Nitish Kumar Gupta
Course: GATE
Computer Science Engineering(CS)

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SINGLE SUBJECT : DATABASE (GATE - 2019) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(33) | CORRECT(10) | INCORRECT(13) | SKIPPED(10)

Q. 1

Consider R = (A, B, C, G, H, I) be a relation schema with the following dependencies:

$A \rightarrow B, A \rightarrow C, CG \rightarrow H, CG \rightarrow I, B \rightarrow H$

Which of the following is candidate key of R?

Solution Video | Have any Doubt ?

A AC

B AGH

C BCG

D AG — Your answer is **Correct**

Solution :
(d)

Find closure of each option:

$AC \rightarrow ACBH$

$AGH \rightarrow ABCGHI$

$AG \rightarrow ABCGHI$

Since AG is proper subset of AGH so AG is Candidate key.

QUESTION ANALYTICS +

Q. 2

Consider R(A, B, C, D E) be a relational schema with the following functional dependencies :

$F = \{A \rightarrow BC, CD \rightarrow E, B \rightarrow D, E \rightarrow A\}$

Which of the following is true for decomposition of *R* into (A, B, C) and (C, D, E)?

Solution Video | Have any Doubt ?

A Lossless Join and Dependency Preserving.

B Lossless Join but not Dependency Preserving.

C Lossly Join and Dependency Preserving. — Your answer is **Wrong**

D Neither Lossless Join Nor Dependency Preserving. — Correct Option

Solution :
(d)

$R_1 = \{A, B, C\}, R_2 = \{C, D, E\}$

- Since R_1 intersection R_2 = C and C is not a key for R_1 or R_2, the decomposition is not lossless join.
- $E \rightarrow A$ and $B \rightarrow D$ are lost, so it is not dependency preserving.

QUESTION ANALYTICS +

Q. 3

Consider the relation R(A, B, C, D) with the following set of functional dependencies:

$F = \{A \rightarrow D, AB \rightarrow C, AD \rightarrow C, B \rightarrow C, D \rightarrow A, D \rightarrow B\}$

Which of the following is true R?

Solution Video | Have any Doubt ?

A In 1NF but not in 2NF — Your answer is **Wrong**

B In 2NF but not in 3NF — Correct Option

Solution :
(b)

Candidate key: A, D,

So relation will be in 2NF but since $B \rightarrow C$ is non prime to non prime dependency which is not allow in 3NF.

C In 3NF but not in BCNF

D In In BCNF

QUESTION ANALYTICS +

Q. 4

Consider the relation R(A, B) in which {AB} is the primary key and the relation S (A, C) where A is the primary key. Assume there are no null values and no foreign keys or integrity constraints.

Query$_1$: Select A from R where A in (select A from S).
Query$_2$: Select A from S where A in (select A from R).
Which of the following option is correct related to following queries?

Solution Video | Have any Doubt ?

A Both queries will always give the same result. Your answer is **Wrong**

B Both queries will always give a different result.

C Both queries may give the same result. Correct Option

Solution :
(c)
For the same values (unique) for the column A in tables R and S. Query$_1$ and Query$_2$will give the same output.

D None of these

QUESTION ANALYTICS +

Q. 5

Consider the following schedule involving two transactions:

S_1 : r_1(A); w_1(A); w_2(B); w_3(C); r_1(D); w_2(D).

S_2 : r_3(A); w_4(B); r_1(C); r_3(D); w_3(B); w_2(D); r_3(A); w_1(D); r_3(B); r_2(C); r_1(A).

Which one of the following is true?

Solution Video | Have any Doubt ?

A Only S_1 is allowed under 2PL.

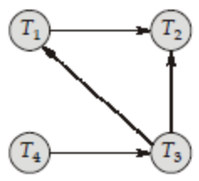
B Only S_2 is allowed under 2PL.

C Both S_1 and S_2 are allowed under 2PL. Your answer is **Correct**

Solution :
(c)
Check for S_1:

T_1	T_2	T_3
X(A)		
r(A)		
w(A)		
	X(B)	
	w(B)	X(C)
		w(C)
		u(C)
S(D)		
r(D)		
u(D)		
u(A)		
	X(D)	
	w(D)	
	u(D)	
	u(B)	

So S_1 is allowed under 2PL.
Check for S_2:
Making precedence graph:



No cycle in precedence graph.
S_2 is allowed under 2PL.

D Neither S_1 nor S_2 are allowed under 2PL.

QUESTION ANALYTICS +

Q. 6

Consider the following airline database schema:

Flights (flno, from, to, distance, departs)
Aircraft (aid, aname, range)
Certified (eid, aid)
Employees (eid, ename, salary)

According to schema pilots are those employees who are certified on at least one aircraft. An aircraft can be used for any flight provided it has sufficient range. Pilots can pilot any flight provided they are certified on an aircraft with sufficient range. Which of the following query represent "find flno of flights that can be piloted by every pilot whose salary is over $100000"?

Solution Video | Have any Doubt ?

