CS & IT ENGINEERING

Database Management System

Practice Sheet discussion (Part -02)
File Org & Indexing

Discussion Notes

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01 Question

02 Discussion

Q.1

Assume a relational database system that holds relation: C(colleges) with the following characteristics

- Records are stored as fixed length, fixed format records, length is 256 bytes.
- There are 16384 records.
- Records contains key attribute CollegeNumber (C.N), length 22 bytes and other fields.
- Unspanned organization is used to store the information or record.

Let's suppose we want to build a sparse primary index on C.N then how many numbers of 4096-byte blocks are needed to store the primary index when block pointer size is 10 bytes _____? [MCQ]

A. 7

B. 8

C. 9

D. 10

Record Size = 256 Byte Total #Record = 16384 BS = 4096 Key = 22 Bp = 10

$$BF \text{ of DB File} = \left\lfloor \frac{4096}{256} \right\rfloor = \frac{2^{12}}{2^8} = 2^4 = 16 \text{ Record Per Block.}$$

$$\text{Total \# DB Block} = \frac{16384}{16} = \frac{2^{14}}{2^4} = 2^{10} = \boxed{1024 \text{ DB Block}}$$

One Index Record = Key + Bp = 22 + 10 = 32 Byte

$$BF \text{ of Index file} = \left\lfloor \frac{\text{Block Size}}{RS} \right\rfloor = \frac{4096}{32} = \frac{2^{12}}{2^5} = 2^7 = 128 \text{ Index Record Per Block}$$

Entries

Primary: SPARSE : Total #Index Entries = 1024 (#DB Block).

$$\#\text{Index Block} = \left\lceil \frac{1024}{128} \right\rceil = \frac{2^{10}}{2^7} = 2^3$$

$$= 8 \text{ Index Block}.$$

Q.2

Assume a relational database system that holds relation: Product (P) with the following characteristics

- Records are stored as fixed length, fixed format records, with the length of 256 bytes.
- There are 262144 records. [2^{18}]
- Records contain attribute P.I (The identifier of the product involved), with the length 24 bytes, and an attribute P.C (the cost of product), with the length 32 bytes and other fields.
- Unspanned organization is used to store the record.

Assume that we want to build a dense secondary index on P.C, then how many numbers of 4096-byte blocks needed to store the dense secondary index. When record pointer size is 32 bytes?

_____.

[NAT]

BlockSize = 256B #Records = 262144 [2^{18}] P.I = 24 Byte BlockSize = 4096B

PC = 32 Byte Pointer = 32B [Secondary Index on PC]
Dense

One Index Record Size = (PC) key + Pointer = 32 + 32 = 64 Byte

Block factor of Index file = $\frac{4096}{64} = \frac{2^{12}}{2^6} = 2^6 = 64$ Index Entries Per Block

Secondary [Dense] Total # Index Entries = 262144 [2^{18}] (# Records)

Total # Index Block = $\frac{2^{18}}{2^6} = 2^{12}$ = (4096 Index Block) Ans

Q.3

Consider the following specification of system-

Disk block size = 2048 bytes

Block pointer size = 16 bytes

Record pointer size = 20 bytes long

file contains 30,000 records.

Each record of the file has the following fields: [MCQ]

Block factor of DB file $= \left\lfloor \frac{2048}{64} \right\rfloor = \frac{2^{11}}{2^6} = 2^5$

$= 32$ Record for Block

Fields	Size (in Bytes)
EmpName	5
EmpNum	10
DeptNum	9
Addr	20
PhNum	9
DOB	1
Sex	1
Job	3
Sal	5

63Byte

1Record Size = 64Byte

G341 = 64Byte

An extra/additional byte is used per record to represent end of the record.

What is the block factor of the database file assuming unspanned file organization?

A. 16

B. 32

C. 48

D. 64

Q.4 Which one of the following statements is/are True regarding indexing? [MSQ]

PI SI ✓

CI SI ✓

A. A database file can contain multiple clustered indexes.

B. A database file can consist of only one clustered index with multiple secondary indexes.

C. A database file can consist of multiple primary indexes.

D. A database file can consist of both primary and clustered index.

PI ✓ CI ✗ & Multiple SI possible.

Q.5

Consider a database of fixed-length records stored as an ordered file. The database has 25,000 records with each records being 100 bytes, of which the non-key attribute on which clustering index is formed occupies 10 bytes. The data file is completely block aligned.

Suppose, block size, of the file system is 512 bytes and a pointer to the block occupy 5 bytes. You may assume that a binary search on an index file of b block may take $\lceil \log_2 b \rceil$ accesses in worst case.

Given that a cluster consumes 2 blocks, the number of block accesses required to identify the desired data in the worst case is _____.

[NAT]

#Record = 25,000 Record Size = 100B Key = 10B Rp = 5B

Block Size = 512B Cluster Consume 2 Block. Block wise

Block factor of DB File $= \left\lfloor \frac{512}{100} \right\rfloor = 5$ Record per Block.

Total # DB Block $= \left\lceil \frac{25000}{5} \right\rceil = 5000$ Data Block.

Each cluster Consume 2 Block.

Total # Index Entries $= \frac{5000}{2} = 2500$

One Index Record size $= 10 + 5 = 15$ Byte

#Record = 25,000 Record Size = 100B key = 10B R_p = 5B

Block Size = 512B Cluster Consume 2 Block. Block wise.

Block factor of Index File $= \left\lfloor \frac{512B}{15B} \right\rfloor = 34$ Index (Record) Entries Per Block.

Total # Index Block $= \left\lceil \frac{2500}{34} \right\rceil = 74$ Index Block.

#Block Access Required $= \lceil \log_2 b \rceil + 1 + 1$

$= \lceil \log_2 74 \rceil + 1 + 1 \Rightarrow 7 + 1 + 1 = 9$ Ans

(1 → 1st block of the cluster; 1 → 2nd Block of the cluster.)

Q.6

Consider the following statements-

S_1: If the records of a relation X are physically ordered over a non-key field P and an index is build over the key-field of relation X, then the index is necessarily a secondary index over key attribute.

S_2: More than one secondary indexes are possible.

Which of the given statement(s) is/are CORRECT? [MCQ]

A. S_1 only

B. S_2 only

C. Both S_1 and S_2

D. Neither S_1 nor S_2

(Non key + ordered)

SI [Non key / Cand. key + Unordered] → Secondary Index over key

PI ✓	CI ✗
PI ✓	SI ✓
CI ✓	SI ✓

But only 1 PI (or) 1 CI [Any One Not both] Possible.

More than one SI possible.

R(ABCDEFG) every Attribute forming Index.

