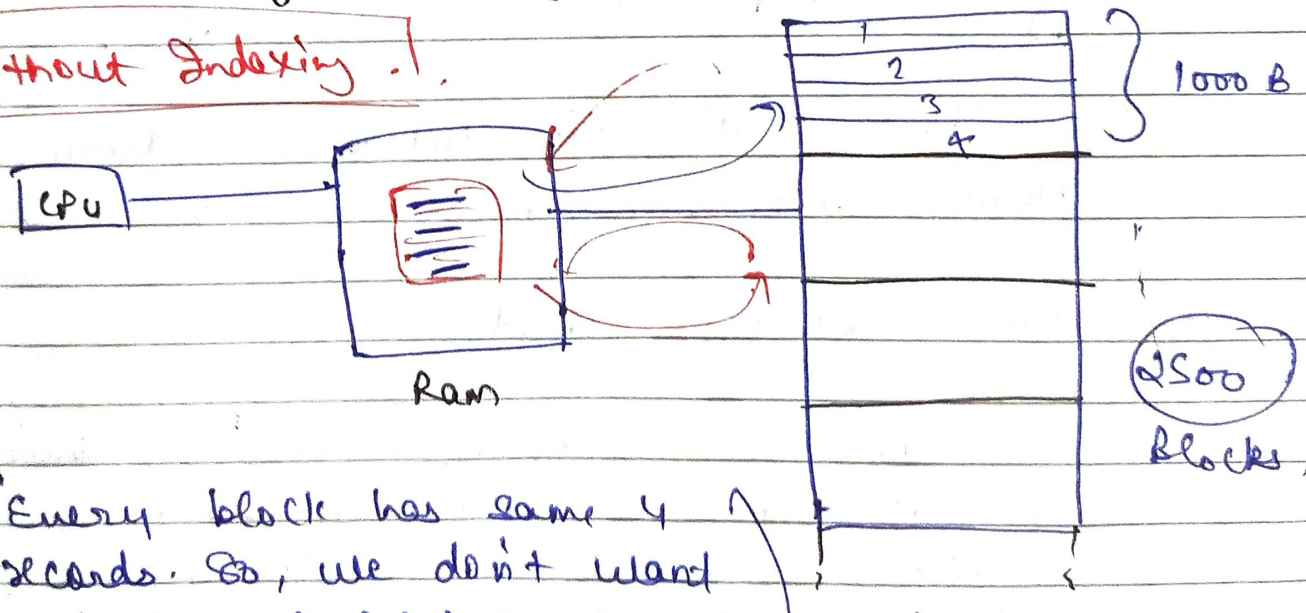
» (Let, Index is of 2-3 page, then just see that topic an Index & then directly go to that page).

92- Numerical Ex. on I/O Cost in Indexing :→

Q:→ Consider a Hard Disk in which Block Size = 1000 Bytes, each record is of size = 250 Bytes. If total no of records are 10,000 and the data entered in Hard Disk without any order (unordered).

- What is avg time Complexity to search a record from HD?

Without Indexing :



* Every block has same 4 records. So, we don't want that time of RAM to search in a block bcz it is always 4.

⇒ No. of Records we can put in every block = $\frac{1000\ B}{250\ B} = 4$.

&

⇒ No. of Blocks Required = $\frac{10000}{4} = 2500$

⇒ I/o Cost :- ⇒

(#) Best Case = 1
Worst Case = 2500 = (N).
Avg Case = $\frac{2500}{2} \Rightarrow 1250$ $\left(\frac{N}{2}\right)$.

⇒ Avg Time Complexity : O(N) ✓.

& This is all for unordered Data.
Hence, we used linear Search here.

(#) Let, Ordered Data :-
then,
we use Binary Search here,
but it Searches on Sorted data
(either ascending or descending).
& then,
Time Complexity : $O(\log_2 N)$ ✓

Here, ⇒ $\log_2 2500$.

12 approx

Hence,
we need approx 12 blocks in ordered data.

⇒, this both case are without Indexing.

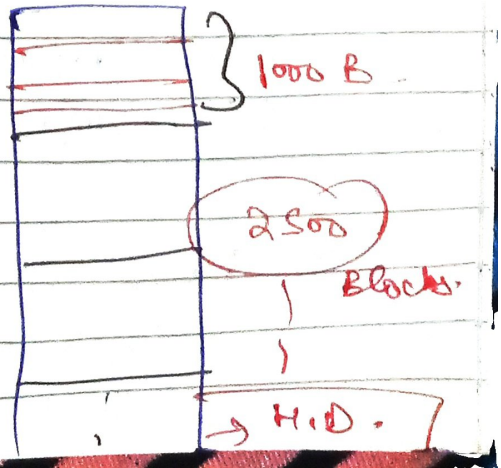
⇒ When we used Indexing, we even need less blocks than these.

I/o cost is low.

93. Numerical on I/o Cost in Indexing :-

Q:- Consider a H.D. in which Block size = 1000 Bytes, each record is of size = 250 Byte. If total no. of records are 10,000 and the data entered in Hard disk without any order (Unordered Data). What is the avg time Complexity to search a record from Index Table if Index Table entry = 20B (key 10B + pointer 10B).

⇒ 2500 Blocks.



⇒ Index is also stored in the H.D. When we search any data, then Index come into the Ram.

→ Then, we first search into the Index.

[Note:-] [Block size in Index (page) = Block size in H.D. (page)].

1000 B — 1000B

→ understanding :- In a book, all pages are of same size. whether it is Index page or anything.

(*) Index Table Entry = 20 B (key + pointer).

10B — 10B.

[key value → वैसा value जिसको search कर रहे (Topic name), Roll no - etc.

pointer → page. No.].

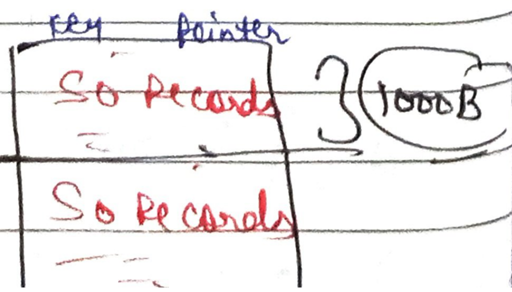
- Each block in Index Table contains Record = Block Size / Index Entry Size

$$= \frac{1000}{20} = 50$$

$$\boxed{= 50}.$$

Hence, we can put 50 records in a block of Index.

(bcz, contains only topic name → ज्यादा आ जाएंगे).



⇒ How we can Enter records in an Index:-

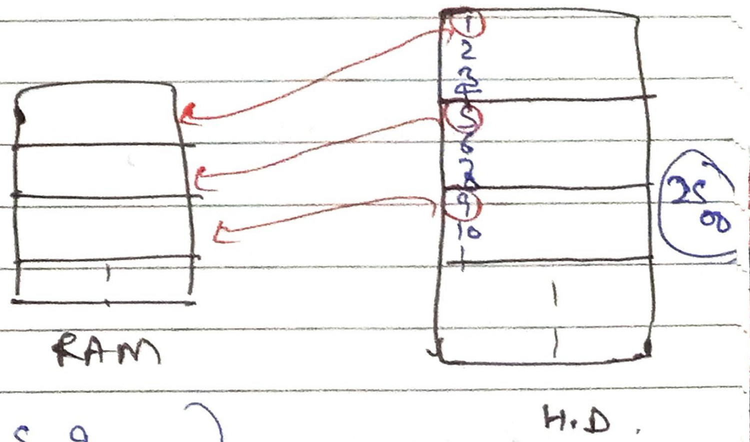
1.) **Dense:-** used when unordered data.

Here, we have to put all the records of H.D. into the Index.

(Ex:-) Here, all 10k records are to be Entered in Index.

2.) **Sparse:-** used when data is ordered / sorted.

Here, we just Enter 1 record from the block into the Ram like, we entered Anchor data (leader) into the Index. (1, 5, 9 ...).



(Ex:-) So, here → we just have to enter the no. of records in RAM equal to no. of blocks in H.D.

Here, 2500 records are to be Entered In Index.

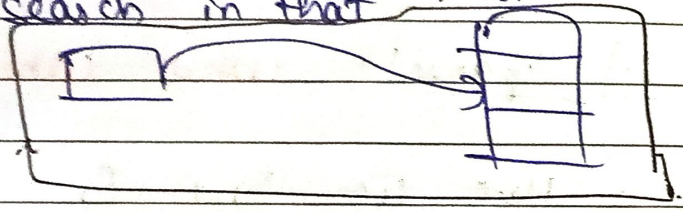
(*) Now, come to ques^n,
If our data is ordered → then.
→ i.e, [Sparse] →
No. of ~~records~~ Blocks in Index = $\frac{2500}{50}$ = 50 [⇒ 50]

Then, search time → $\log_2$ 50

→ 6 approx

Hence,
We have to search 6 times to find the desired page no.

then that page no. takes us to the desired block in H.D & then, we just only have to search in that block.



So

Total no. of search = 6 + 1

= 7

6 search in Index. &
last (1) search in H.D.

But
→ our data is unordered +
Hence, Dense →

→ No of blocks in Index = $\frac{\text{All records}}{\text{record in one block of Index}}$

$= \frac{10,000}{50}$

$= 200$

Now,

Searching → $\log_2 200 + 1$

$+ 8 + 1$

29 approx

$\log_2 2^8 + 1$

$8 + 1 = 9$

$2^8 = 256$

→ Here, we use $\lceil \log_2 200 \rceil$ also, for Index में तो unordered data को ordered/sorted होकर ही जाएगा ना।

↳ we use $\lceil \log_2(n) \rceil$ here, ✓

94. Types of Indexes :→

1.) Primary Index
2.) Clustered "
3.) Secondary "

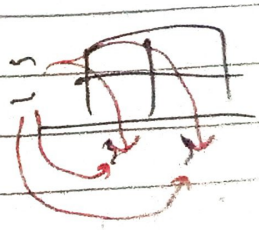
key → uniqueness.
non key → not unique.