A Π_{flno} (Flights) – Π_{flno} ((Π_{flno} (Flights) × Π_{eid} ($\sigma_{salary > 100000}$ (Employees ⋈ Certified))) – $\Pi_{flno, eid}$ ($\sigma_{range < distance}$ (Aircraft × Flights) ⋈ Certified))

B Π_{flno} (Flights) – Π_{flno} ((Π_{flno} (Flights) × Π_{eid} ($\sigma_{salary > 100000}$ (Employees ⋈ Certified))) – $\Pi_{flno, eid}$ ($\sigma_{range >= distance}$ (Aircraft × Flights) ⋈ Certified))

C $\Pi_{flno,e\ id}$ ($\Pi_{range >= distance}$ (Aircraft × Flights) ⋈ Certified) ÷ Π_{eid} ($\sigma_{salary > 100000}$ (Employees ⋈ Certified))

D Both (b) and (c) — Correct Option

Solution :
(d)
Option (a) represent flight number that can not be piloted by any pilot whose salary is over $100000, since aircraft can be used for any flight provided it has sufficient range but here range is less than sufficient distance.
Option (b) and (c) represent find flno of flights that can be piloted by every pilot whose salary is over $100000.

QUESTION ANALYTICS +

Q. 7

Which of the following statement(s) is/are true about "HAVING" and "WHERE" clause in SQL?
S_1 : "WHERE" is always used before "GROUP BY" and HAVING after "GROUP BY".
S_2 : "WHERE" is always used after "GROUP BY" and "HAVING" before "GROUP BY".
S_3 : "WHERE" is used to filter rows but "HAVING" is used to filter groups.
S_4 : "WHERE" is used to filter groups but "HAVING" is used to filter rows.

Solution Video | Have any Doubt ?

A S_1 and S_3 only — Your answer is **Correct**

Solution :
(a)
HAVING is performed after GROUP BY. If you have to apply some conditions to get results. We need to use WHERE before group by.

B S_1 and S_4 only

C S_2 and S_3 only

D S_2 and S_4 only

QUESTION ANALYTICS +

Q. 8

Consider the relation R has 40000 tuples and relation S has 60000 tuples. The block size is 150 tuples/block for both relations. These two relations have to be joined as per a specified join condition that needs to be evaluated for every pair of records from these two relations. The memory buffer space available can hold exactly one block of records for R and one block of records for S simultaneously at any point in time. No index is available on either relation. What is the optimal number of block transfers required in case of Nested Loop Join (NLJ)?

Solution Video | Have any Doubt ?

A 15960

B 16000000

C 16000267 — Correct Option

Solution :
(c)

$$\text{Number of tuples in R} = Nr = 40000$$
$$\text{Number of tuples in S} = Ns = 60000$$
$$\text{Block size} = 150 \text{ tuples/block}$$
$$\text{Number of blocks in R} = Br = \left\lceil \frac{40000}{150} \right\rceil = 267$$
$$\text{Number of blocks in S} = Bs = \left\lceil \frac{60000}{150} \right\rceil = 400$$

Optimality is achieved when the outer relation is smaller. Therefore, R is the outer relation.

$$\text{Number of block transfers in NLJ} = B_{(outer)} + N_{(outer)} \times B_{(inner)}$$
$$= 267 + 40000 \times 400$$
$$= 16000267$$

D 16020400

QUESTION ANALYTICS +

Q. 9

Which of the following is True?

Solution Video | Have any Doubt ?

A Schedules that are conflict serializable have to be produced by two phase locking. — Your answer is **Wrong**

B Schedules produced by two phase locking are guaranteed to prevent cascading aborts.

C Under multi granularity locking, locks should be acquired and released from the top level to the bottom level.

D Wound wait and wait die algorithms are pessimistic deadlock avoidance algorithms and can cause more transaction aborts than needed. — Correct Option

Solution :
(d)
• 2PL guarantee schedule will be conflict serializable but reverse is False.
• Strict 2PL schedule guarantee to prevent cascading aborts but not Basic 2PL, So false.
• Under multi granularity locking Locks are acquired top down, but released bottom up, so False.
• Wound wait and wait die algorithms are pessimistic deadlock avoidance algorithms and can cause more transaction aborts than needed, which is true.

QUESTION ANALYTICS +

Q. 10

Consider a relational database about hotels, customers (guests) and their bookings that is maintained by an online hotel booking company. The database consisting of the following tables
(where the primary keys are underlined):
Hotel (hId, hName, hAddress, hCity)
Guest (gId, gName, gAddress, gCity)
Room (hid, roomNo, type, price)
Booking (gId, hId, roomNo, fromDate, year, noofDays)
Which of the following TRC query represent "finds the ids and names of the hotels for which every one of our guests had made a booking during the year 2004"?

Solution Video | Have any Doubt ?

A $\{t \mid \exists h \in \text{Hotel}\ (t.hId = h.hId \wedge t.hName = h.hName \wedge \forall g \in \text{Guest}\ \exists b \in \text{Booking}\ (h.hId = b.hId \wedge b.year = 2004))\}$

B $\{t \mid \exists h \in \text{Hotel}\ (t.hId = h.hId \wedge t.hName = h.hName \wedge \forall g \in \text{Guest}\ \exists b \in \text{Booking}\ (h.hId = b.hId \wedge g.gId = b.gId \wedge b.year = 2004))\}$ — Correct Option

Solution :
(b)
Query (a) did not compare g.gId = b.gId which results unwanted tupple.
Query (b) results the ids and names of the hotels for which every one of our guests had made a booking during the year 2004.
Query (c) is gives wrong tuples in result.

C $\{t \mid \exists h \in \text{Hotel}\ (t.hId = h.hId \wedge t.hName = h.hName \wedge \exists b \in \text{Booking}\ \forall g \in \text{Guest}\ (h.hId = b.hId \wedge g.gId = b.gId \wedge b.year = 2004))\}$

D None of the above

QUESTION ANALYTICS

Q. 11

Consider the relation R(A, B, C, D, E) with the function dependencies:
$A \rightarrow B$, $B \rightarrow C$, $C \rightarrow A$, $D \rightarrow E$ and $E \rightarrow D$
The maximum possible super-keys of R is _____.