1 PI + 6 SI

1 CI + 6 SI.

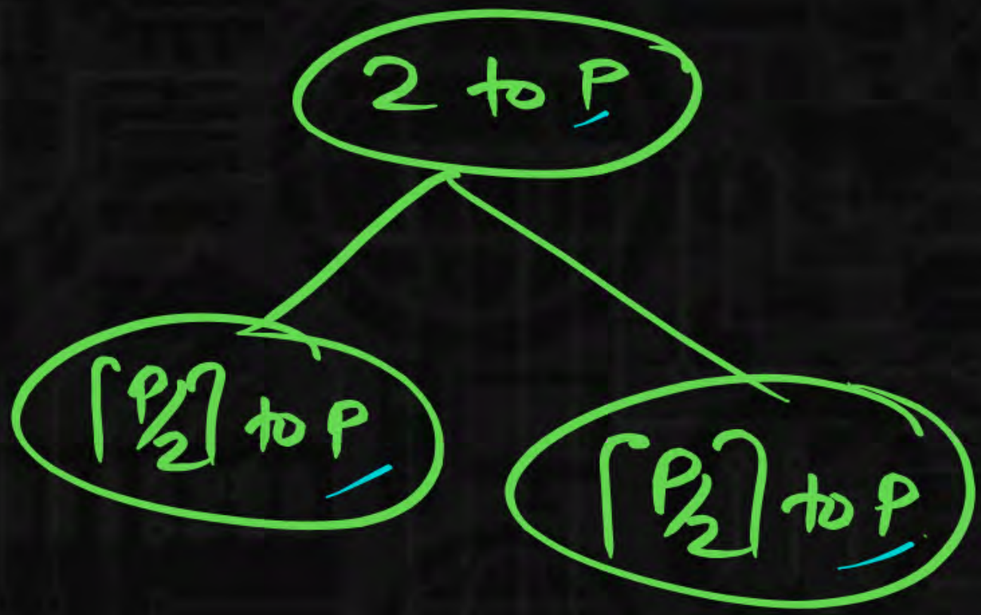
Q.7

The order of a node in B+ tree is defined as the number of pointers it can hold. What is the maximum number of keys that a B+ tree of order 4 and height 4 can have ? _____

(Assume that the height of a root node is 1)

[NAT]

Ans (255)



Order = 4 (P=4) Level = 4

Height/Level	max # Node	max # BP	max # keys	P = 4
0/1	1	P	(P−1)	(P−1) = 3 = 3
1/2	P	P^2	P(P−1)	⇒ 4×3 = 12
2/3	P^2	P^3	$P^2(P-1)$	⇒ 4^2×3 = 48
3/4	P^3	P^4	$P^3(P-1)$	⇒ 4^3×3 = 192
4/5	P^4	P^5	$P^4(P-1)$	
h/h+1	P^h	P^{h+1}	$P^h(P-1)$	

255 Ans

Q.8 Given a block can hold either 3 records or 10 key pointers. A database contains P records, then how many blocks do we need to hold the data file and the dense index? **[MCQ]**

A. $\frac{P}{30}$

B. $\frac{P}{3}$

C. $\frac{13P}{30}$

D. $\frac{P}{10}$

Block factor = 3 Record per Block.

Dense Index

#Index Entries = #Records [P]

#DB Block = $P/3$

#Index Block = $P/10$

Total #Block Required = $P/3 + P/10$

$= \frac{10+3}{30}$

$= 13P/30$ Ans

Q.9 The order of an internal node in B+ tree index is the maximum number of children it can have. Assume that a child pointer takes 6 bytes, the search field value takes 34 bytes and the blocks size is 2048 bytes. The order of the internal node is _____.

[NAT]

$$P * B_p + (P-1)\,key \leq B.S.$$

$$P*6 + (P-1)34 \leq 2048$$

$$6P + 34P - 34 \leq 2048$$

$$40P \leq 2048 + 34$$

$$\frac{2082}{40} = 52.1 = 52$$ Ans

52

Q.10 Assume a disk with block size B = 1024 Bytes, A block pointer is P_B = 12 bytes long and a record pointer is P_R = 18 bytes long. A file has 1,00,000 patients records of size 100 bytes. Suppose the file is ordered by the key field PID and we want to construct a secondary (dense) index on non-key field DeptID (14 bytes), then minimum of how many blocks are required to store index file assuming an unspanned organization?

[MCQ]

A. 3000

B. 3100

C. 3125

D. None of the above

$B_p = 12B$

Block Size = 1024 Byte $\quad R_p = 18B$ $\quad$ # Rec = 10^5. $\quad$ Record size = 100B

SI (Non key) = 14 Byte

One Index Record = $14 + 18 = 32$ Byte.

Block factor of Index file = $\frac{1024}{32} = \frac{2^{10}}{2^5} = 2^5 = 32$ Index Record per Block

SI [Dense] Total # Index Entries = 10^5 (# Records)

Total # Index Block = $\left\lceil \frac{100000}{32} \right\rceil = 3125$ Ans

Q.11 The order of a node in B tree is the maximum number of block pointers it can hold. Given that the block size is 2K bytes, data record pointer is 8 bytes long, the search key is 9 bytes long and a block pointer is 5 bytes long. The best possible order of B tree node is____. **[NAT]**

$$P * B_P + (P-1)\,key + (P-1)R_P \le \text{Block Size}$$

$$P*5 + (P-1)9 + (P-1)8 \le 2048$$

$$5P + 9P - 9 + 8P - 8 \le 2048$$

$$22P - 17 \le 2048$$

$$22P \le 2065$$

$$P = \left(\frac{2065}{22}\right) = 93 \quad \text{Ans}$$

B Tree : $P * B_p + (P-1)key + (P-1)R_p \leq \text{Block size}$

B+ Tree

Internal Node = $P * B_p + (P-1)key \leq \text{Block size}$

Leaf Node : $(P-1)key + (P-1)R_p + 1B_p \leq \text{Block size}$

Q.12 The order of a leaf node (P) in a B+ tree is the maximum number of (value, data record pointer) pairs it can hold. Given that P=36, data record pointer is 8 bytes long, the search field is 6 bytes long and a block pointer is 8 bytes long. The permissible block size is_____. **[NAT]**

$$P(key + R_p) + 1B_p \leq Block\ size$$

$$36[8+6] + 8$$

$$36 \times 14 + 8$$

$$= 512 \text{ Ans}$$

Q.13 (Assume that the level of root node is1)

The order of different nodes in B^+ tree/B tree are given as-

2 to P block pointers in root node.

$\left\lceil \frac{P}{2} \right\rceil$ to P block pointers in internal node.

$\left\lceil \frac{P}{2} \right\rceil - 1$ to $(P-1)$ keys in leaf node.

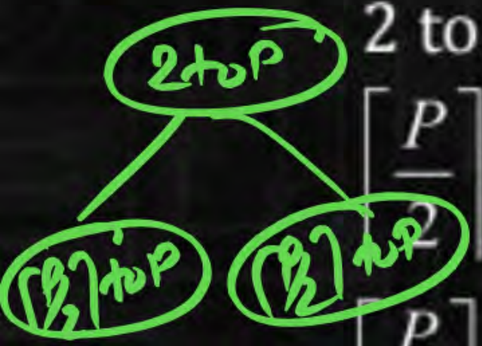
Let a and b be

The minimum number of keys in

B tree and B^+ tree node of order

P = 5 and level = 5. The value of (a + b) is_____.

[NAT]



B Tree a = 161
min keys

B^+ Tree: b = 108

[B+ Tree all keys are in last (Leaf) Node.]

All keys available in last (Leaf Node)

a : 161
+b : 108
269 Ans

Height / Level	min # Node	min # BP	min # keys.
0 / 1	1	2	1
1 / 2	2	$2\lceil p/2 \rceil$	$2(\lceil p/2 \rceil - 1)$
2 / 3	$2\lceil p/2 \rceil$	$2\lceil p/2 \rceil^2$	$2\lceil p/2 \rceil(\lceil p/2 \rceil - 1)$
3 / 4	$2\lceil p/2 \rceil^2$	$2\lceil p/2 \rceil^3$	$2\lceil p/2 \rceil^2(\lceil p/2 \rceil - 1)$
4 / 5	$2\lceil p/2 \rceil^3$	$2\lceil p/2 \rceil^4$	$2\lceil p/2 \rceil^3(\lceil p/2 \rceil - 1)$
⋮			
$h / h+1$	$2\lceil p/2 \rceil^{h-1}$	$2\lceil p/2 \rceil^h$	$2\lceil p/2 \rceil^{h-1}(\lceil p/2 \rceil - 1)$

$\lceil p/2 \rceil = \lceil 5/2 \rceil = 3$ (p = 5) Level = 5

$1 = 1$

$2(\lceil p/2 \rceil - 1) = 4$ (2 × 2)

$2 \times 3 \times 2 = 12$

$2 \times 3^2 \times 2 = 36$

$2 \times 3^3 \times 2 = 108$

161

Q.14 (Assume that the level of root node is1)

The order of different nodes in B^+ tree/B tree are given as-

2 to P block pointers in root node.