(#) Table :-

	key	non key
ordered file	primary Index	clustered Index
unordered file	Secondary Index	Secondary Index

At most 1.

key	non key
1	1
2	1
3	2
4	2
5	3
1	3
:	1
:	:
:	:
:	:



(##) we all have primary Index in our Books & In last of Book → Secondary Index.

If we want I/O cost to be less, then we made Indexes.

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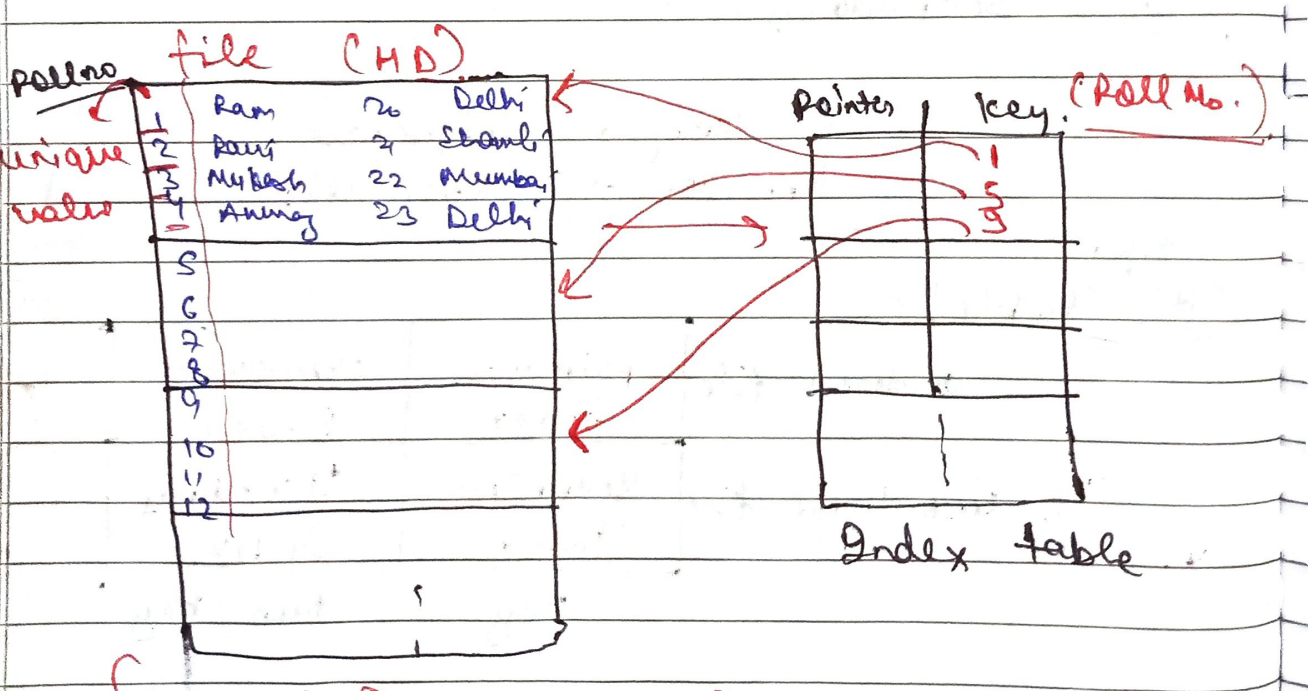
15. Primary Index :→

1) In a table, if we made any of att. primary key, then By default → primary Index is operated on them Automatically.

2) Advantages :-
1.) data is Ordered
2.) & also unique. (key value is present)

Ex:- In IRCTC, we just find everything, by Train No.



↳ Data is (Sorted + unique)

↓

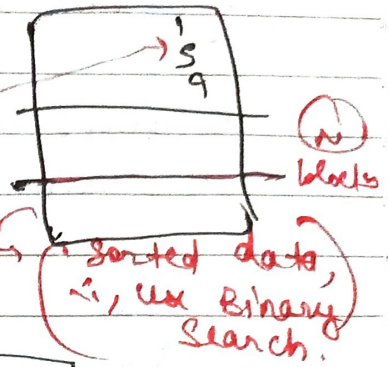
So, we use Sparse here.

→ No. of Entries in Index Table = No. of blocks in H.D.

and, we call it Anchor (Leader).
↓
(1, 5, 9, 13 ...).

Primary Index is Sparse.

Ex.1) we have to find 3,
then,
we know it is found in block of '1'.



Hence,

Total Search Time = $(\log_2 N + 1)$.

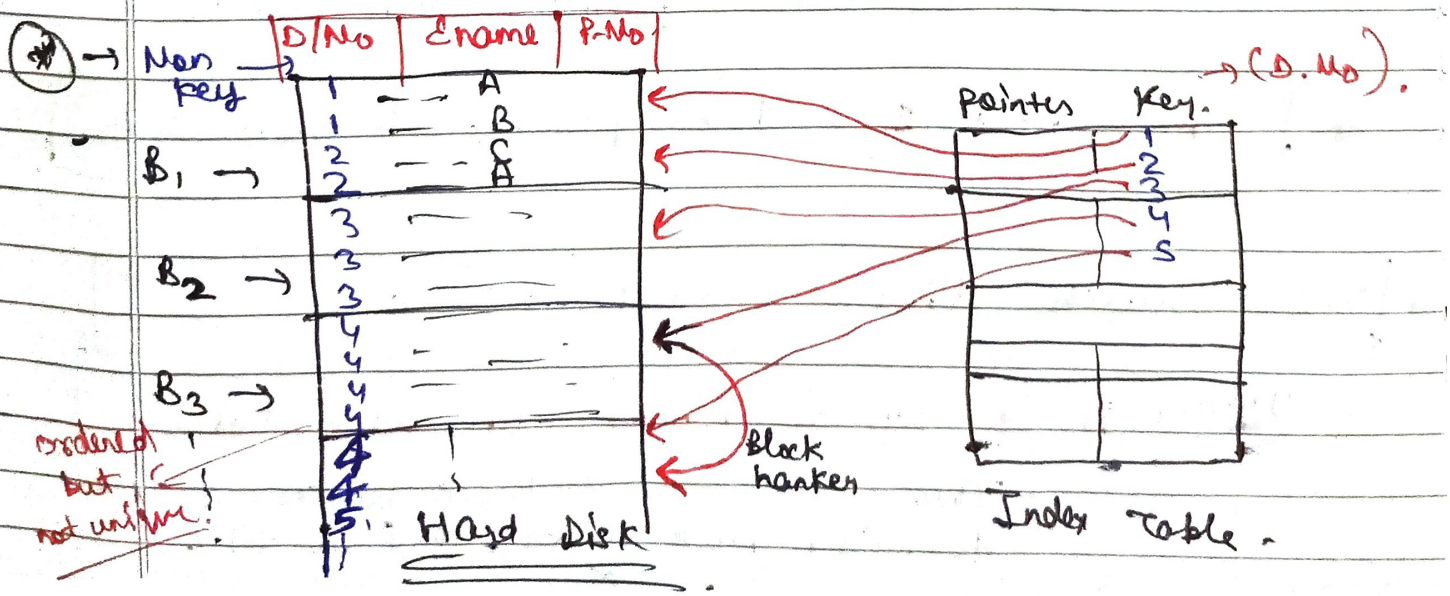
where,
N is the No. of blocks in Index Table.

---

36. Clustered Index :→

→ data must be ordered & with Non key, (i.e, not unique).

↓ ie,
(value may be repeated but must be sorted.)



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- If our data is multiple times (not unique) in H.D. then, It also comes only 1 time in Index.

(In Index, no repetition). i.e., (unique)

→ Here, 4 is not only in one block. Some 4s are also in next block. So, How we point to them.
So,
Now, we use [Block hanker] to point to next block for same value.

→ Here, Searching criteria slightly increased (↑).

→ Clustered Index is also sparse, always. bcz we don't need to make pointer for every value. ∵ Repetition - there is only 1 pointer.

→ एक से ज्यादा primary Index & cluster Index नहीं बना सकते, bcz no need. & 1 Table has only 1 primary key ना।
So,
* At most 1, (both primary & cluster Index)

* Total Search Time = $(\log_2 N + 1) + 1$

Where, N is No. of blocks in Index Table.

(These extras are ∵ Block hanker. for, Each block hanker, there is +1).