Solution Video | Have any Doubt ?

21 — Correct Option

Solution :
21
Candidate keys of R: AD, AE, BD, BE, CD and CE.
Every super-key must consist of at least one of {A, B, C} and {D, E} (since every key has at least one element of each). The number of super-keys is the number of ways to choose 1, 2, or 3 attributes from {A, B ,C} times the number of ways to choose 1 or 2 attributes from {D, E}.

$$\left(\binom{3}{1}+\binom{3}{2}+\binom{3}{3}\right)\cdot\left(\binom{2}{1}+\binom{2}{2}\right) = (3+3+1)\cdot(2+1) = 21$$

Your Answer is 16

QUESTION ANALYTICS

Q. 12

Consider the database with the block size is 1 K bytes, data record pointer is 5 bytes long, the value field is 10 bytes long and a block pointer is 7 bytes long, if the order of a leaf node in a tree B+ is defined as the maximum number of (value, data record pointer) pairs it can hold, then the order of the leaf node is _____.

Solution Video | Have any Doubt ?

67 — Your answer is **Correct**67

Solution :
67
Format of B+ tree leaf node:
P(Keys + Record pointer) + Block pointer ≤ block size

$$P(10 + 5) + 7 \leq 1024$$
$$P(15) + 7 \leq 1024$$
$$P(15) \leq 1024 - 7$$
$$P \leq \left\lfloor \frac{1017}{15} \right\rfloor$$
$$P = 67$$

QUESTION ANALYTICS

Q. 13

Consider the following database tables named "EXAM_RESULTS":

Student_ID	First_Name	Last_Name	Exam_ID	Exam_Score
10	Rohit	Singh	1	90
10	Mohit	Sharma	2	85
11	Samir	Gupta	1	78
11	Nisha	Sharma	2	72
12	Ritu	Krishna	3	95
12	Ritu	Krishna	2	92
13	Priya	Gupta	1	70
13	Priya	Gupta	2	100
14	Harvinder	Kaur	3	85

The number of rows returned by below SQL query _____.
SELECT EXAM_ID, COUNT(DISTINCT STUDENT_ID)
FROM EXAM_RESULTS

GROUP BY EXAM_ID;

Solution Video | Have any Doubt ?

3 — Correct Option

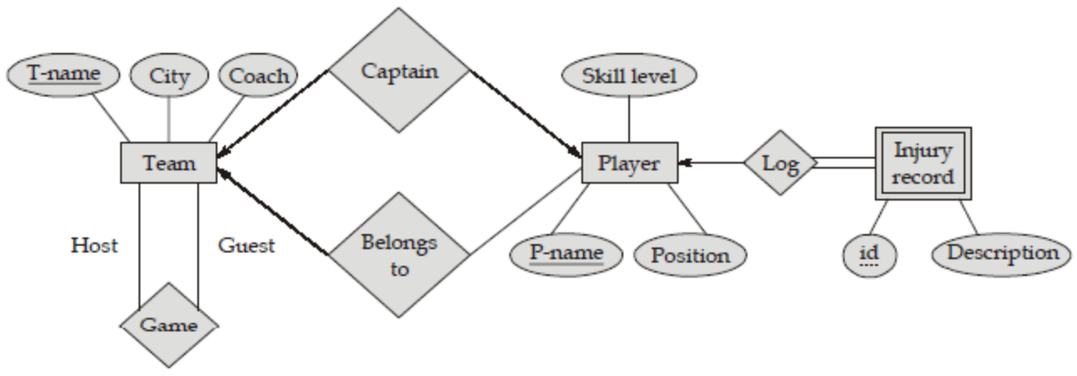
Solution :
3
The query will return "how many students took each exam" i.e. 3 rows (1, 3) (2, 4) and (3, 2).

Your Answer is 5

QUESTION ANALYTICS +

Q. 14

Consider the following ER-diagram for simple database for the National Hockey League given below:

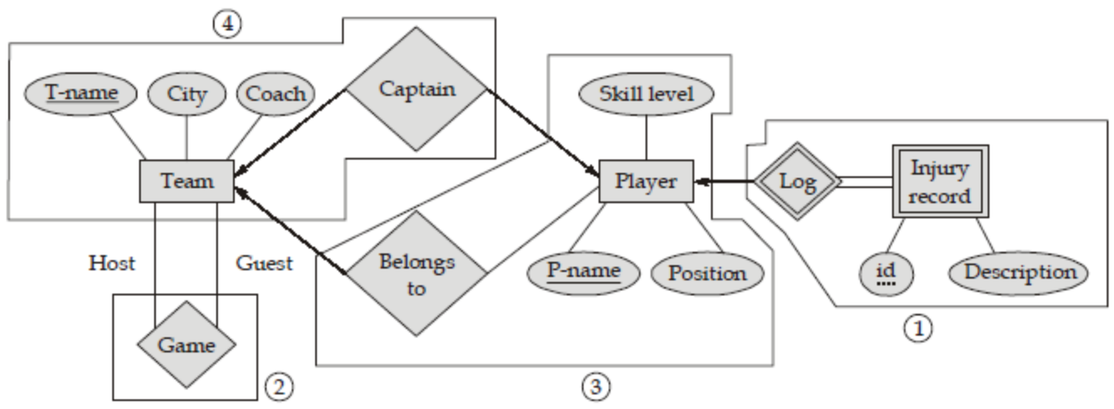


The minimum number of table required for database to be in 2NF is _____.