$\left\lceil \frac{P}{2} \right\rceil$ to P block pointer is internal node.

$\left\lceil \frac{P}{2} \right\rceil - 1$ to (P–1) keys in leaf node.

Let a and b be the maximum number of keys in B tree and B+ tree node of order P = 5 and level = 5. The value of (a +b) is 5624. Ans

[NAT]

a = 3124

b = 2500

5624

Last [Leaf] Node.

Height/Level	max # Node	max # BP	max # keys	p=5 Level=5 p-1=4
0/1	1	p	(p-1)	(p-1) = 4 = 4
1/2	p	p^2	p(p-1)	5 x 4 = 20
2/3	p^2	p^3	$p^2(p-1)$	5^2 x 4 = 100
3/4	p^3	p^4	$p^3(p-1)$	5^3 x 4 = 500
4/5	p^4	p^5	$p^4(p-1)$	5^4 x 4 = 2500
h/h+1	p^h	p^{h+1}	$p^h(p-1)$	3124

Q.15 Consider the keys (1– 5000) are going to be interested into a B^+ tree. Assume, all the order are available before insertion. The orders P for B^+ tree node is defined as-

2 to P pointer for root

$\left\lceil \frac{P}{2} \right\rceil$ to P pointer for another node.

The maximum possible levels in a B+ tree index for P = 9 is _____.

(Assume that level of the root node is 1)

[NAT]

5000

Min keys in the node.

Min $\lceil 9/2 \rceil - 1 \; \lceil 9/2 \rceil - 1$

$5 - 1$

4

Ans (6)

$minBr = \lceil P/2 \rceil = \lceil 9/2 \rceil = 5$

ORDER: 9

For maximum Level then Min #keys Required in each Node.

Min key $= \lceil P/2 \rceil - 1 \Rightarrow \lceil 9/2 \rceil - 1 \Rightarrow 5 - 1 = (4)$

Total = 5000

Total = $\frac{5000}{4} =$ (1250 Node)

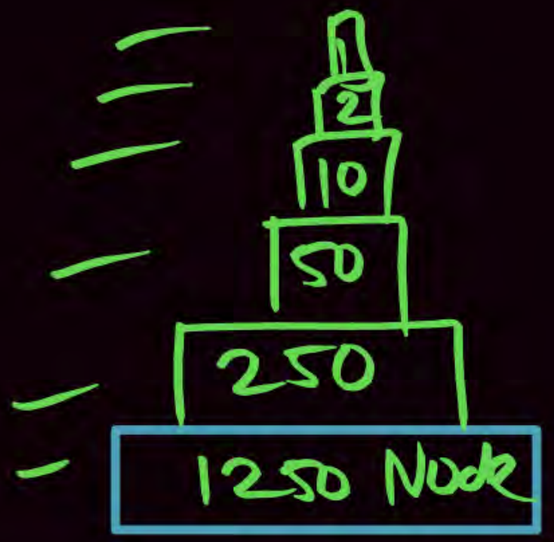
$\lceil 2/2 \rceil = 1$

$\frac{10}{2} = 2$

$\frac{50}{5} = 10$

$\frac{250}{5} = 50$

$\frac{1250}{5} = 250$



Q.16 Consider the following statements:

S_1: In a B+ tree, data pointers are stored only at the leaf nodes of the tree.

S_2: The leaf node has an entry for every value of the search field, along with the data pointer to the record.

Choose the correct statements. **[MCQ]**

A. Only S_1 is true

B. Only S_2 is true

C. Both S_1 and S_2 are true

D. Neither S_1 nor S_2 is true

Q.17 Consider the keys (1– 5000) are going to be interested into a B^+ tree. Assume, all the order are available before insertion. The orders P for B^+ tree node is defined as-

2 to P pointer for root

$\left\lceil \frac{P}{2} \right\rceil$ to P pointer for another node.

The minimum possible levels in a B+ tree index for P = 9 is _____.

(Assume that level of the root node is 1)

[NAT]

Minimum Level means maximum keys in the Node. $P = 9$

Max key $= (P-1) \Rightarrow (P-1) = 8$ key.

Total Node $= \frac{5000}{8} = 625$.

