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Course: GATE
Computer Science Engineering(CS)

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TOPICWISE : DATABASES-1 (GATE - 2019) - REPORTS

OVERALL ANALYSIS | COMPARISON REPORT | SOLUTION REPORT

ALL(17) | CORRECT(9) | INCORRECT(5) | SKIPPED(3)

Q. 1

A student can take one or more courses and courses can be offered to any number of students.Which of the following represents given scenario in ER-model?

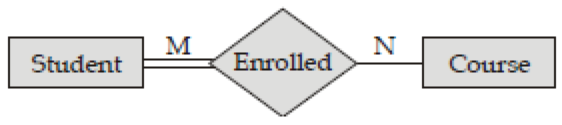
FAQ | Solution Video | Have any Doubt ?

A

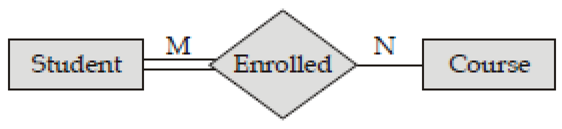

B


Correct Option

Solution :
(b)
A student can enroll one or more course.



A course can be enrolled by one or more students.



Option (b) is correct. It is a many to many relation with total participation at one end.

C


Your answer is **Wrong**

D


QUESTION ANALYTICS +

Q. 2

Consider relation R(A, B, C, D, E, F, G) with the following functional dependencies AB → CD,D → B, AF → D, DE → F, C → G, F → E and G → A. What is the highest normal form?

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A 1NF — Your answer is **Wrong**

B 2NF

C 3NF — Correct Option

Solution :
(c)
Candidate keys: ABE, BEG, BCE, AF, FG, ADE etc. since all attribute are prime attribute. So, neither (prime → non-prime) nor (non-prime → non-prime) possible, so relation is always in 2NF as well as in 3NF. But since (candidate → anything), not present, so not in BCNF and highest normal form is 3NF.

D 4NF

QUESTION ANALYTICS +

Q. 3

Let R_1 (P, Q, R) and R_2 (S, T) be two relation schema, where the primary keys are shown underlined,and let R be a foreign key in R_1 referring R_2. Which one of the following relational algebra expressions would necessary produce an empty relation ?

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A $\pi_R(R_1) - \pi_S(R_2)$ — Your answer is **Correct**

Solution :
(a)
As R_1 is referring to R_2 and S is primary key of R_2, $\pi_R(R_1) - \pi_S(R_2)$ will give empty relation or empty table as number of values in R column of table R_1 will always refer from respective values in S column of R_2.

B $\pi_S(R_2) - \pi_R(R_1)$

C $\pi_S(R_1 \bowtie_{R \neq S} R_2)$

D $\pi_R(R_1 \bowtie_{R \neq S} R_2)$

QUESTION ANALYTICS +

Q. 4

Which of the following statement is false?

Solution Video | Have any Doubt ?

A. Relation with every attribute is prime always in 3NF

B. Relation with every candidate key simple always in 2NF.

C. Relation with every attribute is prime always in BCNF. Your answer is **Correct**

Solution :
(c)

- If every attribute is prime then (partial key → non key) and (non key → non key) is not possible. So, relation is always in 2NF as well as in 3NF.
- If every candidate key is simple (having exactly 1 attribute), then (partial key → non key) not possible. Hence, relation is in 2NF.
- Assume a relation R (ABC) with following functional dependencies:
  R (ABC)
  $\{AB \to C, C \to A\}$
  Candidate keys are AB and BC
  $AB \to C$ is in BCNF but $C \to A$ not in BCNF.

D. Relation R which satisfy 3NF and atmost one compound candidate key is also in BCNF.

QUESTION ANALYTICS +

Q. 5

Consider a schema R(A, B, C, D, E, F) and functional dependencies:
AB → C, AC → B, AD → E, B → D, BC → A, E → F
Then the decomposition of R into R_1 (ABC), R_2(ABDE) and R_3(EF) is

Solution Video | Have any Doubt ?