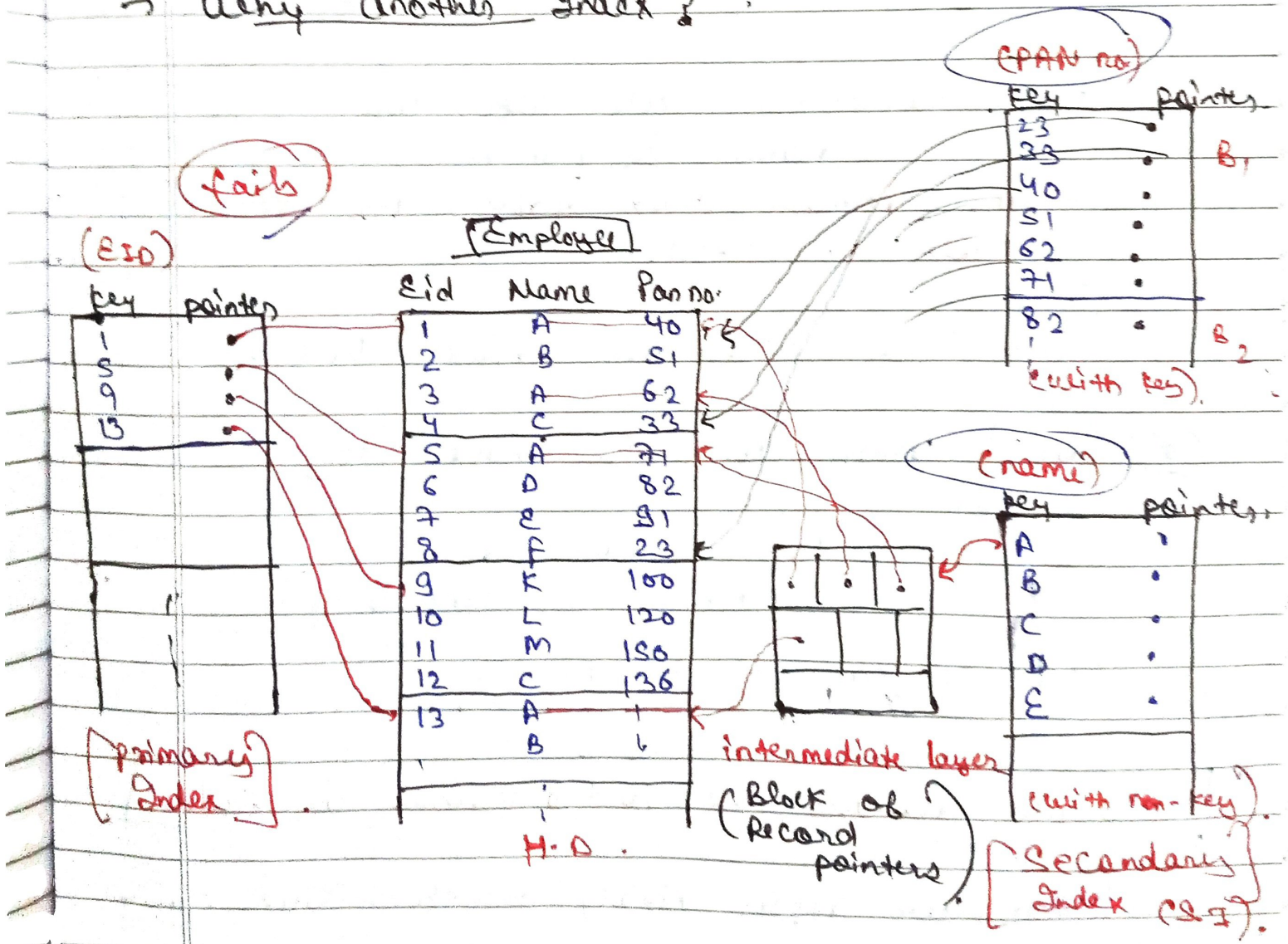
(17.) Secondary Index (S.I.), (Multilevel Indexing):

⇒ (Already there is an Index in database, we have to made another Index).

→ Where use S.I. ?

Unordered Data,
↙ ↘
key Non key.

→ Why another Index ?



→ Why Another Index? →

⇒ Let, H.R. has data of Employee table & data is already sorted on basis of E-Id (primary key) → [(Unique + Not Null)]

↳ bcz most of the query are on E-Id.

↓

(⇒ Find * of Employee where E-Id = ~ .)

↳ then we use primary Index.
(which is already there, formed on basis of E-Id.)

- But, sometimes we also use name & pan no.
then, Primary Index fails, bcz, It is made on E-Id.

So,
We use Secondary Index here.

(*) Case I when we also have key.
then
we use PAN no.
(unique + unordered)

(As u can see in Diag.)

* (*) We always use sorted values in Index.

↳ then, we apply binary search → Time Saving.

* Index is always sorted & unique.

* 2) Secondary Index on key, is always DENSE.

bcz, we don't have any anchor (leader) here like in primary In.

→ These values are not sorted. Hence, we put them sorted in Index & write all the records of H.D. in Index Table.
So, Dense.

i.e.
No. of records in Index = No. of records in H.D.

⇒ Search time: $\log_2 N + 1$

where,
N is the no. of blocks in Index Table.

(3) Case II when we have Non key with unordered data.
It is the worst case.
then,
we use NAME,
↳ (neither ordered, nor key) (unique).
i.e. (Secondary Ind in D.bg.)

⇒ In Index, we don't have to take multiple values of A... (only once).
But, A is many times in Hard Dsk.
So,
here we made an Intermediate layer.
(It is a block of Record pointers).

book में पहले secondary Index (S.I.) मिल जाता है।

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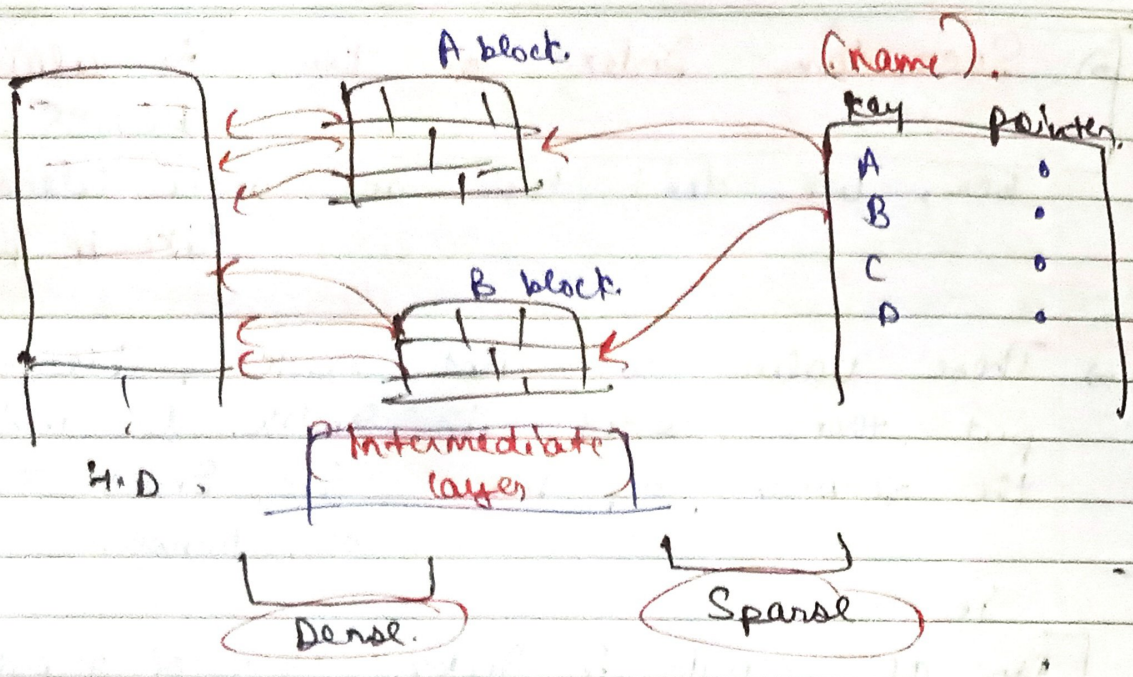
Ex!,→



⇒ Hence, It is Mix of Dense & Sparse.

So,

⇒ We can say it DENSE Overall.

⇒ Time Complexity : $\log_2 N + 1 + 1 + \dots$

(extra for intermediate layer)

(And this is only for 'A'. It may be more than $\lceil \log_2 N + 2 \rceil$)

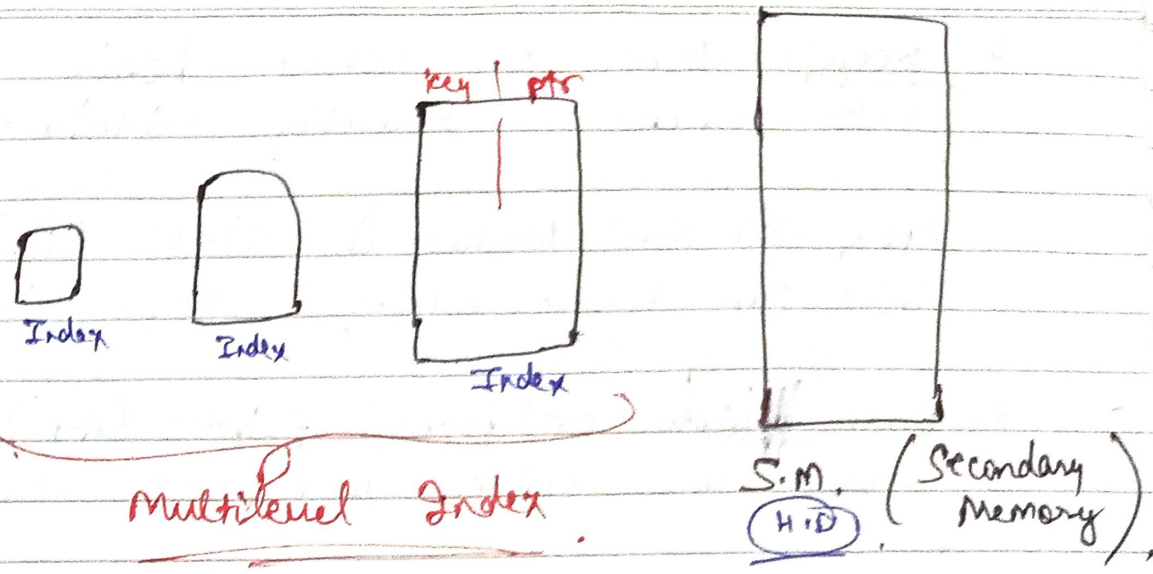
(*) Secondary Index is always dense.