Solution Video | Have any Doubt ?

4 — Correct Option

Solution :
4



So, minimum 4 tables are required.

QUESTION ANALYTICS +

Q. 15

Consider the following Professor table with following tuples:

PName	Rating
Ramesh	8.7
Ram	9.7
Vinod	8.5
Kapil	9.8
Raju	8.7
Arjun	8.5

```
(SELECT *
FROM Professor P1
WHERE P1.Rating > ALL (SELECT Rating
                       FROM Professor P2
                       WHERE 5 > = (SELECT COUNT(*)
                                    FROM Professor P3
                                    WHERE P2.Rating < = P3.Rating)))
```

The number of rows result by above query is _____.

Solution Video | Have any Doubt ?

0 — Correct Option

Solution :
0
Outer query results Select Professors who have Rating > ALL(inner query).
None of tuple will satisfied the condition.

QUESTION ANALYTICS +

Q. 16

Consider the following relations:
R_1(P Q R) and R_2 (P, S, T)
R_1 has 1000 records and R_2 has 2000 records. The non-Null attribute 'P' in R_2 is referencing
attribute 'P' in R_1. Let X be minimum number of records in $R_1 \bowtie R_2$ and Y be the maximum number of records in $R_1 \bowtie R_2$. X + 2Y is _____.

Solution Video | Have any Doubt ?

6000 — Correct Option

Solution :
6000
Since 'P' in R_2 is not key, hence all value of 'P' may or may not be unique. Hence every entry under 'P' in R_2 will match with 'P' in R_1 because P in R_2 is FK referencing to P in R_1.
Hence maximum is 2000. But 'P' in R_2 is foreign key referencing 'P' in R_1.
Therefore minimum is also 2000.
$\therefore$ X = 2000

$$\therefore \quad X = 2000,$$
$$Y = 2000;$$
$$X + 2Y = 2000 + 4000 = 6000$$

Your Answer is 3000

QUESTION ANALYTICS

Q. 17

Consider two relations R and S have n and m tupples respectively. Match the following expression with maximum and minimum number of tupples as result:

Expression	Tupples
A. $R \cup S$	1. max = $n \times m$, min = 0
B. $R \bowtie S$	2. max = $n + m$, min = max (m, n)
C. $\sigma_C(R) \times S$	3. max = $m \times n$ min = 0
D. $\pi_A(R) - S$	4. max = n, min = 0

	A	B	C	D
(a)	1	2	3	4
(b)	2	1	3	4
(c)	2	3	1	4
(d)	3	2	1	4

Solution Video | Have any Doubt ?

A a

B b — Your answer is **Wrong**

C c — Correct Option

Solution :
(c)

A. $R \cup S$: maximum = $n + m$, minimum = max (m, n)

B. $R \bowtie S$: maximum = $m \times n$, minimum = 0
Maximum will be when both the tables have same attribute value then it will give $n \times m$ tuples.

C. $\sigma_C(R) \times S$: maximum = $n \times m$, minimum = 0

D. $\pi_A(R) - S$: maximum = n, minimum = 0

D d

QUESTION ANALYTICS

Q. 18

Which of the following relation schema with given functional dependency follows BCNF?

Solution Video | Have any Doubt ?

A R(A, B, C, D) with FD's AB → C, C → D and D → A.

B R(A, B, C, D) with FD's A → B, B → C, C → D and D → A. — Your answer is **Correct**

Solution :
(b)

1. R(A, B, C, D)
   AB → C, C → D, D → A
   Candidate Keys: AB, DB, CB
   Relation is in 1NF, 2NF and 3NF since on RHS all are prime attribute are present, but not in BCNF because AB → C and C → A violates the condition.
2. R(A, B, C, D)
   A → B, B → C, C → D, D → A
   Candidate keys: A, B, C, D
   Since all attributes are prime attribute and on LHS single attribute present. So in BCNF.
3. R(A, B, C, D, E)
   AB → C, C → D, D → B, D → E
   Candidate keys: AB, AD, AC
   Here D → E is partial dependency hence not in 2NF.
4. R(A, B, C, D)
   B → C, B → D
   Candidate key: AB
   Here B → C is partial dependency. Hence not in 2NF.

C R(A, B, C, D, E) with FD's AB → C, C → D, D → B and D → E.

D R(A, B, C, D) with FD's B → C and B → D.

QUESTION ANALYTICS

Q. 19

Consider the following relational schema:
Suppliers(sid: integer, sname: string, city: string, street: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)
Assume that relation corresponds to schema are not empty. Which of the following query "find the names of suppliers supplying some red part for less than 100 cost"?

Solution Video | Have any Doubt ?

A $\pi_{sname}(\sigma_{colour = red}(Part) \bowtie \sigma_{cost < 100}(Catalog) \bowtie Supplier)$

B $\pi_{sname}(\pi_{sid}(\sigma_{colour = red}(Part) \bowtie \sigma_{cost < 100}(Catalog)) \bowtie Supplier)$

C Both (a) and (b) Your answer is **Correct**

Solution :
(c)
Both query (a) and (b) represent the names of suppliers supplying some red part for less than 100 cost, but query2 is optimized variation of query1.