A. Dependency preserving and lossless join. Your answer is **Correct**

Solution :
(a)

R(A, B, C, D, E, F)
AB → C, AC → B, AD → E, B → D, BC → A, E → F

R_1(ABC)	R_2(ABDE)	R_3(EF)
AB → C	AD → E	E → F
BC → A	B → D	
AC → B		

Relation is dependency preserving since no dependencies is lost, also lossless decomposition because $R_1 \cap R_2$ = AB is candidate key of R_1, then $R_1R_2 \cap R_3$ = E is candidate key of R_3.

B. Dependency preserving but lossy join.

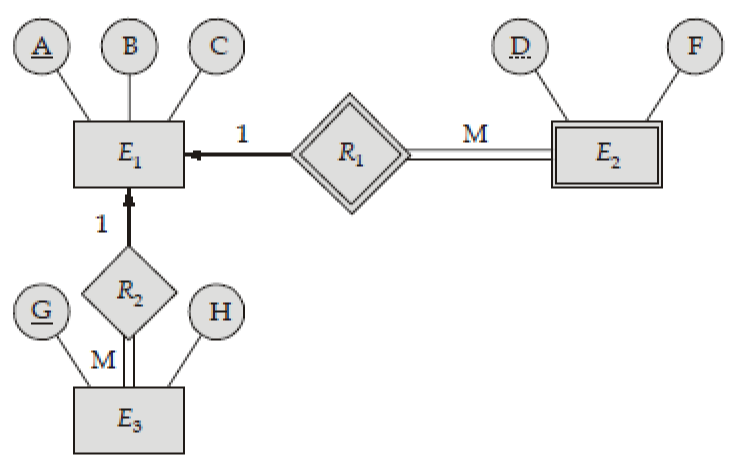
C. Not dependency preserving but lossless join.

D. Neither dependency preserving nor lossless.

QUESTION ANALYTICS +

Q. 6

Consider the following ER-diagram:

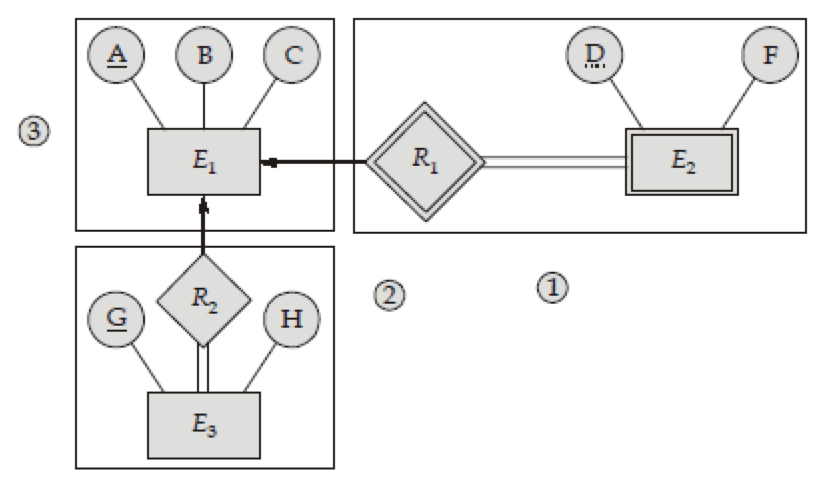


The minimum number of tables needed to represent E_1, E_2 and E_3 are ________.

FAQ | Solution Video | Have any Doubt ?

3 Your answer is **Correct**3

Solution :
3



R_1(A, B, C, G), R_2(G, H), R_3(D, F, A)
Only 3 tables are required.

QUESTION ANALYTICS +

Q. 7

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

$AC \to G$, $D \to EG$, $BC \to D$, $CG \to BD$, $ACD \to B$, $CE \to AG$

The number of different minimal cover possible are ________.

Solution Video | Have any Doubt ?