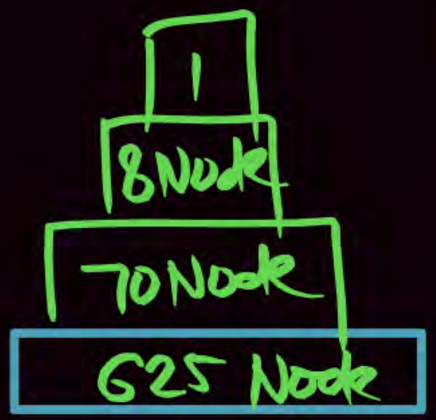
Max $B_p = P$

$B_p = 9$

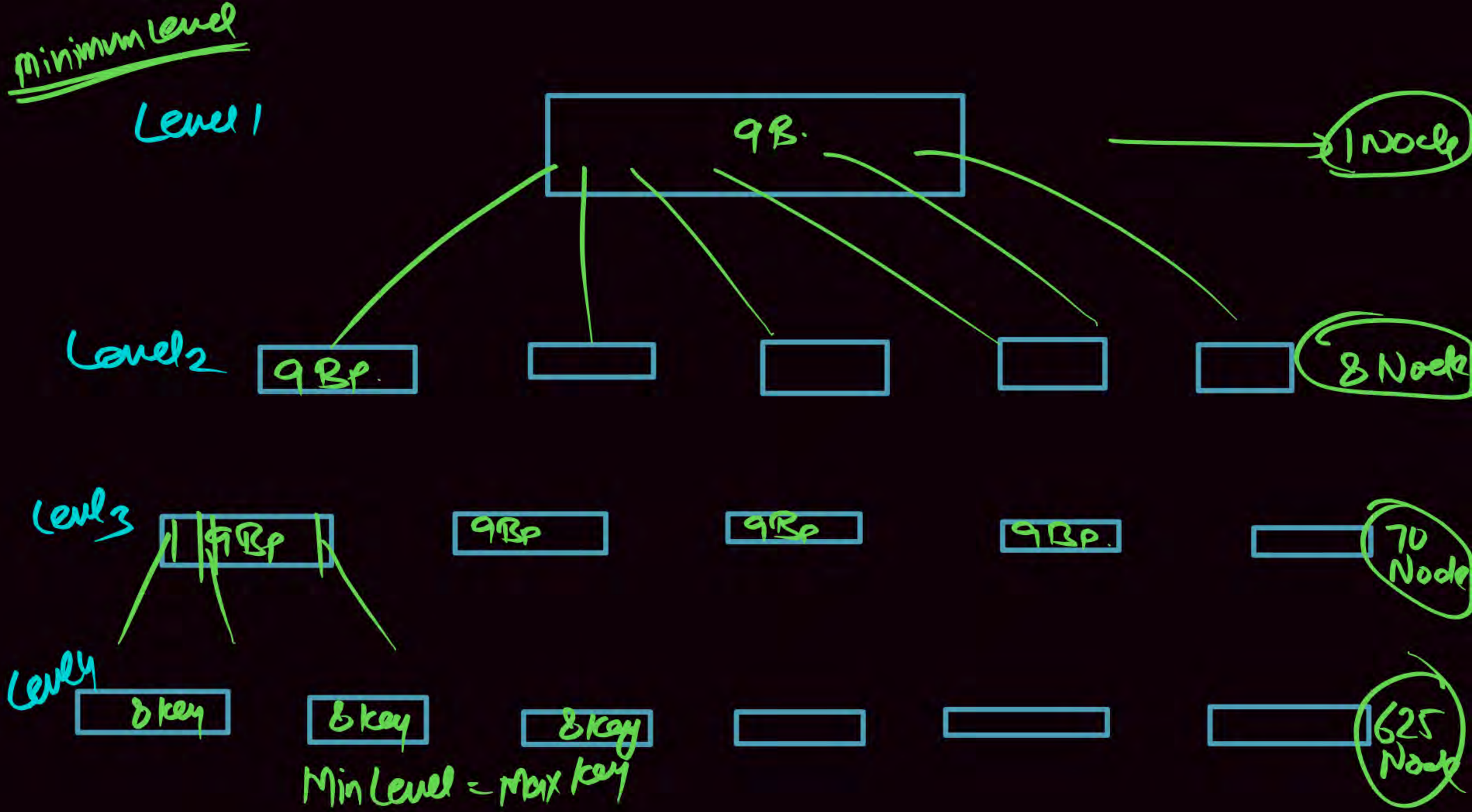
$\lceil \frac{8}{9} \rceil = 1$

$\lceil \frac{70}{9} \rceil = 8$

$\lceil \frac{625}{9} \rceil = 70$



Total Minimum 4 Level Required.


Minimum Level
Level 1
9B.
1 Node
Level 2
9Bp.
8 Nodes
Level 3
9Bp
9Bp
9Bp
9Bp.
70 Nodes
Level 4
8 key
8 key
8 key
625 Nodes
Min Level = Max key


Max. level
1
2
3
2
10
4
50
5
5Bp
5Bp
250
6
4key
4key
4key
4key
1250
Min #key = 1250

Q.18

Consider a file of r = 40,000 records, each record is R = 100 bytes long and its key field is of size v = 20 bytes. The file is ordered on a key field, and the file organization is unspanned. The file is stored in a file system with block size B = 2000 bytes, and size of block pointer is 20 bytes. If the primary index is built on the key field of the file and multilevel index scheme is used to store the primary index, then the total number of blocks required by the multilevel index is_____.

[NAT]

#Records = 40000 Record Size = 100B. Block Size = 2000B Unspanned Primary.

Key = 20B Bp = 20B.

Block factor of DB file = $\left\lfloor \frac{2000}{100B} \right\rfloor$ = 20 Record Per Block.

Total # DB Block = $\left\lceil \frac{40000}{20} \right\rceil$ = 2000 Data Block

Indexing

One Index Record Size = 20+20 = 40Byte

Block factor of Index file = $Bf_I = \left\lfloor \frac{2000}{40} \right\rfloor$ = 50 Index per Block Entries

∴

SPARSE

Total # Index Entries = 2000 (# DB Blocks)

1st Level: Total # Index Block = $\frac{2000}{50}$ = 40 Index Block.

2nd Level: # Index Entries = 40 (# 1st Level Block)

Total # Index Block = $\left(\frac{40}{50}\right)$ = 1 Block.

Total Index Block = 40 + 1 = (41) Ans

PS-1

Q.2

Consider the student relation shown below with schema Stud(Sname, Sage, Smail, Smarks) as follows: [NAT]

Stud

Sname	Sage	Smail	Smarks
Rohit	28	R@pw.live	68
Kanika	25	K@pw.live	75
Pankaj	25	K@pw.live	75
Rohit	28	R@pw.live	88
Anjali	26	A@pw.live	75

✗ Sname Sage
✗ Sname Smail
✓ Sname Smarks
✗ Sage Smail
✗ Sage Smarks
✗ Smail Smarks

Sname Smarks Ans

For the above given instance how many 2-set of attributes can determine a row uniquely?

Q.10 Consider the below instance of relation: **[NAT]**

Employee:

Emp_rating	Emp_name	Emp_mail	Emp_sal
1	Rohit	p@pw	40000
2	Kanika	c@pw	60000
1	Rohit	Null	50000
3	Pankaj	g@pw	60000

R N M S

X R N

X R M → S.K

R S

X N M → S.K

N S

M S → S.K

The maximum possible number of alternate keys for the above relational instance is/are ____.

X Emp rating

X Emp name

Email

X Emp Sal

(M) Mail key

Total key 3

Rating Salary

Name Salary

Q.13

Choose the incorrect statement from the following

[MCQ]

A. All super keys cannot be primary key. → Correct

B. We choose the minimal candidate key to be a primary key. → Correct

C. The number of super keys are equal to the number of primary keys for a relation. ✗ Incorrect

D. None of the above.

Q.14 Suppose a relation R has 9 attributes, then the maximum possible number of candidate keys are? **[NAT]**

$$\text{Max \#Ck} = {}^{n}C_{\lfloor n/2 \rfloor} = {}^{9}C_{\lfloor 9/2 \rfloor} = {}^{9}C_{4}$$

$$= \frac{9 \times 8 \times 7 \times 6 \times 5!}{5! \times 4 \times 3 \times 2}$$

$$63 \times 2$$

$$= 126 \quad \text{Ans}$$

PS-৫

Q.12 Assume a relation R(P, Q, R, S, T, U) with the following dependencies

1. $PQ \rightarrow RS$ 2. $T \rightarrow R$ 3. $Q \rightarrow TU$

Given the functional dependencies as shown above which among the options shows the decomposition of relation R is normalized to 3NF? [MCQ]

First Find Minim

$PQ \rightarrow R$ $(PQ)^+ = (PQSTR$

$PQ \rightarrow S$

$T \rightarrow R$

$Q \rightarrow T$

$Q \rightarrow U$

A. $R_1(P, Q, R, S, T, U)\ R_2(T, R)\ R_3(Q, T, U)$

B. $R_1(P, Q, R, S)\ R_2(R, T)\ R_3(T, U, Q)$

C. $R_1(P, Q, R, S)\ R_2(R, T)\ R_3(Q, T, U)$

D. $R_1(P, Q, S), R_2(T, R)\ R_3(Q, T, U)$

R(PQRSTU)

$\{PQ \to S,\quad T \to R\quad Q \to TU\}$

Candidate key = PQ.

Check 3NF ?

$T \to R$
$Q \to TU$
} Violate 3NF

$R_2(TR) \cap R_3(QTU) = (T)^+ = TR$

$R_1(PQS) \cap R_{23}(QTUR)$

$(Q)^+ = (QTUR] \supseteq R_{23}$

Lossless

3NF Decomposition

PQRSTU

Q.14

Consider a table/Relation R has one candidate key, then which of the following is always true? [MCQ]

A. If R is in 2NF, then it is also in 3NF

B. If R is in 3NF, then it is also in BCNF

C. If R is in 2NF, but it is not in 3NF

D. None of the above.

R(ABC) (A→B, A→C)

Candidate key = (A)

R is in 3NF & BCNF.