(9th) Intro to B-Tree & its Structure :→

→ B- Tree (Dynamic Multilevel Index) :-

(Balanced Tree)

graph → cycle
Tree → acyclic.

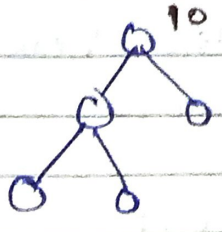


Multilevel Index

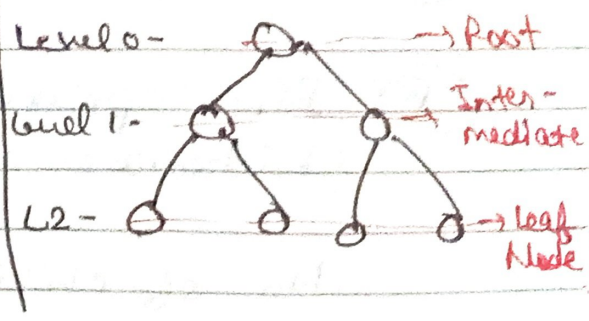
⇒ In this, it is hard to manage. bcz, If we insert data in S.M. then we have also insert in all the Indexes & same for delete...

(#) Balanced Tree (B-Tree!→)

→ means, all the Elements are at the same level of leaf Node.

⇒ 

⇒ Not Balanced.



⇒ Block pointer (B.P.) or Tree pointer! →
When node denotes his child. Then, we use Block pointers (B.P.).

⇒ Note! → A node can contain multiple values here.

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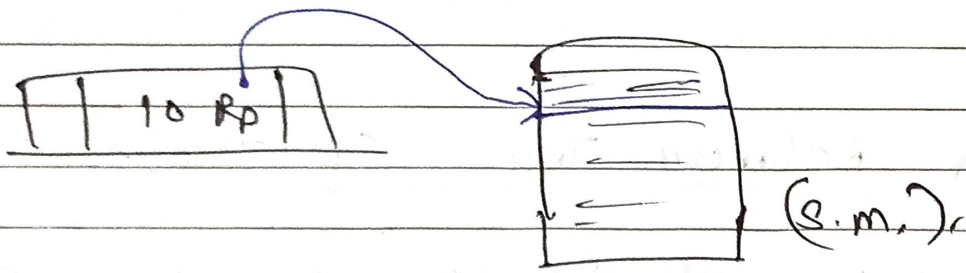
⇒ **Keys**:- that on which basis we have to search. Searching Criteria - key.

(key को इन Nodes के अंदर रखेंगे।)
(We can insert multiple keys in a node).

⇒ **Data pointer (or) Record pointer (R.P.)**:→ (D.P.)
These are with correspond to keys.

→ This record pointers points to in the Secondary Memory (Hard Disk) where are record is present of that key.



(#) keys = Record pointers.

(#) Block pointer depends on the how many childrens are there in a Node.

No. of children = No. of B.P.

(#) Order = p (of a B-tree)
: Max. no. of Block pointers.

Order = p = Max no of children a node can have.

(#) Keys = p-1 (Max)
Rp = p-1

Min keys = $\lceil \frac{p}{2} \rceil - 1$

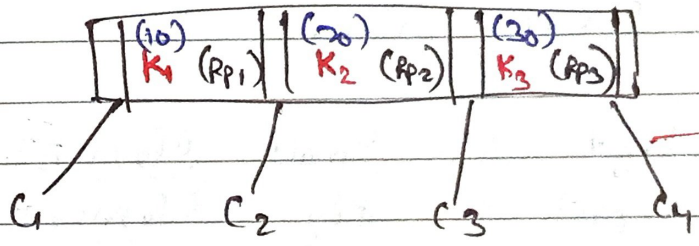
Table :-

Children		Root	Intermediate Node.
	max	p	p
	Min	2	$\lceil \frac{p}{2} \rceil$

↳ ceiling value

Ex :-

Let $p = 4$ = order of a Tree.



(#) We always insert keys in the sorted Order. (bcz, it follows the prop. of Binary Search Tree).

---

99. Insertion in B-Tree :-→

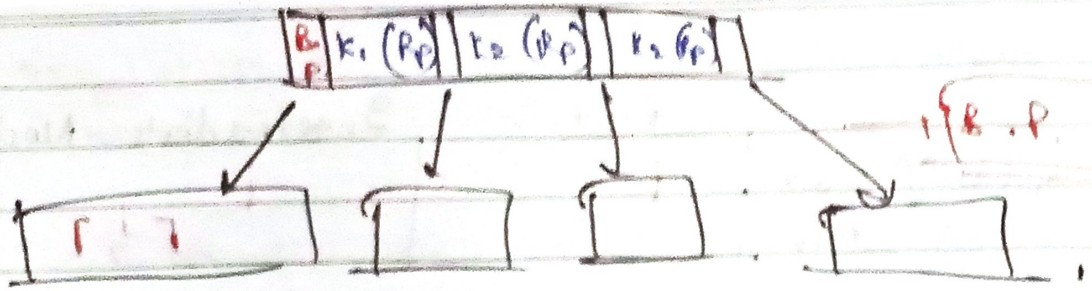
Q:- Insert the following keys into B-Tree, if order of B-tree = 4.

1, 2, 3, 4, 5, 6, 7, 8, 9, 10.

⇒ Order = 4 = max. no of children.

Max keys = $p - 1 = 3$

Min keys = $\lceil \frac{p}{2} \rceil - 1 \Rightarrow 1$



⇒ We follows the prop of Binary Search Tree in Insertion.

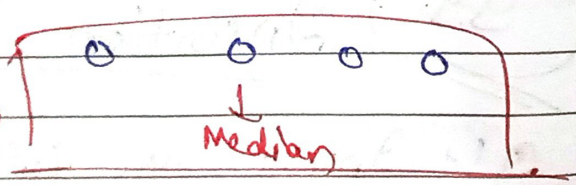
(#) In Binary Search Tree,

Root → Left = Small Element
Root → Right = Big Element.

(#) Overflow होते ही, Median किसी तरह break करना पड़ेगा,

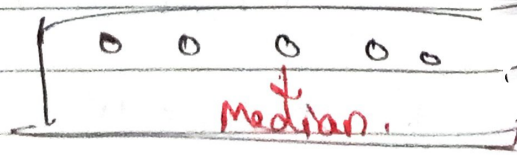
→ When, n - Even ⇒ $\frac{n}{2}$ ⇒

Let, 4 ⇒ $\frac{4}{2}$ ⇒ (2)



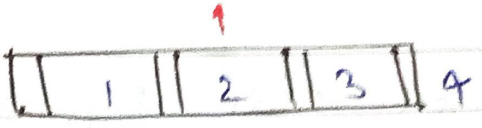
→ When, n - odd ⇒ $\frac{n+1}{2}$ = Median

Let, 5 ⇒ $\frac{6}{2}$ ⇒ (3)

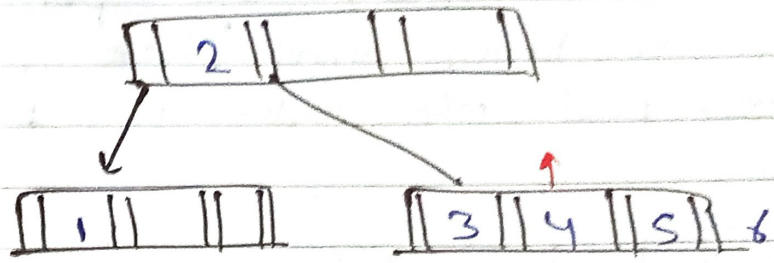


⇒ and, Shift Median to upward (↑), & उसके Left & Right Elements उसमें नीचे आ जाएंगे। & ये, how we break.

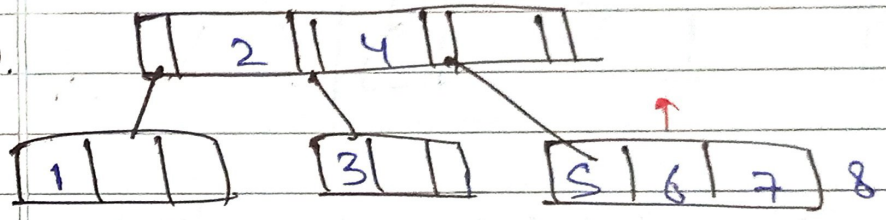
(Ans), 1, 2, 3, 4, 5, 6, 7, 8, 9, 10

a) 