D None of these

QUESTION ANALYTICS +

Q. 20

Consider the schedules S_1 and S_2 given below:

$S_1 : r_1(X); r_2(Z); r_1(Z); r_3(X); r_3(Y); w_1(X); c_1; w_3(Y); c_3; r_2(Y); w_2(Z); w_2(Y); c_2;$

$S_2 : r_1(X); r_2(Z); r_1(Z); r_3(X); r_3(Y); w_1(X); w_3(Y); r_2(Y); w_2(Z); w_2(Y); c_1; c_2; c_3;$

$S_3 : r_1(X); r_2(Z); r_3(X); r_1(Z); r_2(Y); r_3(Y); w_1(X); c_1; w_2(Z); w_3(Y); w_2(Y); c_3; c_2;$

Which of the following is true about above schedules?

Solution Video | Have any Doubt ?

A S_1 is cascadeless and strict, S_2 is not recoverable and S_3 is cascadeless but not strict. Your answer is **Correct**

Solution :
(a)
In S_1, every transaction commits right after it writes some items. There is no write to or read from an item before the last transaction that wrote that item has committed. So S_1 is strict. And cascadeless too.
In S_2, T_2 reads item Y from T_3 but T_2 commits before T_3 commits. So S_2 is non-recoverable.
S_3 is not strict because T_2 writes Y before T_3 commits. But S_3 is cascadeless because there is no transaction reads items that were written by an uncommitted transaction.

B S_1 is cascadeless but not strict, S_2 and S_3 is strict.

C S_1 is cascadeless but not strict, S_2 is not recoverable and S_3 is cascadeless but not strict.

D S_1, S_2 and S_3 is strict.

QUESTION ANALYTICS +

Q. 21

The relation EMPLOYEE(Essn, Fname, Lname, sex, Salary), PROJECT(Pno, Pname, Dno) and WORKS_ON(Pno, Ssn) contains atleast one tupples.
Consider the following query:

```
SELECT Fname, Lname
FROM EMPLOYEE
WHERE NOT EXISTS ((SELECT Pno
                   FROM PROJECT
                   WHERE Dno = 5) EXCEPT (SELECT Pno
                                          FROM WORKS_ON
                                          WHERE Ssn = Essn));
```

Which of the following is true about above query?

Solution Video | Have any Doubt ?

A Find the name of each employee who does not works on all the projects controlled by department number 5.

B Find the name of each employee who works on any project controlled by department number 5.

C Find the name of each employee who works on all the projects controlled by department number 5. Correct Option

Solution :
(c)
The first subquery (which is not correlated with the outer query) selects all projects controlled by department 5, and the second subquery (which is correlated) selects all projects that the particular employee being considered works on.
If the set difference of the first subquery result MINUS (EXCEPT) the second subquery result is empty, it means that the employee works on all the projects and is therefore selected.

D Find the name of each employee who works on atleast one project controlled by department number 5.

QUESTION ANALYTICS +

Q. 22

Consider a database with the following relation:

Shipping (ShipName, ShipType, TripId, Cargo, Port, Date)
With the following functional dependencies:
ShipName → ShipType
TripId → ShipName, Cargo
ShipName, Date → TripId, Port
If the database is re-designed with following schemas:
R_1 (ShipName, ShipType)
R_2 (TripId, ShipName, Cargo)
R_3 (ShipName, Date, TripId, Port)

What is the strongest normal form that the new database satisfies?

Solution Video | Have any Doubt ?

A 1 NF

B 2 NF

C 3 NF

D BCNF — Correct Option

Solution :
(d)
Functional dependencies of re-designed schemas:

R_1 (ShipName, ShipType)	{ShipName → ShipType}
R_2 (TripId, ShipName, Cargo)	{TripId → ShipName, Cargo}
R_3 (ShipName, Date, TripId, Port)	{ShipName, Date → TripId, Port}

All R_1, R_2 and R_3 are in BCNF.

QUESTION ANALYTICS +

Q. 23

Consider a database that has a relation schema:
student (rollNo, name, degree, year, sex, deptNo, advisor)
course (courseId, cname, credits, deptNo)
enrollment (rollNo, courseId, sem, year, grade)
Assume that every student is enrolled in at least one course, then which of the following query "Retrieve the names of students who have scored 'A' in all subjects they have enrolled"?

Solution Video | Have any Doubt ?

A $\{s.name \mid student(s) \wedge (\forall e)\ ((enrollment(e) \vee e.rollNo = s.rollNo) \rightarrow e.grade = 'A')\}$

B $\{s.name \mid student(s) \wedge (\forall e)\ ((enrollment(e) \wedge e.rollNo = s.rollNo) \rightarrow e.grade = 'A')\}$ — Your answer is **Correct**

Solution :
(b)
In option (b)
When Student e with all A grade, for enrollment tuples not having her roll number, LHS is false.
For enrollment tuples having her/his roll number, LHS is true, RHS also true so the implication is true for all e tuples.
When Student e with some non-S grades, for enrollment tuples not having her roll number, LHS is false.
For enrollment tuples having her roll number, LHS is true, but RHS is false for at least one tupple.

C $\{s.name \mid student(s) \wedge (\exists e)\ ((enrollment(e) \wedge e.rollNo = s.rollNo) \rightarrow e.grade = 'A')\}$

D $\{s.name \mid student(s) \wedge (\exists e)\ ((enrollment(e) \vee e.rollNo = s.rollNo) \rightarrow e.grade = 'A')\}$

QUESTION ANALYTICS +

Q. 24

Consider relation schema R(A, B, C, D) and the two sets of functional dependencies:
$H = \{A \rightarrow B, B \rightarrow A, AB \rightarrow C, AC \rightarrow D, B \rightarrow C\}$
$G = \{CA \rightarrow B, BA \rightarrow D, B \rightarrow D, DB \rightarrow C\}$
Which of the following is true?