Counter eg:

@ R(ABCD) (AB→C, C→D)

Candidate key = (AB)

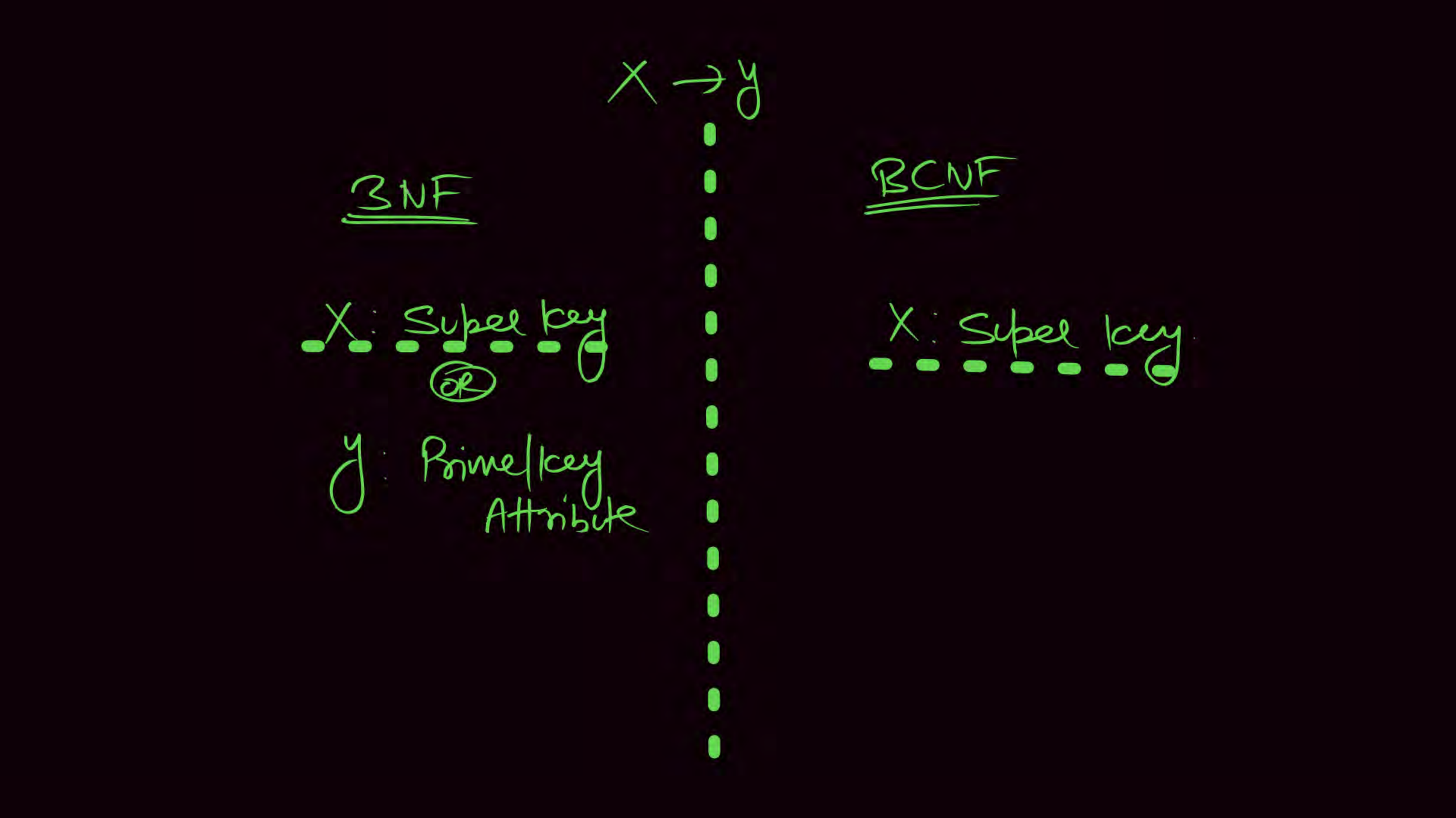
C→D Not in 3NF

2NF But Not in 3NF

© R(ABCD) (AB→C, AB→D)

Candidate key = (AB)

Here R is in 2NF, 3NF & BCNF


X → y
3NF
X: Super key
OR
y: Prime key Attribute
BCNF
X: Super key

R(ABCDE) (AB→C, C→D, B→E)

Cand. key = (AB)

Check 2NF ?

B → E

B: Proper subset of ck

E: Non key Attribute

Not in 2NF.

Q.17 Consider a relation X (P, Q, R, S, T) with the FD's: [MSQ]

$PQ \rightarrow R$

$Q \rightarrow S$

$ST \rightarrow P$

$(PQ)^+ = (PQRS)$ Candidate key = QT

$Q \rightarrow S$ is a BCNF violation for X. Suppose we decide to decompose X into X_1(Q, S), and X_2 (P, Q, R, S, T).

Which of the following statements are incorrect?

(1) $\{PQ \rightarrow R\}$ is a minimal cover for the FD's that hold in X_2. ← Incorrect

(2) $PQ \rightarrow R$ is a BCNF violation for X_2. ← Correct

(3) X_2 should be decomposed further into X_3(P, Q, R) and X_4 (R, T) ← Incorrect

A. (1)

B. (2)

C. (3)

D. (1) and (2) only

$PQ \rightarrow R, \quad Q \rightarrow S, \quad ST \rightarrow P$

Cand. key = (QT)

Check BCNF ?

$PQ \rightarrow R$
$Q \rightarrow S$
$ST \rightarrow P$
} Violation of BCNF

$R_1(PQT)$
$R_2(PQR)$
$R_3(QS)$

BCNF Decomposition

$R(PQRST)$

$PQ \rightarrow R$ $\quad R_2(\underline{PQ}\,R)$

$Q \rightarrow S$ $\quad R_3(\underline{Q}\,S)$

Q.18

Suppose functional dependency Q → R holds in relation R (P, Q, R, S) which additional FD will make R be in 3NF, but not BCNF? [MCQ]

A. $S \rightarrow PQ$

B. $PR \rightarrow S$

C. $RS \rightarrow Q$

D. $PS \rightarrow Q$

Ans C

@ PQRS [Q→R, S→PQ]

Candidate key = S

Check 3NF? Q→R Not in 3NF

Not in 3NF (Q Not Superkey, R Not Prime Attribute)

© PQRS[Q→R, RS→Q]

Candidate key = [PQS, PRS]

Prime Attribute = [P, Q, R, S]

Check 3NF

(X)→y Q→R

(X)→y RS→Q

Here x is Not superkey But y is Prime

So R is in 3NF But Not in BCNF

PQRS [Q→R, PS→Q]

C.k = [PS]

Q→R

Not in 3NF

PQRS (Q→R, PR→S]