4 — Correct Option

Solution :
4

Given relation: R(A, B, C, D, E, F, G, H)

$AC \to G$, $D \to EG$, $BC \to D$, $CG \to BD$, $ACD \to B$, $CE \to AG$

Since, $(AC)^+ = ABCD$

So, $ACD \to B$, here D is extraneous.

Minimal cover:

1. $\{AC \to G, D \to EG, BC \to D, CG \to B, CE \to AF\}$
2. $\{AC \to G, D \to EG, BC \to D, CG \to D, CE \to AF\}$
3. $\{AC \to B, D \to EG, BC \to D, CG \to D, CE \to AF\}$
4. $\{AC \to B, D \to EG, BC \to D, CG \to B, CE \to AF\}$

Total 4 minimal cover.

QUESTION ANALYTICS +

Q. 8

Consider a relation $R(A, B, C, D, E)$ with the following functional dependencies:

$A \to BC$
$C \to E$
$B \to D$
$E \to A$

The total number of super keys present in the relation are _______.

FAQ | Solution Video | Have any Doubt ?

28 — Correct Option

Solution :
28

Candidate keys: $A^+ = \{A, B, C, D, E\}$

If A is a candidate key, then E will also be the candidate key, similarly C is also the candidate key.

A + {Any combination of B, C, D, E} = 2^4

+

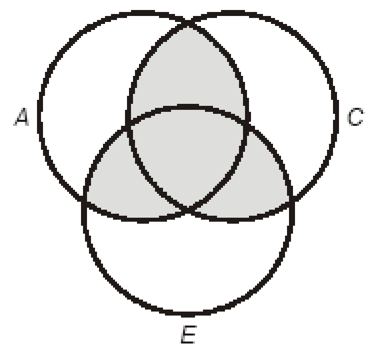
E + {Any combination of A, B, C, D} = 2^4

+

C + {Any combination of A, B, D, E} = 2^4

–

Common key



$$2^4 + 2^4 + 2^4 - 3 \times 2^3 + 2^2$$
$$= 3[2^4 - 2^3] + 2^2$$
$$= 24 + 4 = 28$$

Your Answer is 10

QUESTION ANALYTICS +

Q. 9

Consider the instances of relational schema for relation Employee and Dependent:

Employee

Eid	Ename	Eage
1	Vamshi	30
2	Gangesh	32
3	Rahul	28
4	Vartika	30
5	Rahul	30

Dependent

Did	Deid	Dname	Dage
D_1	1	CS	30
D_2	2	EC	31
D_3	4	EE	32
D_2	2	CE	30
D_4	3	IN	19

The following is the query made on the database:

$$\pi_{Eid}(\text{Employee}) - \pi_{Eid}(\text{Employee} \bowtie_{(Eid = Deid) \wedge (Dage \le Eage)} (\text{Dependent}))$$

The number of tuples in output are ________.

Solution Video | Have any Doubt ?

2 — Your answer is **Correct**2

Solution :
2

I. $\pi_{Eid}(\text{Employee}) = \{1, 2, 3, 4, 5\}$

II. $\pi_{Eid}(\text{Employee} \bowtie_{(Eid = Deid) \wedge (Dage \le Eage)} (\text{Dependent}))$ results employee id whose age is greater than equal to his/her dependent i.e. 1, 2, 3.

So, I – II = {1, 2, 3, 4, 5} – {1, 2, 3} = {4, 5}

QUESTION ANALYTICS +

Q. 10

Consider relation 'R' and 'S' have 'n' and 'm' tuples, respectively. Choose the best matching between List-I (Expression) and List-II (Maximum number of tuple):

List-I	List-II
P. $R \cup S$	1. n
Q. $R \cap S$	2. $m \times n$
R. $\sigma_C(R) \times S$	3. $\min(m, n)$
S. $\pi_L(R) - S$	4. $n + m$

Codes:

	P	Q	R	S
(a)	1	2	4	3
(b)	1	4	2	3
(c)	4	2	3	1
(d)	4	3	2	1

FAQ Solution Video Have any Doubt ?