Solution Video | Have any Doubt ?

A G covers H

B H covers G — Your answer is **Correct**

Solution :
(b)
Check G covers H:
1. $A \rightarrow B$ cannot be derived from G which is present in H, So G not covers H.

Check H covers G:
1. $CA \rightarrow B$ can be derived from H i.e. $A \rightarrow B$ then $CA \rightarrow CB$.
2. $BA \rightarrow D$ can be derived from H i.e. $A \rightarrow B$, $B \rightarrow AC$, $AC \rightarrow D$ then $B \rightarrow D$ and $AB \rightarrow D$.
3. $B \rightarrow D$ can be derived from H i.e. $A \rightarrow B$, $B \rightarrow AC$, $AC \rightarrow D$ then $B \rightarrow D$.
4. $DB \rightarrow C$ can be derived from H i.e. $B \rightarrow C$ then $DB \rightarrow DC$.

Hence H covers G.

C H and G are equivalent

D Neither H covers G not vice versa

QUESTION ANALYTICS +

Q. 25

Which of the following statement is true?

Solution Video | Have any Doubt ?

A A secondary index should be sparse.

B A second level index should be Dense. — Your answer is **Wrong**

C For queries of the form $\sigma_{A=a}(R)$ hashing is usually better than a B+ tree. — Correct Option

Solution :
(c)
• A secondary index has to be dense since the file is not organized according to a secondary index. Otherwise, the index structure does not allow to

find all values directly.
• If it were dense, we would have the same number of entries in the second level as in the first level index which defeats the purpose of the second level index.
• Yes, since we can directly access the record.
• Hashing does not support range queries since a hash function needs a specific key value
(whereas we don't know the values of A given just A > a).

D For queries of the form $\sigma_{A > a}$ (R) hashing is usually better than a B+ tree.

QUESTION ANALYTICS +

Q. 26

Consider the following relational schema:
Student (Sid: integer, Sname: string, address: string)
Course (Cid: integers, Cname: string, branch: string)
Enrols (Sid: integers, Cid: integer, employee: integer)
Which of the following queries are equivalent to this query in English? "Find the Sid of students who are enrolled in some courses of 'CS' branch and some courses of 'IT' branch".

1. $\rho(R_1, \pi_{sid}(\pi_{cid}(\sigma_{branch = 'CS'}(Course)) \bowtie Enrols))$
   $\rho(R_2, \pi_{sid}(\pi_{cid}(\sigma_{branch = 'IT'}(Course)) \bowtie Enrols))$
   $R_1 \cap R_2$
2. $\{T \mid \exists T_1 \in enrols\ (\exists x \in courses\ (x.branch = 'CS' \wedge x.cid = T_1.cid) \wedge \exists T_2 \in Enrols\ (\exists y \in courses\ (y.branch = 'IT' \wedge y.cid = T_2.cid) \wedge T_2.sid = T_1.sid) \wedge T.sid = T_1.sid)\}$
3. Select Sid
   From courses P, Enrols C
   where P.branch='CS' AND P.cid = C.cid AND EXISTS (Select Sid
   From courses P2, Enrol C2
   where P2.branch = 'IT' AND C2.sid = C.sid
   AND P2.cid = C2.cid)

Solution Video | Have any Doubt ?

A Only 1 and 2

B Only 3 and 4

C Only 2 and 3

D All of the above — Correct Option

Solution :
(d)

1. $\rho(R_1, \pi_{sid}(\pi_{cid}(\sigma_{branch = 'CS'}(Course)) \bowtie Enrols))$
   $\rho(R_2, \pi_{sid}(\pi_{cid}(\sigma_{branch = 'IT'}(Course)) \bowtie Enrols))$
   $R_1 \cap R_2$
   Find the Sid who enrolled atleast one course of CS branch then find the Sid who enrolled atleast one course of IT branch. Then take inter-section both Sid.
2. $\{T \mid \exists T_1 \in enrols\ (\exists x \in courses\ (x.branch = 'CS' \wedge x.cid = T_1.cid) \wedge \exists T_2 \in Enrols\ (\exists y \in courses\ (y.branch = 'IT' \wedge y.cid = T_2.cid) \wedge T_2.sid = T_1.sid) \wedge T.sid = T_1.sid)\}$
   Find the Sid who enrolled atleast one course of CS branch then find the Sid who enrolled atleast one course of IT branch with same Sid. Then return Sid.
3. Select Sid
   From courses P, Enrols C
   where P.branch = 'CS' AND P.cid = C.cid AND EXISTS (Select Sid
   From courses P2, Enrol C2
   where P2.branch = 'IT' AND C2.sid = C.sid
   AND P2.cid = C2.cid)
   Find the Sid who enrolled atleast one course of CS branch then find the same Sid enrolled for atleast one course of IT branch and return it.

QUESTION ANALYTICS +

Q. 27

Consider the following database table:
Supplier (Sid, Sname, rating)
Parts (Pid, Pname, color)
Catalog (Sid Pid, cost)
Which of the following SQL query correct representation to retrieve Sid's who supplied every white part.