Candidate key = PQ

Q→R

↳ Violation of 2NF

R Not in 3NF

PS-3

PS-3

PS-3

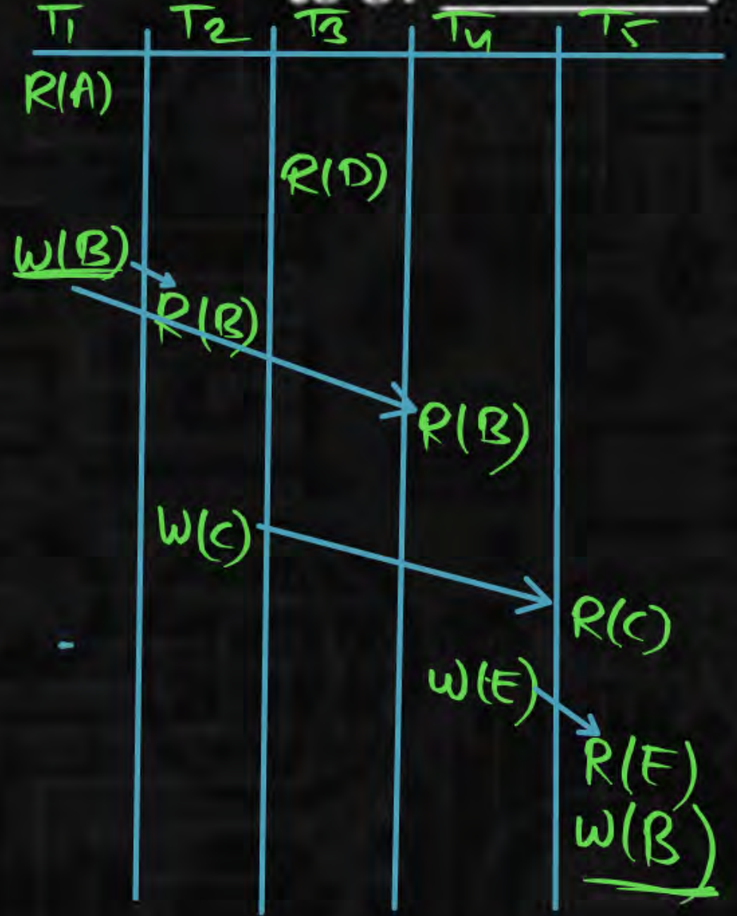
Q.7

Consider the following schedule

S: $R_1(A), R_3(D), W_1(B), R_2(B), R_4(B), W_2(C), R_5(C), W_4(E), R_5(E), W_5(B)$

How many serial schedules are possible which will be view equal to S? _____.

[NAT]



① Initial Read

A: By T_1 D: By T_3

② Final write

B: $T_1 \rightarrow T_5$

③ Updated Read (write Read)

$W_1(B) - R_2(B)$: $T_1 \rightarrow T_2$

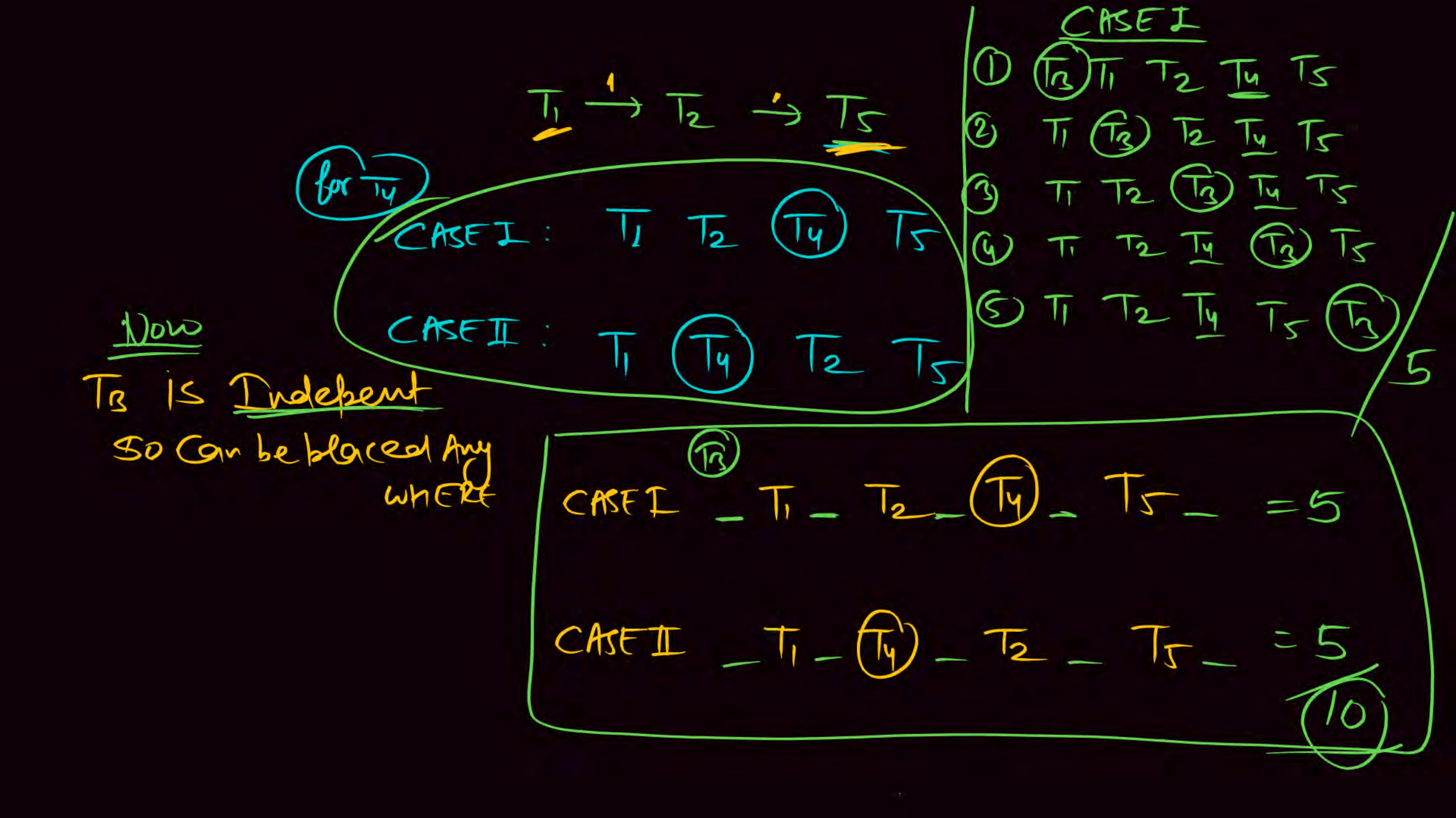
$W_1(B) - R_4(B)$: $T_1 \rightarrow T_4$

$W_2(C) - R_5(C)$: $T_2 \rightarrow T_5$

$W_4(E) - R_5(E)$: $T_4 \rightarrow T_5$

$T_1 \rightarrow T_2 \rightarrow T_5$

[comes] T_4 appear before T_5 & T_1 appear before T_4.


$T_1 \xrightarrow{1} T_2 \xrightarrow{1} T_5$
for T_4
CASE I : T_1 T_2 T_4 T_5
CASE II : T_1 T_4 T_2 T_5
Now
T_3 is Indepent
So Can be placed Any where
CASE I
① T_3 T_1 T_2 T_4 T_5
② T_1 T_3 T_2 T_4 T_5
③ T_1 T_2 T_3 T_4 T_5
④ T_1 T_2 T_4 T_3 T_5
⑤ T_1 T_2 T_4 T_5 T_3
5
T_3
CASE I _ T_1 _ T_2 _ T_4 _ T_5 _ = 5
CASE II _ T_1 _ T_4 _ T_2 _ T_5 _ = 5
10

Q.13

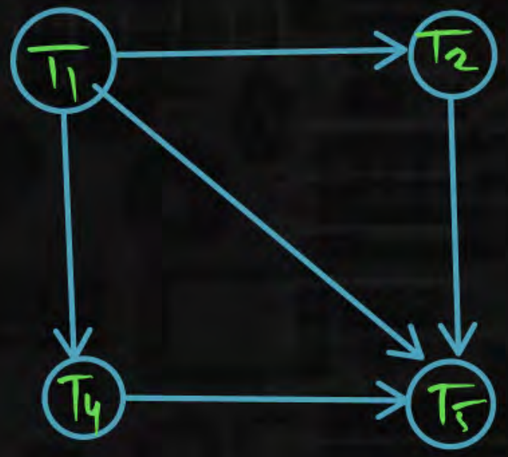
Consider the following schedule

$S = r_1(P); r_3(S); w_1(Q); r_2(Q)\ r_4(Q), w_2(R)$
$r_5(R); w_4(T); r_5(T); w_5(Q)$

How many serial schedules conflict equal to schedules(S)?