A a

B b Your answer is **Wrong**

C c

D d Correct Option

Solution :
(d)

- Maximum number of tuple for $R \cup S$ is $n + m$.
- Maximum number of tuple for $R \cap S$ is $\min(m, n)$.
- Maximum nubmer of tuple for $\sigma_C(R) \times S$ is $m \times n$.
- Maximum number of tuple for $\sigma_L(R) - S$ is n.

QUESTION ANALYTICS +

Q. 11

Which of the following query transformations (i.e. replacing LHS expression by the RHS expression) is correct? (Assume R_1, R_2 and R_3 are relations, C_1 and C_2 are selection conditions and A_1 and A_2 are attributes of relations)?

FAQ Solution Video Have any Doubt ?

A $\pi_{A1}(R_1 - R_2) \to \pi_{A1}(R_1) - \pi_{A1}(R_2)$ with condition $R_2 \subseteq R_1$

B $(R_1 ⟗ R_2) ⋈ R_3 \to R_1 ⋈ (R_2 ⟗ R_3)$

C $\pi_{A1}(\sigma_{C1}(R_1)) \to \sigma_{C1}(\pi_{A1}(R_1))$

D $\pi_{A1}(\pi_{A2}(\sigma_{C1}(\sigma_{C2}(R_1)))) \to \pi_{A1}(\sigma_{C2}(\sigma_{C1}(R_1)))$ with condition $A_1 \subset A_2$ Your answer is **Correct**

Solution :
(d)

(a) $\pi_{A1}(R_1 - R_2) \neq \pi_{A1}(R_1) - \pi_{A1}(R_2)$ because

R_1

A_1	A_2
2	4
3	4
2	5
3	5

R_2

A_1	A_2
2	4
2	5
3	5

LHS results:

A_1
3

RHS result:

A_1
Empty

(c) $\pi_{A1}(\sigma_{C1}(R_1)) \to \sigma_{C1}(\pi_{A1}(R_1))$ because LHS is always superset of RHS.

(d) $\pi_{A1}(\pi_{A2}(\sigma_{C1}(\sigma_{C2}(R_1)))) \to \pi_{A1}(\sigma_{C2}(\sigma_{C1}(R_1)))$ with condition $A_1 \subset A_2$ it gives the same results when LHS is replaced by RHS.

QUESTION ANALYTICS +

Q. 12

Consider the following relation:
Supplier (Sid, Sname, Address)
Parts (Pid, Pname, Color)
Catalog (Sid Pid, Cost)
Retrieve pairs of Sids such that the supplier with the first Sid charges more for some part than the supplier with the second Sid.

$Q_1: \pi_{Sid,S}(\text{Catalog} \underset{Sid \neq S \wedge Pid = P \wedge Cost > C}{⋈} \rho_{S,P,C}(\text{Catalog}))$

$Q_2: \pi_{Sid,S}(\text{Catalog} \underset{Sid \neq S \wedge Cost > S}{⋈} \rho_{S,P,C}(\text{Catalog}))$

Which of the following is correct about above queries ?

Solution Video Have any Doubt ?

A Q_1 correct but not Q_2 Your answer is **Correct**

Solution :
(a)

Queries 1 will returns pairs of Sids such that the supplier with the first Sid charges more for some part than the supplier with the second Sid. Which is possible by the condition that is when two supplier id is different but part id is same and charges of first supplier is more than second supplier.

Queries 2 will returns empty set because we compare cost with Sid which is always returns empty set.

B Q_2 correct but not Q_1

C Q_1 and Q_2 both correct

D Both Q_1 Q_2correct

QUESTION ANALYTICS

Q. 13

Consider A (P, Q, R, S, T, V, W) and the following FD's:
$W \to VS$
$T \to S$
$WS \to RT$
$QS \to P$
Which of the following is minimal cover of the given FD's?

Solution Video | Have any Doubt ?