Q_1 : Select Sid
from Catalog
where Pid = ALL (Select Pid
from Parts
Where color = 'White')

Q_2 : Select Sid
from Catalog T1
Where EXISTS (Select Pid
from Parts
where color = 'White'
EXCEPT
Select Pid
from Catalog T_2
where T_1.Sid = T_2.Sid)

Solution Video | Have any Doubt ?

A Only Q_1

B Only Q_2

C Neither Q_1 nor Q_2 — Correct Option

Solution :
(c)
Q_1: Fails if two or more white parts.
If two or more white parts then (= ALL) false for every records

Q_2: Retrieves Sid who not enrolled every white part.
So both Q_1 and Q_2 is incorrect.

D Both Q_1 and Q_2 — Your answer is **Wrong**

QUESTION ANALYTICS +

Q. 28

Consider the following database table:

Emp (Eid, Ename, age)
Project (Pid, Pname, budget)
Works for (Eid Pid)

```
Select Eid
From Emp E
where age > 30 and not Exists   (select Pid
                                 From project P
                                 where Pname = 'database' and not exist (select Pid
                                                                         from works W
                                                                         where W.Eid = E.Eid
                                                                         and W.Pid = P.Pid))
```

Which of the following sets is computed by the above query retrieves employees whose

Solution Video | Have any Doubt ?

A Age more than 30 and works for every project with project name database. — Correct Option

Solution :
(a)

```
Select Eid    ⇐ employee age max than 30
From Emp E
where age > 30 and
      not Exists  (select Pid     ⇐ all the project id whose project name is database
                   From project P
                   where Pname = 'database' and
                         not exist (select Pid ⇐ the P.id where Eid is not in work relation
                                    from works W
                                    where W.Eid = E.Eid
                                    and W.Pid = P.Pid))
```

B Age more than 30 and works for some project with project name database.

C Age more than 30 and not works for every project with project name database.

D Age more than 30 and not works for any project with project name database. — Your answer is **Wrong**

QUESTION ANALYTICS +

Q. 29

Consider that blocks can hold either ten records or 99 keys and 100 pointers. Assume that the average B+ tree node is atleast 70% full, i.e. except root it will have 69 keys and 70 pointers. The total number of blocks needed for a 10000, record file, if memory initially is empty, the search key is the primary key for the records and the data file is a sequential file, sorted on the search key, with 10 records per block with dense index are _____.

Solution Video | Have any Doubt ?

1147 — Correct Option

Solution :
1147

$$\boxed{10000 \text{ records}} \left\lfloor \frac{10000}{69} \right\rfloor = 144$$

$$\text{The next level of the } B^+ \text{ tree requires} = \left\lfloor \frac{144}{70} \right\rfloor$$

$$= \text{ceil}(2.04) = 2 \text{ blocks}$$

$$\text{Next level} = \left\lfloor \frac{2}{70} \right\rfloor = 1 \text{ blocks}$$

The number of blocks needed is therefore 1000 + 144 + 2 + 1 = 1147 blocks.

QUESTION ANALYTICS +

Q. 30

Consider a disk with block size 512 bytes, pointer is P = 6 bytes long. A file has R = 300000 EMPLOYEE records of fixed-length. Each record has the following fields:

Field Name	Size (in Bytes)
NAME	30
SSN	9
DEPARTMENT CODE	9
ADDRESS	40
PHONE	9
BIRTHDATE	8
SEX	1
JOBCODE	4
SALARY	4

An additional byte is used as a deletion marker. Suppose the file is ordered by the key field SSN and we want to construct a primary index on SSN. The number of levels needed if we make it into a multi-level index is _____.

Solution Video | Have any Doubt ?

3 — Correct Option

Solution :
3

$$\text{Record length } R = (30 + 9 + 9 + 40 + 9 + 8 + 1 + 4 + 4) + 1 = 115 \text{ bytes}$$

$$\text{Blocking factor bf} = \text{Floor } (B/R) = \text{Floor } \left(\frac{512}{115}\right) = 4 \text{ records per block}$$

$$\text{Number of blocks needed for file} = \text{Ceiling}(r/bf) = \text{Ceiling } \left(\frac{30000}{4}\right) = 7500$$

$$\text{Index entry size} = (\text{VSSN} + P) = (9 + 6) = 15 \text{ bytes}$$

$$\text{Index blocking factor} = \text{floor } (B/\text{Index record size}) = \text{floor } \left(\frac{512}{15}\right) = 34$$

Number of first-level index entries R1 = Number of file blocks b = 7500 entries
Number of first-level index blocks B1 = Ceiling(R1/Index blocking factor)

$$= \text{Ceiling } \left(\frac{7500}{34}\right) = 221 \text{ blocks}$$

Number of second-level index entries R2 = Number of first-level blocks B1 = 221 entries
Number of second-level index blocks B2 = Ceiling(R2/Index blocking factor)

$$= \text{Ceiling } \left(\frac{221}{34}\right) = 7 \text{ blocks}$$

Number of third-level index entries R3 = Number of second-level index blocks B2 = 7 entries
Number of third-level index blocks B3 = Ceiling(R3/Index blocking factor)

$$= \text{Ceiling } \left(\frac{7}{34}\right) = 1$$

Since the third level has only one block, it is the top index level.
So 3 levels are required.

Your Answer is 4

QUESTION ANALYTICS

Q. 31

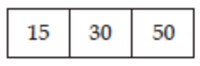
The following key values are inserted into a B+- tree in which order of the internal nodes is 4, and that of the leaf nodes is 3, in the sequence given below. The order of internal nodes is the maximum number of tree pointers in each node and the order of leaf nodes is the maximum number of data items that can be stored in it. The B+-tree is initially empty 50, 15, 30, 40, 35, 20, 8, 10, 5.
The maximum number of times nodes would get split up as a result of these insertions is _____.