_____.

[NAT]



$T_1 - T_2 - T_4 - T_5 - = 5$

T_3 $- T_1 - T_4 - T_2 - T_5 - = 5$

10

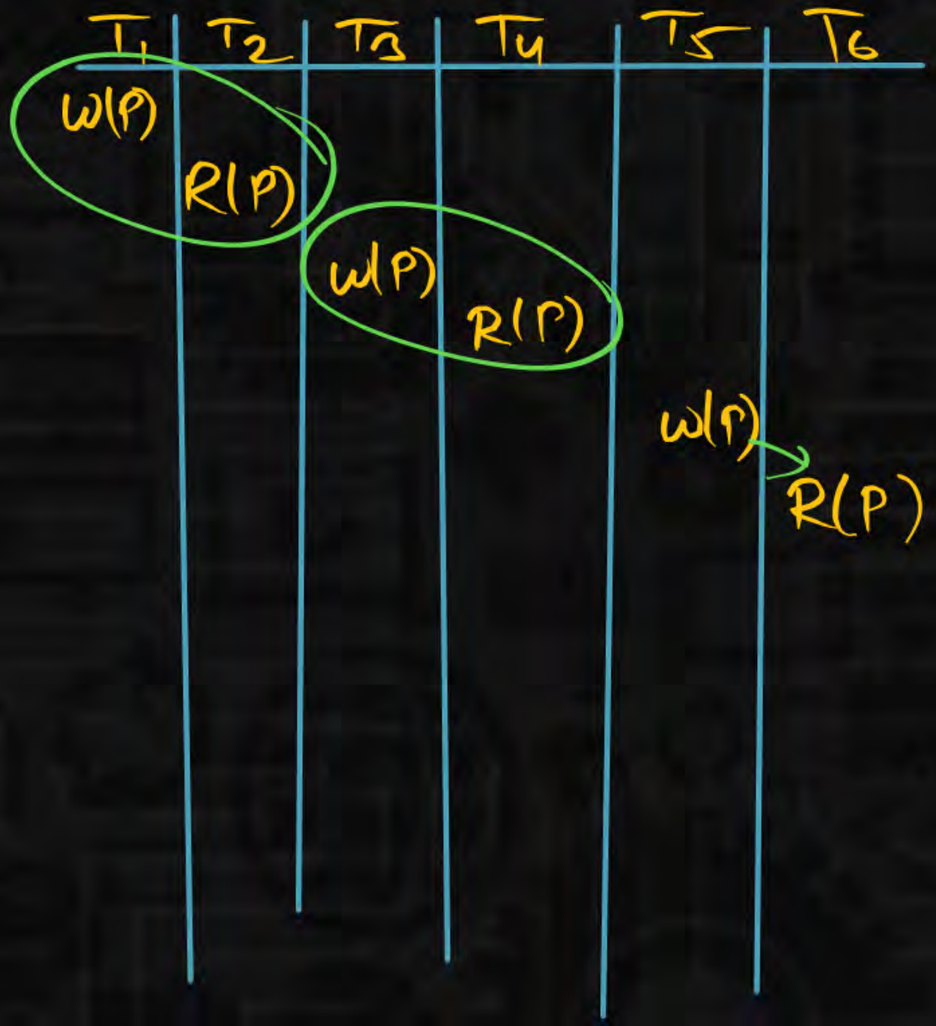
T_3 Indepent
Placed Anywhere.

Q.16 How many views equivalent serial schedules are possible for the given schedules below _____

S: $w_1(P)\ r_2(P)\ w_3(P)\ r_4(P) w_5(P)\ r_6(P)$

Final write T_5

[NAT]



Updated Read

$w_1(P) - r_2(P)$: $T_1 \rightarrow T_2$

$w_3(P) - r_4(P)$: $T_3 \rightarrow T_4$

$w_5(P) - r_6(P)$: $T_5 \rightarrow T_6$

$T_1\ T_2$ $T_3\ T_4$ $T_5\ T_6$ Fixed

$T_3\ T_4$ $T_1\ T_2$ $T_5\ T_6$

Q.17

The goal of concurrency control on database system is to [MCQ]

A. Only allow concurrent execution of transaction that correspond to serial execution of some of the transactions.

B. Allow only transactions that don't access common relationship to run concurrently.

C. Execute transactions serially.

D. None of the above.

Concurrent Equivalent $(T_1\ T_2)$

4! = 24 Serial

T_1

T_4

T_2 T_3

CASE I T_1 _ T_2 _ T_3 _ = 4

II _ T_2 _ T_1 _ T_3 _ = 4

III _ T_2 _ T_3 _ T_1 _ = 4

T_2

Q.25

Consider the following schedule –

S : $W_2(P); W_1(P); W_2(Q); W_3(P); W_1(Q); W_3(Q); C_1; C_2; C_3;$

Which of the following is/are correct?

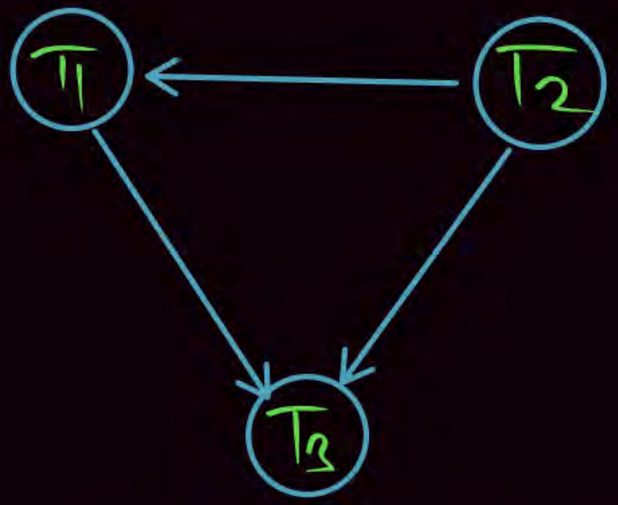
[MSQ]