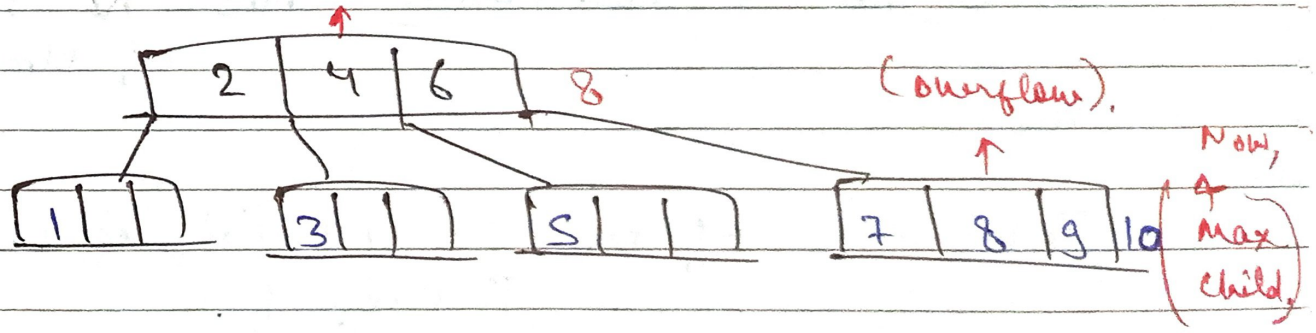
(overflow). ⇒ $\frac{n}{2} \Rightarrow \frac{4}{2} \Rightarrow 2$

⇒ 

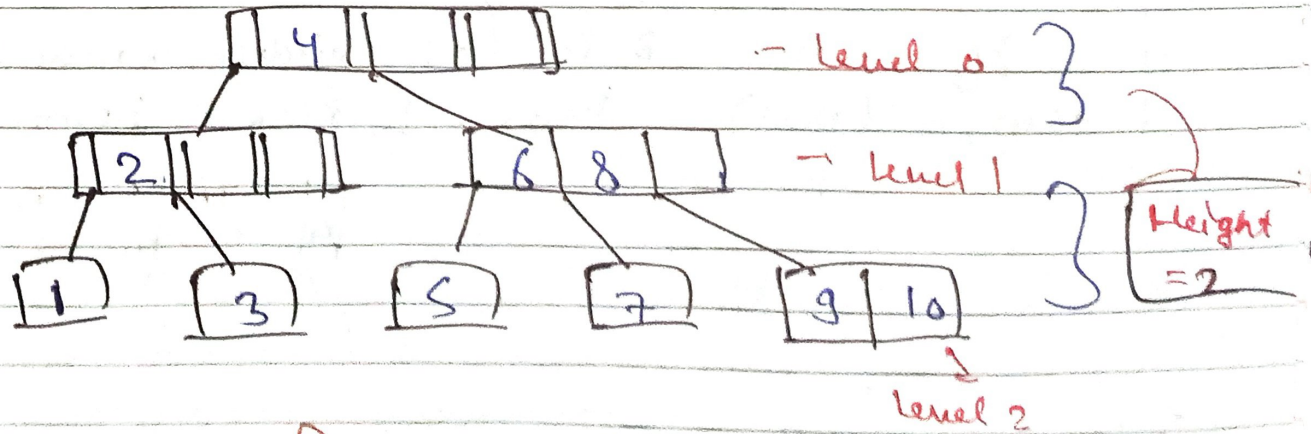
(overflow).

c) 

(overflow).

⇒ 

(overflow).

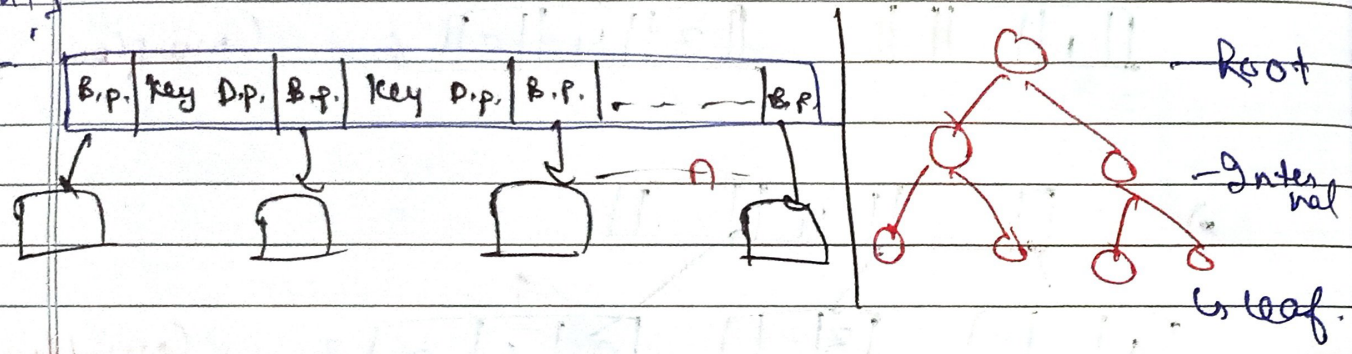
⇒ 

⇒ height - 2
levels - 3

100. How to find Order of B-Tree :→

Q:- Consider a B-tree with key size = 10 bytes, block size 512 bytes, data pointer is of size 8 bytes and block pointer is 5 bytes. Find the order of B-tree?

Sol^n :→



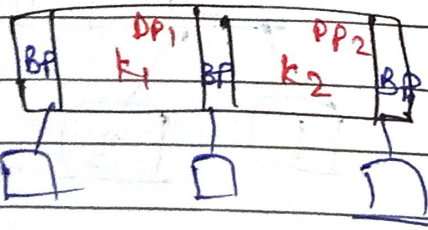
→ Let, In a node / Block has 'n' no. of Block pointers.

So,

Total size of B.P. = n × (size of 1 B.P.)

= n.Bp

→ If n B.Ps (or children a node can have) then, (n-1) keys, & Record pointer.



$n \times Bp + (n-1)$ key size $+ (n-1) Rp \leq$ Block size (or) Node size.

2). $n \times 5 + (n-1)(10+8) \leq 512$.

$\Rightarrow 5n + 18n - 18 \leq 512$

$\Rightarrow 23n \leq 530$

$\Rightarrow \boxed{n \leq \frac{530}{23}}$.

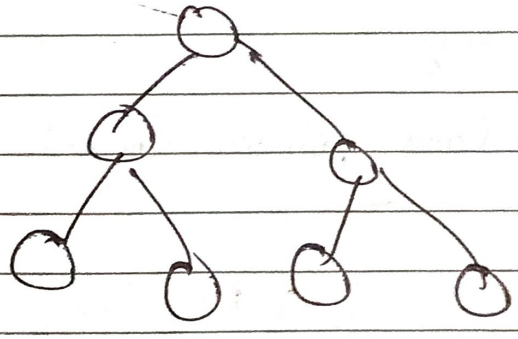
$\Rightarrow n \leq 23.04$

$\therefore$, $n = 23$ ✓. — Max. 23 children.

$\Rightarrow$ Every B.P. represent a children.

SO, Max. Order = 23. ✓

$\Rightarrow$



Max	Min children
23	2
23	$\lceil \frac{23}{2} \rceil \Rightarrow \lceil 11.5 \rceil$ ✗ 12.
Leaf has no children.	

✓

- Keys = Order - 1 ⇒ 22 ✓.

✗ ✗

101. DIB — B-Tree & B+ Tree :→

* B-Tree :→

1) Data is stored in leaf as well as internal nodes.
2) Searching is slower, deletion complex.

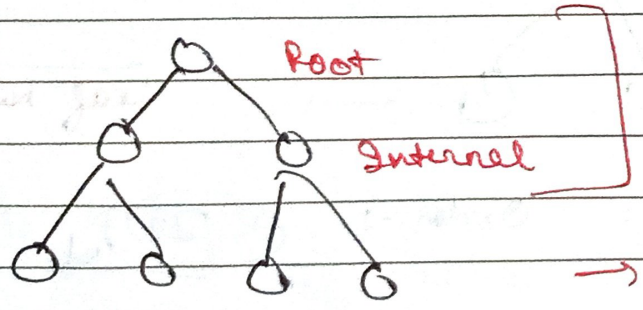
3.) No Redundant (Duplicate) search key present.
4.) Leaf Nodes not linked together.

B+ Tree :-

1.) Data is stored only in leaf Nodes.
2.) Searching is faster, deletion easy. (directly from leaf Node).
3.) Redundant keys may present.
4.) Linked together like linked list.

We use B & B+ Tree, to put Index Record. These trees actually contain Index Record.

Index Record → key
Data pointer (Record pointer).



In B tree, the structure of every node is same. (Either root, internal or leaf).

leaf Node, has no children. So, what's the role of B.P.. Then, they points to NULL.

B.P - Block pointer.

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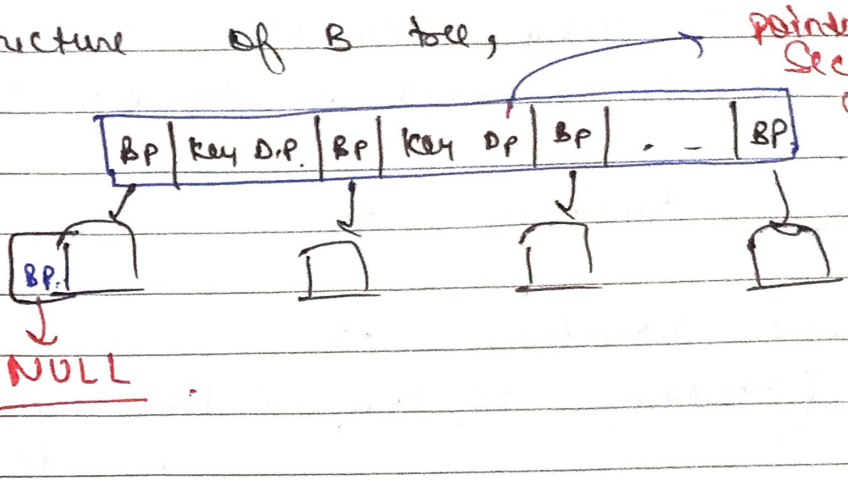
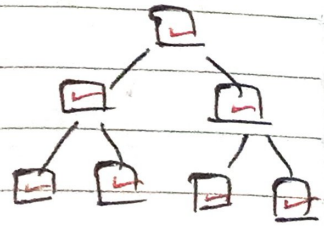
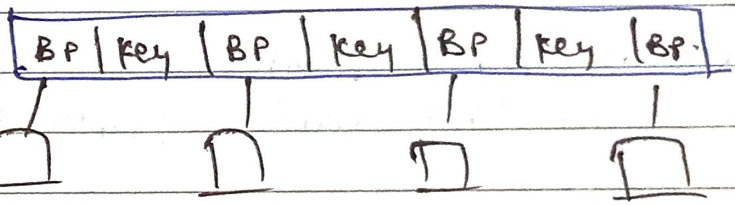
Structure of B tree,





Structure of B+ tree :→

⇒ Non leaf structure :→ or Internal Node →.