Solution Video | Have any Doubt ?

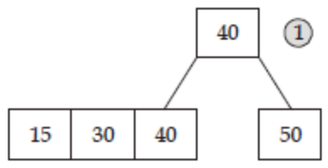
8 — Correct Option

Solution :
8

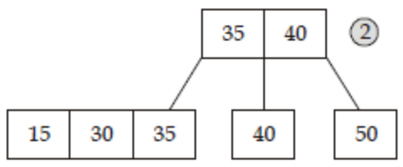
1. On insertion of 50, 15, 30



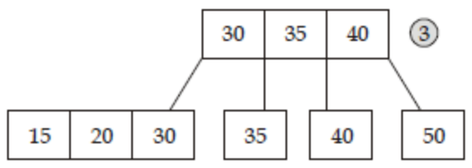
2. On insertion 40



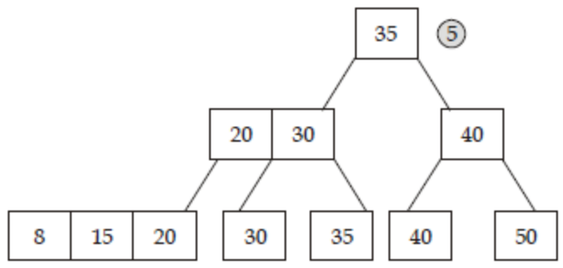
3. On insertion 35



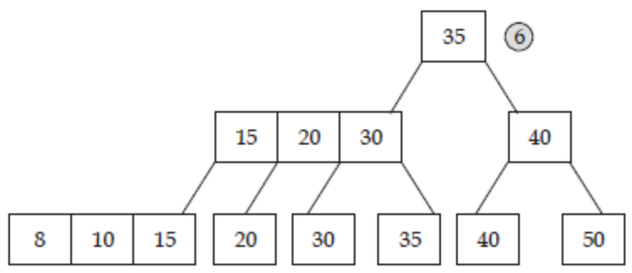
4. On insertion 20



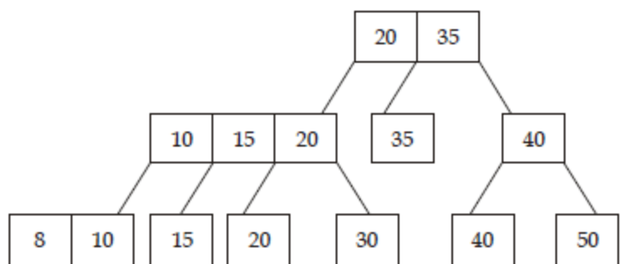
5. On insertion 8



6. On insertion 10



7. On insertion 5
   Two more times nodes going to split.
   So 6 + 2 = 8 times



Your Answer is 3

QUESTION ANALYTICS

Q. 32

Consider the following schema:
Suppliers(sid: integer, sname: string, address: string)
Parts(pid: integer, pname: string, color: string)
Catalog(sid: integer, pid: integer, cost: real)
Here key fields are underlined, and the domain of each field is listed after the field name. Therefore sid is the key for Suppliers, pid is the key for Parts, and sid and pid together form the key for Catalog. The Catalog relation lists the prices charged for parts by Suppliers. Consider the table for Part and Catalog given below:

Catalog

SID	PID	Cost
1	1	20
1	2	30
1	3	10
2	5	60
2	4	70
3	5	20
3	3	10
4	3	15

Part

PID	Pname	Color
1	P_1	Red
2	P_2	Red
3	P_3	Green
4	P_4	Blue
5	P_5	Red

The number of tuples result by given query is _____.

```
SELECT DISTINCT C.sid
FROM Parts P, Catalog C
WHERE P.color = 'red' AND P.pid = C.pid AND EXISTS (SELECT P2.pid
                                                    FROM Parts P2, Catalog C2
                                                    WHERE P2.color = 'green' AND
                                                    C2.sid = C.sid AND P2.pid = C2.pid)
```

Solution Video | Have any Doubt ?

2 — Correct Option

Solution :
2
The given query result "the sids of suppliers who supply some red part and some green part". So the out tuples are sid 1 and sid 3.

QUESTION ANALYTICS

Q. 33

Consider the transaction T_1 and T_2 given below:
$T_1 : R_1(A)\ W_1(A)\ R_1(B)\ W_1(B)$
$T_2 : R_2(A)\ W_2(A)\ R_2(B)\ W_2(B)$
Where Ri(Z) represent the read operation by Transaction Ti on variable Z and Wi(Z) represent the write operation by Transaction Ti on variable Z. The total number of possible conflict serializable schedules formed by T_1 and T_2 are _____.

Solution Video | Have any Doubt ?

12 — Your answer is **Correct**12

Solution :
12

Conflict-equivalent to $T_1 \rightarrow T_2$:

Remaining 4 transactions can be arranged in any possible order.

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

Number of possibilities: $\frac{4!}{2! \times 2!} = 6$

Conflict-equivalent to $T_2 \rightarrow T_1$:

Remaining 4 transactions can be arranged in any possible order.

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

Number of possibilities: $\frac{4!}{2! \times 2!} = 6$

Total number of possibilities 6 + 6 = 12.

QUESTION ANALYTICS