A $\{W \to V, T \to S, W \to R, WS \to T, QS \to P\}$

B $\{W \to V, W \to S, T \to S, W \to R, QS \to P\}$

C $\{W \to V, T \to S, W \to R, WS \to R, QS \to P\}$

D $\{W \to V, T \to S, W \to R, W \to T, QS \to P\}$ — Your answer is **Correct**

Solution :
(d)
Checking $QS \to P$, $Q^+ = Q$, $S^+ = S$, Hence $QS \to P$ is essential.
Checking $WS \to R$, $WS \to T$
$W^+ \to WVSRT$, Hence it can be decomposed to $W \to R$, $W \to T$
So, the dependencies remained are
$W \to V$, $W \to S$, $T \to S$, $W \to R$, $W \to T$, $QS \to P$
Now, $\{W \to T, T \to S\}$ by transitive rule $W \to S$ can be obtained.
Hence minimal cover is: $W \to V$, $T \to S$, $W \to R$, $W \to T$, $QS \to P$.

QUESTION ANALYTICS

Q. 14

Consider the following relation schemas:
STUDENT (Sid, Sname, sex)
ENROLL (Sid, Cid)
Assume relation STUDENT contains all the information about student and relation ENROLL contains information about which student enroll for what course. Which of the following represent. "Courses in which only male students are enrolled". (Assume every course is taken by atleast one male or atleast one female student).

FAQ | Solution Video | Have any Doubt ?

A $\pi_{Cid}((\pi_{Sid}(\sigma_{sex\ =\ male}(STUDENT)) \times \pi_{Cid}(ENROLL) - ENROLL)$

B $\pi_{Cid}(\sigma_{sex\ =\ male}(STUDENT \bowtie ENROLL)) - \pi_{Cid}(\sigma_{sex\ =\ female}(ENROLL \bowtie STUDENT))$

C $\pi_{Cid}(ENROLL) - \pi_{Cid}(\sigma_{sex\ =\ female}(STUDENT) \bowtie (ENROLL))$

D Both (b) and (c) — Correct Option

Solution :
(d)
- Option (a) represent course in which proper subset of male student are enroll.
- Option (b) represent course in which only male student are enroll.
- Option (c) represent course in which only male student are enroll.

Hence both (b) and (c) are correct.

QUESTION ANALYTICS

Q. 15

Consider a relation $r_1(A, B, C)$, $r_2(C, D, E)$ and $r_3(F, G)$ with primary keys A, C and F respectively. Assume that r_1 has 150 tupples, r_2 has 100 tupples and r_3 has 75 tupples. The number of resultant tuple in $r_1 \bowtie r_2 \bowtie r_3$ are ________.

FAQ | Solution Video | Have any Doubt ?

11250 — Correct Option

Solution :
11250
We know that natural join is associative i.e.

$$(r_1 \bowtie r_2) \bowtie r_3 = r_1 \bowtie (r_2 \bowtie r_3)$$

So, $\underset{150}{r_1} \bowtie \underset{100}{r_2}$ = Number of tupples in foreign key relation, so 150

Then, $(\underset{150}{r_1 \bowtie r_2}) \bowtie \underset{75}{r_3}$ = Number of tupples is $m \times n$

$= 150 \times 75$
$= 11250$

Your Answer is 1125000

QUESTION ANALYTICS

Q. 16

The following key values are inserted into B^+ tree in which the order of internal nodes is 4 and that of the leaf node is 5 in the sequence given below. The order of internal node is maximum number of keys in each node and the order of leaf node is the maximum number of pointers that can be stored in it. The B^+ tree initially empty.