↳ There is no Data pointer (D.P.) in Internal Node structure / Non-leaf Node structure.

R.P / D.P ~~X~~

Hence,

We have more space in internal node. Hence, we can create more children & put more keys.

So, that's why,

B+ tree → Breathwise longer.

B tree → Depthwise longer.

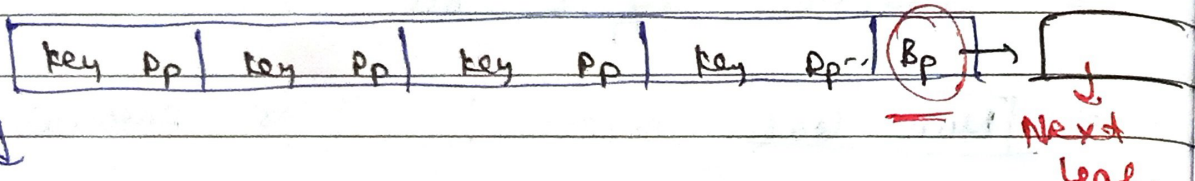
↳ (for less no. of children breathwise as compared to the B+ tree).

So, depth more.

#. ∞, that's why searching is slower in B tree as compared to B^+ tree.

#. B^+ tree Structure →

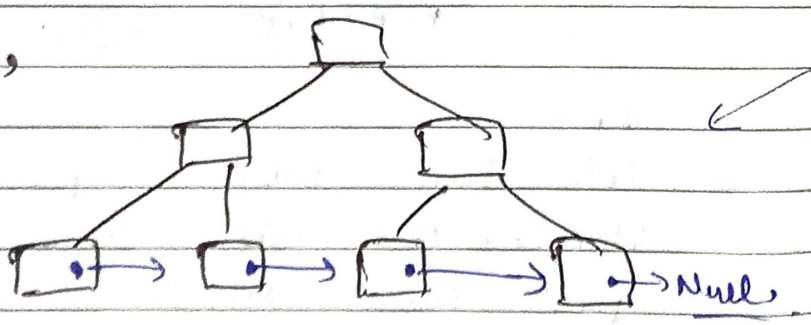
Leaf Node Structure →
(Structure of leaf & Non leaf Nodes are different.)



⇒ (There are no Block pointers in leaf Node Except 1 in last which points to Next leaf.)

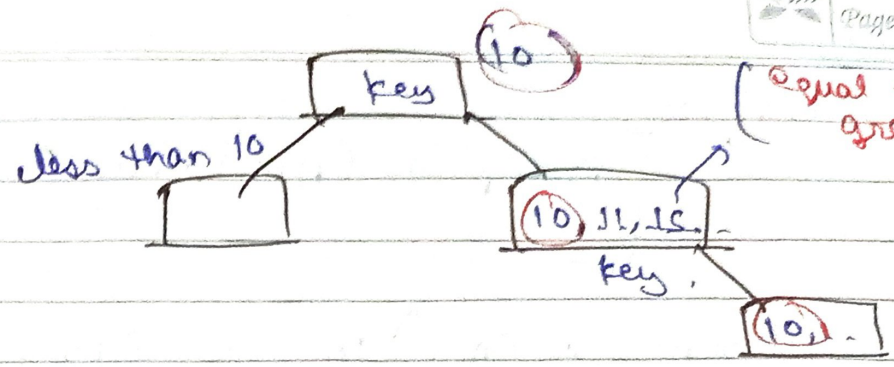
Both, B & B^+ are balanced, i.e, all leaf Nodes are at same level.

In B^+ structure,



⇒ In this, less value to key is in left node & the greater value to key are in Right node. (But here, in Right side, we also have to put the key value with its greater values).

⇒ i.e,



⇒ Reason :→ bcz, we only search in leaf Node, bcz only leaf Node has all keys with Data pointers (D.P.) are present.
So,
(We also have to reach the D.P. of the key)
so, that's why we also carry the key value upto leaf Node.

→ Searching is that's why faster in B+ tree, bcz have to search only in leaf Node.

&
bcz of this, Redundant keys are also present in B+ tree.
Leaf Nodes are also linked together.

---

102. Qus on Order of B+ Tree :→

Q!→ Consider a B+ Tree with key size = 10 bytes, block size = 512 bytes, data pointer = 8 bytes & block pointer = 5 bytes. What is the order of leaf & non leaf node ?

Sol!→ Non leaf :→

BP	key	BP	key	BP	key	BP

Leaf Node :→

key DP	key DP	key DP	B.P. →

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⇒ **Non-leaf :-**

$$n \times BP + (n-1) \times key \leq \text{Block size}$$

→ $5 \times n + (n+1) 10 \leq 512$

$5n + 10n + 10 \leq 512$

$15n \leq 522$

$n \leq \frac{522}{15}$ 34.8

$n \leq 34.8$

$\therefore$ $n = 34$ ✓

Order = 34

(Max BP.) or (Max children possible).

⇒ **Leaf :-**

Let x pairs

$$x(key + PP) + BP \leq \text{Block size}$$

$x(10+8) + 5 \leq 512$

$18x \leq 507$

$x \leq \frac{507}{18}$ 28.18

$x \leq 28.18$

$\therefore$ $x = 28$ ✓ Order = 28 ✓

Note :- Order of a leaf node in B+ tree is the no. of (key, D.P.) pairs.

H.D.D. - Hard Disk Drive.

103. Immediate Database Modification :→
(Log Based Recovery Methods).

⇒ ↳ Immediate means तुरंत, उसी समय।

Ex-1

A = ~~100~~ 200
B = ~~200~~ 400.

Hard Drive.

T_1
R(A)
A = A+100
W(A) −200
R(B)
B = B+200
W(B) −400.
Commit.

Transaction Log.

< T_1, Start >

< T_1, A, 100, 200 > (old, new)

< T_1, B, 200, 400 > (old, new)

< T_1, Commit >

Redo

⇒ जैसे ही Ram के अंदर value (200) हुई, उसी time पे ही Database में भी (A=200) कर दो। बिना Commit हुए।

⇒ i.e, At time, when we write in memory (RAM), At same time also update in the H.D. We don't wait for commit.

⇒ But, when we see in Trans. Log,

Our Recovery Manager sees the log & check whether T_i has both Start & commit or not. & If yes, then it REDO

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→ Redo, means saves the latest value in the Database. i.e.,

→ (Recovery Manager don't see value in the H.D., it only sees in the Trans. log & check (starts & commit) & then saves in the H.D. database. & if already saved, then over-write & fixed them.

→ But, If

Ex:-

Database	T_1	Transaction log
A = ~~100~~ ~~200~~ 100	R(A)	<T_1, start>
B = ~~200~~ ~~400~~ 200	A = A + 100	<T_1, A, 100, 200> (old, new)
	W(A) - 200	
	R(B)	<T_1, B, 200, 400>
	B = B + 200	
	W(B) - 400	UNDO
	⋮ fail.	

→ Here, Recovery Manager don't find commit in Trans. log. So, he UNDO.

→ UNDO, means it saves the old value. But, in database there are updated values now. So, Recovery Manager takes the old values from the Trans. log & saved them in the Database.

In Immediate, we store both old & new value but,
In Deferred, we only store new value.
(i.e. only REDO, not UNDO).

that's why
Immediate Database Modification is known as UNDO - REDO strategy.

Ex:- ⇒ Transac^n log ⇒

< T_1, start >
< T_1, A, 1000, 2000 >
< T_1, B, 5000, 6000 >
< T_1, Commit >
— REDO.

< T_2, start >
< T_2, C, 700, 800 >
old.
— UNDO.

---

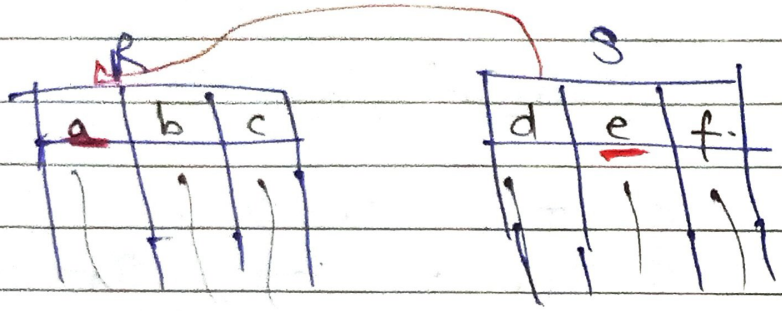
104. Ques^n on DBMS basic Concepts & Data Modelling :-

Q:- Let, R (a, b, c) and S (d, e, f) be 2 Rel^n. 'd' is foreign key of S that refers to primary key of R. Consider 4 operⁿ on 'R' & 'S'

i) insert into R
ii) insert into S
iii) delete from R
iv) delete from S

→ Which of these can violate Referential Integrity?

a) i & ii
b) i & iii
c) ii & iii → Ans.
d) i & iv



⇒ Understand from: → कि Intelligent student कुछ भी delete कर सकता है लेकिन कि इससे बच्चों को भी तो Delete करना पड़ेगा।
(If they don't delete → then, violation.)