A. S is not allowed by 2PL.

B. S is allowed by 2PL.

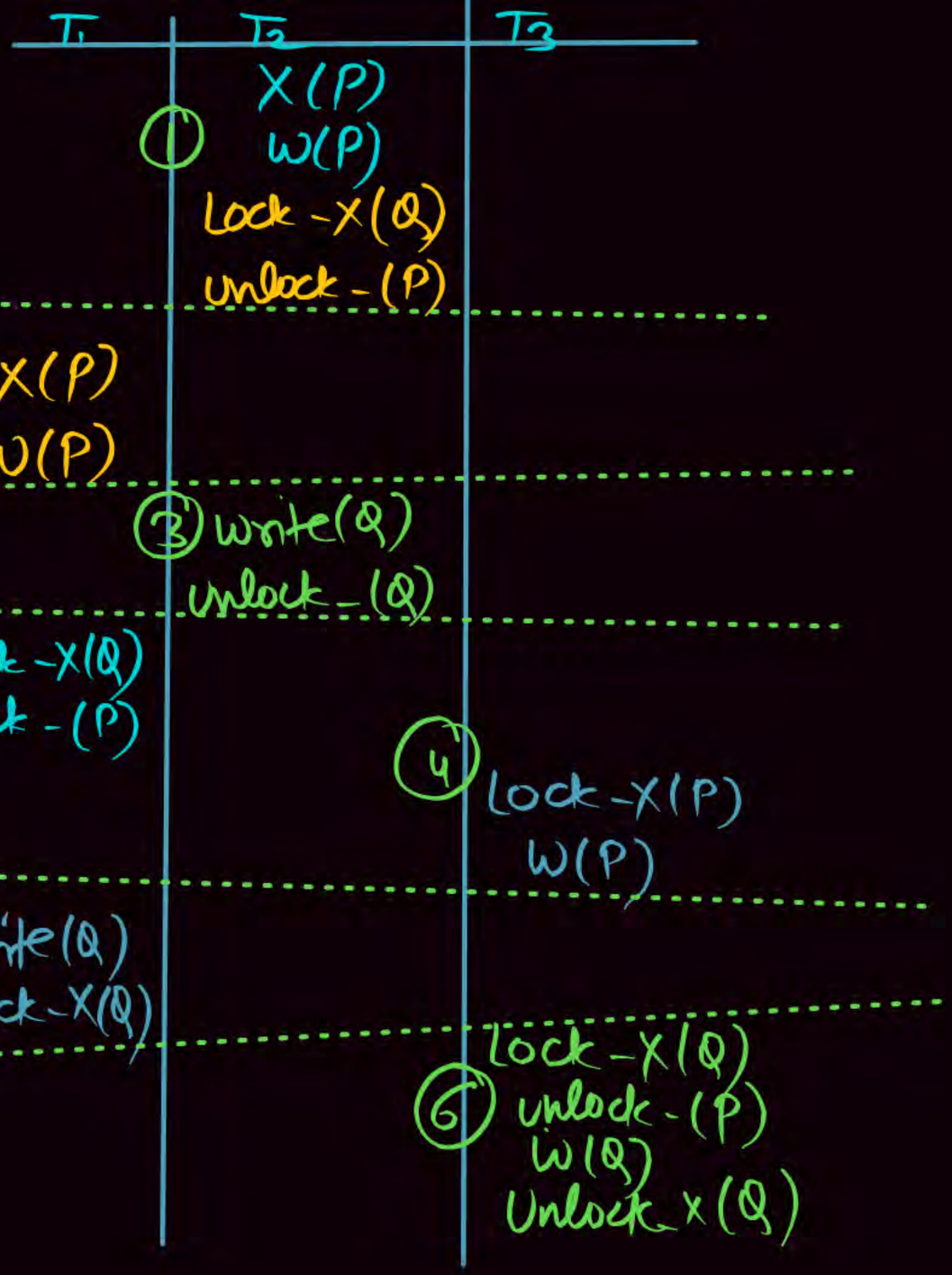
C. The equivalent serial schedule to S is $T_3 \rightarrow T_2 \rightarrow T_1$.

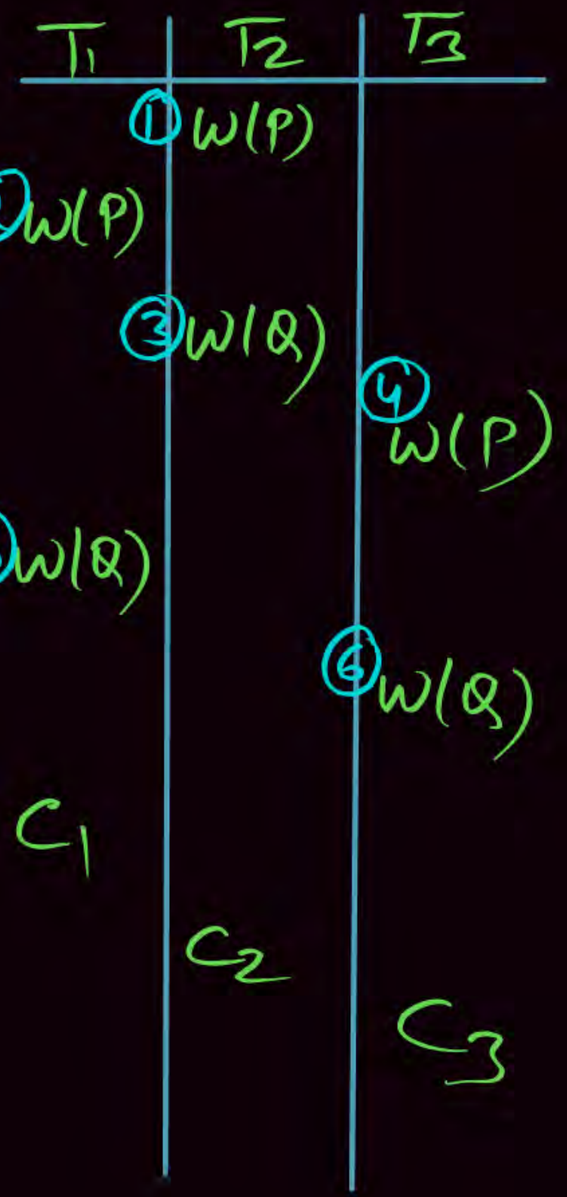
D. The equivalent serial schedule to S is $T_2 \rightarrow T_1 \rightarrow T_3$.



$\langle T_2\ T_1\ T_3 \rangle$

T_1	T_2	T_3
	W(P)	
W(P)		
	W(Q)	
		W(P)
W(Q)		
		W(Q)
C_1		
	C_2	
		C_3


T1
T2
T3
X(P)
1 W(P)
Lock-X(Q)
Unlock-(P)
2 X(P)
W(P)
3 write(Q)
Unlock-(Q)
Lock-X(Q)
Unlock-(P)
4 Lock-X(P)
W(P)
5 write(Q)
Unlock-X(Q)
Lock-X(Q)
6 unlock-(P)
W(Q)
Unlock-x(Q)


T1
T2
T3
1 W(P)
2 W(P)
3 W(Q)
4 W(P)
5 W(Q)
6 W(Q)
C1
C2
C3

Q.26 Consider the following schedule –

$S : W_2(P); W_1(P); W_3(P); W_2(Q); W_1(Q); W_3(Q); C_1; C_2; C_3;$

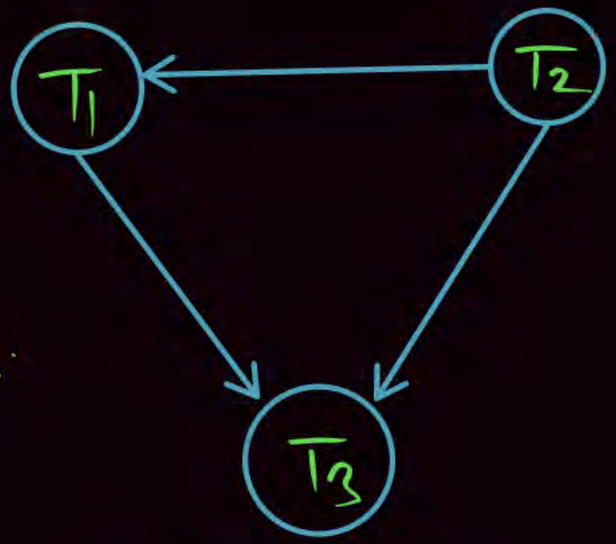
Which of the following is/are correct? **[MSQ]**

A. S is conflict serializable.

B. S is allowed by 2PL.

C. S is not allowed by 2PL.

D. Serial schedule equivalent to S is $T_2 \rightarrow T_1 \rightarrow T_3$.



Not cycle

Conflict

<T2 T1 T3>

T_1	T_2	T_3
	X(P)	
	W(P)	
	Lock-X(Q)	
	Unlock-X(P)	
Lock-X(P)		
Write(P)		
Lock-X(Q)		Lock-X(P) ← Denied by T_1
↓ Not Allocation T_2 T_2 acquire		
		Not

T_1	T_2	T_3
	W(P)	
W(P)		
		W(P)
	W(Q)	
W(Q)		
		W(Q)
C_1		
	C_2	
		C_3


THANK YOU GW
SOLDIERS !