2, 7, 3, 11, 17, 5, 19, 31, 29, 23

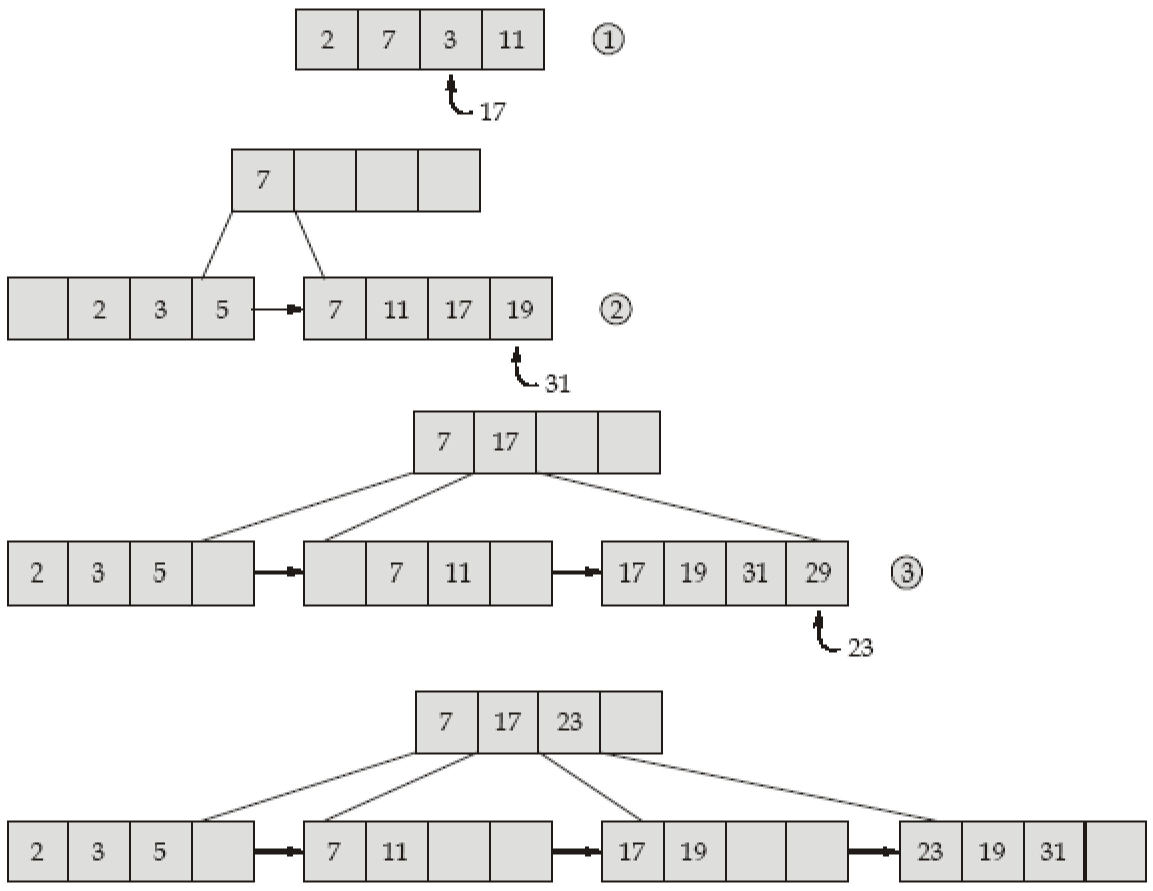
The sum of key values which responsible of leaf node split up as a result of these insertion is ________. (Assume right baising)

FAQ Solution Video Have any Doubt ?

71 Correct Option

Solution :

71



Sum of keys which make split of leaf nodes are 17 + 31 + 23 = 71

QUESTION ANALYTICS +

Q. 17

Consider a B^+ tree in which search key is 15 bytes long, block size is 2048 bytes, record pointer is 12 bytes long and block pointer is 10 bytes long. The maximum number of keys that can be accommodated in each leaf node of the tree is ________. (Assume order of leaf node refers to number of keys present in the node)

FAQ Solution Video Have any Doubt ?

75 Your answer is **Correct**75

Solution :

75

Assume order of leaf node is P

Format of B^+ tree leaf node is 1

$$B_p + P \times (\text{Key size}) + (P)\, R_p \leq \text{Block size}$$

$$P \times (15) + (P)\, 12 + 10 \leq 2048$$

$$27\, P \leq 2038$$

$$P \leq \lfloor 75.48 \rfloor$$

$$P \leq 75$$

QUESTION ANALYTICS +