2. The view of total database content is —

a) Conceptual view Ans. b) Internal view
c) External view d) physical view.

⇒ This is On 3 schema architecture.

* Internal view & External view,
external view is basically related to outer view.

⇒ User को Total view नहीं होता।
User has partial view (data only he need)

Primal - basic, original, fundamental.

⇒ Physical view तो सबसे 3rd level view तो आता।
(Database storage Related).

⇒ In partial case, External view is Ans.

3. In Relational Model, Cardinality is →.

a) No. of tuples
b) No. of attributes.
c) No. of Tables.
d) No. of Constraints.

⇒ If degree, then no. of attributes.

The no. of rows in a Table, called as Cardinality

4. _____ Constraint is used to maintain Consistency among tuples in two relations.

a) key
b) domain.
c) Referential Integrity
d) Entity integrity.

⇒ domain basically deals with that which type of data we put into Table. (integer, varchar, character, etc.)

⇒ Entity integrity, related with primary key.

⇒ key deals with uniqueness.

105. Imp. Ques^n on Advance DBMS :→
(Big Data & Data Warehouse)

Q-1. What do data warehouse support?

a) OLAP
b) OLTP
c) OLAP & OLTP
d) Operational Database.

⇒ data warehouse, where we integrate data at one place from all diff sources.
Ex:- Big BAZAAR, → their outlets mostly found in Every City.
&
(at the end of day, all data integrated from all cities & kept) i.e, data warehouse.

- & we store this data, to analyse on it later. so that, they can also play AD's - to diff users acc. to their data of purchasing items.
(Apply Mining algorithms on these data)

⇒ OLAP → online Analytical processing.
⇒ OLTP → online Transac^n processing.
↳ It works on Current Data.

⇒ (that where to Remove item, when open new store, rename or add items) — all these based on Analysis.

(2.) Hadoop is framework that works with variety of related tools. Common group includes ——.

A) Map reduce, Hive & Hbase
B) Map Reduce, My SQL and Google Apps.
C) Map Reduce, Hummus, Iguana
D) Map Reduce, Heron, Trumpet

⇒ Hadoop, basically work on Big Data. (It is a Tool of Big Data).

↳ like Google, Facebook. Big data deals with the multiple petabytes of the data. Now, to process this much of Data. We don't use normal tool like SQL Server, Oracle. We use Hadoop. (Bcz, this data is also unstructured).
&
↳ (Hadoop Ecosystem / framework includes many small tools like map reduce. (used to process the data, reduce the data (divide) & then works on bench processing — i.e, works on Multi-processing),
⇒ Hive → (If we write to SQL commands in Hadoop, then use Hive),
⇒ Hbase → (helps in data storage),
↳ also tool like Zookeeper, flum, pig, etc.

2) Google Apps, it is part of cloud.

3.) All of the following accurately describe Hadoop, Except :

A) open Source — (listed in Apache, we also install it).
B) Real time
C) Java based
d) Distributed Computing approach.

→ Hadoop, It is basically batch processing. Means we first need data & then we analyse on it.

→ (In Real time, we use SPARK).

4.) Which of the following does not comes under five V's of BIG Data ?

a) Volume (how much amount of data).
b) Velocity (with which velocity, data ↑).
c) Variety (Structured, unstr., semi-structu).
d) Visualization

Note :- let, if there is 'x' amount of total data.
where, x → is all data on Earth,
then,
(80% - 90%) of x is created in last 5-6 years. Mean,
Data is increasing with so much speed.

Unstructured → photos, videos,
Semi-Structured → XML based data.

⇒ Value → (ie, value of our data).
⇒ Veracity → (means, trustworthyness).
↓
(how much capable our data to believe on it.)

⇒ 5 V's of BIG DATA :→
1.) Volume
2.) Velocity
3.) Variety
4.) Value
5.) Veracity.

⇒ Visualiza^, is a part of Data Analytics. where we visualise our data with help of graphs (pie chart, bar chart, ... etc.)

---

106. Deferred Database Modification :→

→ This topic comes under Log based Recovery.
↓
(If there is any failure inside our System, then Either we can recover that System or not)

→ Log, is basically a file (small sized file). in which we store our actions. that (what Trans. performs, are stored in Logs)

(deferred → delayed, postponed, belated)

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→ (like, History in our Browser)

when our system fails, to recover Trans:

⇒ (Either we have to Roll back them or Modify them).

→ We do that, by seeing the log.

⇒ 2 Methods, by seeing the log :→

1.) Deferred Database Modificaⁿ

2.) Immediate " "

Ex.

Database (H.D).	T_1	Transacⁿ log.
A = ~~100~~ 200	R(A)	< T_1, Start >.
B = ~~200~~ 400	A = A + 100	
	W(A) — 200	< T_1, A, 200 >. new value.
	R(B)	
	B = B + 200	< T_1, B, 400 > new value.
	W(B). — 400	< T_1, Commit >.
	Commit.	Redo →

⇒ Here, It don't update in Database hand-to-hand. It updates in Database after Commit. (bcz, deferred – late, postponed).

After commit, database updates.

⇒ How we Recovery in Deferred? Let's, say system fails after Commit.

→ So, when recovery Manager comes, It first check trans. log file. & check (Start & Commit) in it.

Then, Recovery Manager: **REDO**.

- Means, update the new values in the database.
- (Let, due to fail → our database also not there).

then,

- Recovery Manager puts the A & B value from Log in database.

A = 200
B = 400

- (If it already in database, then overwrite हो जाएगा।)

Case II

T1	Transac^n Log
w(A). – 200	<T1, Start>
w(B). – 400	<T1, A, 200>
fail.	<T1, B, 400>

A = 100
B = 200

Roll back.

- Now, fails before Commit. So, now database value is same as before.

Now,

after failure occur, when Recovery Manager opens the log file. → It sees T1 starts but not commit. So, Here Recovery Manager don't do anything. He simply Roll back.

Means, पुरानी value को ही रखो, कुछ भी Opera^n करने की जरूरत नही है।

⇒ So, Deferred Modification also known as No UNDO/REDO Method.

Ex:-

<T1, Start>.
<T1, A, 200>
<T1, B, 400>
<T1, commit>. → (REDO)

<T2, Start>.
<T2, C, 500>. → (No Action).

Roll back नहीं होगा।

In Deferred, we store only new values.

---

107) Like Command in SQL :-

⇒ We use Like Command, generally to search the Data.

Q:- 1.) Find Employee detail whose name starting with 'A'.

2.) Find Emp detail whose name ending with 'n'.

3.) whose name contains 'ee'.

4.) whose name contain 'a' in 2nd place.

5.) whose name contain 'a' in 2nd place & name should contain total five characters.

% → Any value (कुछ भी chara. हो),
↳ यदि 'a' character से हो, कोई problem नहीं।

Emp.

ID	Name
1.	Varun
2.	Arun
3.	Karuna
4.	Amrit
5.	Ranjeet
6.	Ajeet

% → any value
& length.

_ → reserved for a value.

1.) Select * from Emp where name like 'A%';
Output → Arun, Amrit, Ajeet

2.) —"— like '%n';
Output → Varun, Arun.

3.) —"— like '%ee%';
Output → Ranjeet, Ajeet

Note:→ If Name → Saar, Arunee, ... any thing
↳ then, these also comes, bcz sirf 'ee' we need.

% → also 'a' characters include.

4.) —"— like '_a%';
Output → Varun, Karuna, Ranjeet.

5.) —"— like '_a___';
Output → Varun

In, C++ ⇒ =
Here ⇒ :=

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(108.) Basic PL-SQL programming with Execution :→

→ **Program 1:** Find the Sum of 2 numbers.

Declaration ⇒
```
declare
a int ;
b int ;
c int ;
```

Executable part
```
begin
a : = &a;          // value given by user
                   (to take input from user).
b : = &b;
c : = a+b;
dbms_output.put_line ('Sum of a and b =' || c);
end;
```

// cout in C++

// 3 in C++

(#) **program 2:** Greatest of 2 numbers →

```
declare
a int;
b int;
begin
a : = &a;
b : = &b;
if (a>b)
then
dbms_output.put_line ('a is greater');     //a
Else
dbms_output.put_line ('b is greater');     //b
```

SQL line में हमें value पहले ही देनी पड़ती है
उसमें बाद में user value नहीं दे सकता।


```
end if;
end;
```

⇒ (both code works fine). ✓

---

109. PL-SQL :- (while, for loop) :-

program 3 :- For loop :-

```
declare
a number (2);
begin
for a in 0..10          // = 0 to 10.
loop                    // By default, increment of 1 by 1.
dbms_output.put_line (a);
end loop;
end;
```

program 4 :- While loop :-

```
declare                 // print from a to b.
a int;
b int;
begin
a := 0;
b := &b;
while a < b
loop
a := a+1;
dbms_output.put_line (a);
end loop;
end;
```

Output → 1 to 10

then,
→ output → 0 to 9
(Now, first print then increment)
→ output → 10

* In oracle sometimes there shows error in output → then write.

→ Set Serveroutput on → // but in Live SQL It is By default.

Code

→ (both code works fine). ✓

---

110 - Single Row & Multi Row functions in SQL :-

→ Single Row :-
If our func. is applicable on single row, and only apply on single row. & gives an single output corresponding to that row. → then, It is Single Row funcs.

→ Multi-Row :- func.
func. that apply on more than one rows, & gives an single output corresponding to all these rows.

→ Round (Round-off value)
→ Mod. (gives remainder after division)
→ lower (Convert a string into lower letters).
→ InitCap. (Capital the Initial letter).
→ Concat (Add 2 string & make 1).
→ LPAD/ RPAD (for left & Right padding).
→ NVL, NVL2 (to take care of NULL values).

SQL functions -

- Single Row func^n.
  - Number func.
    - Round
    - Trunc
    - Mod
  - Character functions
    - Case Manipulation
      - lower
      - upper
      - initcap.
    - Character Manipulation.
      - Concat
      - Substr
      - length
      - Instr
      - LPAD/RPAD
      - TRIM
      - Replace.
  - Date function
    - Months_between
    - Add_Months
    - NEXT_DAY
    - LAST_DAY
    - ROUND
    - TRUNC
  - General functions
    - NVL
    - NVL2
    - NULL IF
    - COAL ESCE
    - CASE
    - DECODE
  - Data - Type Conversion.
    - TO_CHAR
    - TO_NUMBER
    - TO_DATE
- Multi_Row func^n.
  - Aggregate.
    - SUM
    - MAX
    - MIN
    - COUNT
    - AVG

111. Character functions in SQL with Execution :→

⇒ **Character functions**

- **Case function Manipulation**
  - → lower
  - → Upper
  - → Init Cap
- **Character Manipulation**
  - → Concat ('Varun', 'Singla') Varun Singla
  - → Substr ('Varun', 2, 4) arun
  - → Instr ('Varun', 'u') 4th
  - → length ('Varun') 5
  - → LPAD ('Varun', 10, '*') *****Varun (10 - length)
  - → RPAD —"— Varun*****
  - → TRIM ('V' from 'Varun') Arun
  - → REPLACE ('Varun', 'V', 'T') Tarun.

(*) ANURAG
1 2 3 4 5 6

(#) **Execution** → If we want to implement these funcs, so, first we have to make schema (table).

⇒ **Output Table:→** select * from emp;

ID	NAME
1	Code Smasher
2	Varun Singla

⇒

```
Create table emp
(
id int,
name varchar2(20)
);
insert into emp values (1, 'Gate Smashers');
insert into emp values (2, 'Varun Singla');
Select * from emp;
Select lower(name) from emp;
Select upper(name) from emp;
Select initcap(name) from emp;
Select Concat(id, name) from emp;
Select SUBSTR(name, 2, 5), INSTR(name, 'v')
    from emp;
Select length(name) from emp;
Select lpad(name, 15, '*') from emp;
Select rpad(name, 15, '*') from emp;
Select trim('v' from name) from emp;
Select replace(name, 'v', 't') from emp;
```

Table Created.

2 ROWS

2 ROWS.

Select 1 by 1 Each Row, & See the Output

Output:

REPLACE(NAME, 'V', 'T')
Gate Smashers
tarun Singla.

Output:

LPAD(NAME, 15, '*')
******Gate_Smashers
*********Varun_Singla.

Here, ~~*~~ counts (_) Space also.

Output:

SUBSTR(NAME, 2, 5)	INSTR(NAME, 'v')
ate S	0
arun	1

(~~*~~ don't count (_) here).

i.e.,

GATE	SMASHERS
1 2 3 4	5 6 7 8 9 10 11 12

→ ate S

(112) # View in Database :→

(Oracle, SQL Server Views)

- What is View in Database ?

→ Virtual Table :→

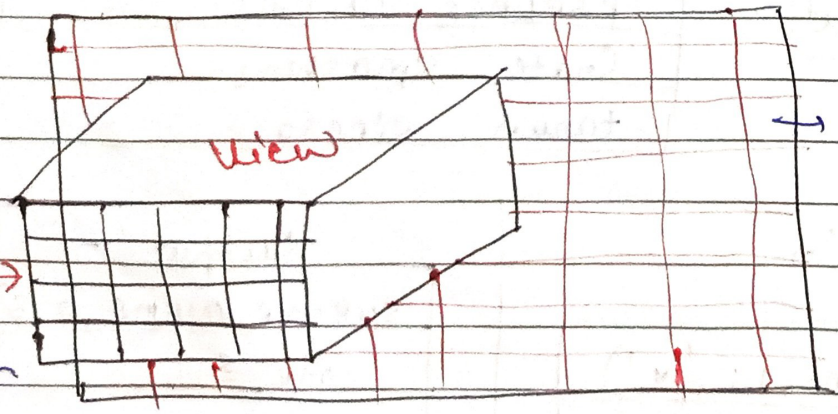
(The Table we create,
Create Table xyz
It takes physical space in memory (H.D.))

⇒ But, View is the virtual Table.
It looks like a Table, but it is not actually a table. It don't take space. any.

⇒ View is the result set of a stored query.

Query :→

```
Create view V1 as Select id from Student;
```



This view has no physical existence. We don't store it anywhere.

V1 - View -

(#) The Execute code of this query, Stores after compile. &

After compile, when we write

Select * from V1

then,

it shows the data like a table from the View

(#) So, actually we just store this little query, rather than Result. We don't store Result.

That's why it's a virtual Table.

⇒ Read-only (vs) updatable Views :→

⇒ If we made any changes in Base Table & that col^n is also in our view, then, obviously that also changes.

⇒ Same, If we delete from Base Table. Then also deletes from View.

(#) ⇒ But, if we change anything in View :→

And we want that changes to execute also in the Base Table, then updatable Views. &

If we Shut down the (Insert, Delete & update) (DML commands) on view, i.e, we disable these commands. So, that it can't Operate on View. Then, we made Read-Only Views for it.

Snapshot – जल्दी से photo लेना ।.

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7). Materialised View :→
type of updated version.

(If our data is on the remote server, & I want a copy of that on my local server / machine. ie, I want a snapshot of that remote data on my local Server. So, that is called Materialised View.
→ (This takes space, but takes less space as comparatively to that data),

(#). We can't apply any DDL command (Alter, etc.) on view.
But, apply only DML commands if we make the updatable view.

(#) We can insert the data of more than 1 table, in a View.
ie.
(View can also take data from Multiple Tables.)

(#) We also can take any particular row from Table to make view. like
where address = 'Delhi';
So, all Delhi students come into the view.

Advantages of View :→

1.) To restrict the Data Access.
(Like, we don't give the access of original Table to our user, we just give view to them) of some data.

2.) To make complex queries Easy.

Ex.1) like, we some data from 3 tables.

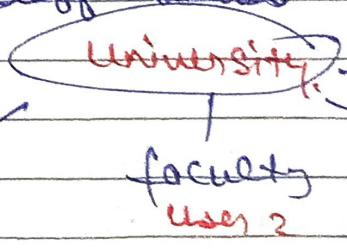
then,
By default, we apply Join as Nested Query.

So,
Its better to just make the views from these tables. Rather, than to write complex Queries

3.) To provide data Independence,
↓
(We just a give a particular access to a user of a Table, rather than giving the full database access).

4.) To present diff. views of the same data.

Ex.1



(They all have diff. privileges).

So,
→ We give diff. views to all of them of the same Data (Table).

(A) SQL CHEAT SHEET :→

(B) Examples →

1.) Select all rows from table with filter applied
→ Select * FROM tbl where Col1 > 5;

2.) Select first 10 rows for 2 columns
Select Col1, Col2 fprom tbl limit 10;

3.) Select all rows with multiple filters applied
→ Select * from tbl where Col1 > 5 AND Col2 < 2;

4.) Select all rows from col1 and col2 ordering by col1
→ Select col1, col2 from tbl order By 1;

5.) Return count of rows in table
→ Select Count (*) from tbl;

6.) Return Sum Of Col1
→ Select SUM (col1) from tbl;

7.) Return max value from Col1
→ Select MAX (col1) from tbl;

8.) Computes summary statistics by grouping col2
→ Select AVG (col1) from tbl GROUP By col2;

9.) Combine data from 2 tables using a left Join

→
```
Select * from tbl1 As t1
LEFT JOIN tbl2 As t2 ON t2.col1 = t1.col1
;
```

10.) Aggregate & filter Results

→
```
SELECT
    col1,
    AVG (col2) = AVG (col3) AS total
FROM tbl
GROUP BY col1
HAVING total > 2 .
```

11.) Implementation of CASE statement →

→
```
Select col1,
CASE
    When col1 > 10 THEN 'more than 10'
    When col1 < 10 THEN 'less than 10'
    ELSE '10'
END AS NewColumnsName
FROM tbl ;
```

(*) ORDER OF EXECUTION →

```
FROM
WHERE
GROUP BY
HAVING
SELECT
ORDER BY
LIMIT
```

(5). Create

```
CREATE DATABASE Mydatabase ;

CREATE INDEX IndexName
ON TableName (col1) ;

CREATE TABLE OurTable (
        id int ,
        name varchar (12)
);
```

* UPDATE TABLE

```
UPDATE OurTable
SET col1 = 56
where col2 = 'something' ;
```

* DELETE

```
DROP DATABASE OurDatabase ;

DROP TABLE Ourtable ;
```

* DELETE Records

→ Delete from OurTable
where col1 = 'something' ;

Add / Remove Column

```
Alter Table OurTable
ADD cols int ;
```

```
ALTER TABLE OurTable
DROP Column cols;
```