CS & IT ENGINEERING

Database Management System

Lecture No.- 01

By- Vijay Agarwal Sir

Recap of Previous Lecture

Topic

Topic

Topics to be Covered

- **Topic** Functional Dependencies
- **Topic** Key Concept
- **Topic** Minimal Cover
- **Topic** Properties of Decomposition

[MSQ]

#Q. Consider the following relation:

A	B	C	TUPLE#
10	b1	c1	1
10	b2	c2	2
11	b4	c1	3
12	b3	c4	4
13	b1	c1	5
14	b3	c4	6

$B \to C$ May Hold

Instance

Given the previous extension (state), which of the following dependencies may hold in the above relation? If the dependency cannot hold, explain why by specifying the tuples that cause the violation.

✗ i. $A \to B$, ✓ ii. $B \to C$, ✗ iii. $C \to B$. ✗ iv. $B \to A$, ✗ v. $C \to A$

What we can conclude:

A does not functionally determine B. $A \not\to B$

C " " " " B. $C \not\to B$

B " " " " A. $B \not\to A$

C " " " " A. $C \not\to A$

$A \to A$ ✓
$B \to B$ ✓
$C \to C$ ✓

$AB \to A$ ✓
$AB \to B$ ✓
$AB \to AB$ ✓

Common Data Question for Q1 & Q2

Consider the relation shown in Figure

1. List all the functional dependencies that this relation instance satisfies.

X	Y	Z
x_1	y_1	z_1
x_1	y_1	Z_2
x_2	y_1	z_1
x_2	y_1	z_3

$X \rightarrow Y$
$X \rightarrow Z$
$X \rightarrow YZ$

$Y \rightarrow X$
$Y \rightarrow Z$
$Y \rightarrow XZ$

$Z \rightarrow X$
$Z \rightarrow Y$
$Z \rightarrow XY$

$XY \rightarrow Z$
$YZ \rightarrow X$
$XZ \rightarrow Y$

$$\boxed{\begin{array}{l} X \rightarrow Y \\ Z \rightarrow Y \\ XZ \rightarrow Y \end{array}}$$

Ans

Common Data Question for Q1 & Q2

Consider the relation shown in Figure

2. Assume that the value of attribute Z of the last record in the relation is changed form z_3 to z_2. Now list all the functional dependencies that this relation instance satisfies.

No Changes.

$\boxed{\text{Ans (3)}}$

X	Y	Z
x_1	y_1	z_1
x_1	y_1	Z_2
x_2	y_1	z_1
x_2	y_1	$\cancel{z_3}$ z_2

$X \rightarrow y$

$Z \rightarrow y$

$XZ \rightarrow y$

Ans

[NAT]

#Q. Consider the following set F of functional dependencies on the relation schema r(A, B, C, D, E, F):

$$A \rightarrow BCD$$
$$BC \rightarrow DE$$
$$B \rightarrow D$$
$$D \rightarrow A$$

$[B]^+ = [BDACE]$

a. Compute B^+.

b. Prove that AF is a super key.

$[AF]^+ = [ABCDEF]$

AF is super key.

[MCQ]

#Q. Which is true about functional dependency?

I. If FD $A \rightarrow B$, $B \rightarrow C$ holds on $R(A, B, C)$ we can infer the FD $A \rightarrow C$ holds on R.

$(A)^+ = [ABC]$

II. If FD $\alpha \rightarrow \beta$ is a trivial only if β is a subset of α.

$\alpha \supseteq \beta$.

A I

B II

C I and II

$\boxed{\text{Ans [C]}}$

D None of these

[MCQ]

#Q. Consider relation R(A, B, C, D, E) with functional dependencies

$AB \to C, C \to D, BD \to E$

Which of the following sets of attributes does not functionally determine E?

(A) ~~BC~~

(B) ~~AB~~

(C) ~~ABC~~

(D) AD $(AD)^+ = (AD)$

$(BC)^+ = (BCDE)$

$(AB)^+ = (ABCDE)$

$\boxed{\text{Ans (D)}}$

[MCQ]

#Q. Armstrong (1974) proposed systematic approach to derive functional dependencies. Match the following with respect to functional dependencies.

List-I		List-II	
a.	Decomposition rule -4	1.	If $X \to Y$ and $Z \to W$ then $\{X, Z\} \to \{Y, W\}$
b.	Union rule -3	2.	If $X \to Y$ and $\{Y, W\} \to Z$ then $\{X, W\} \to Z$
c.	Composition rule -1	3.	If $X \to Y$ and $X \to Z$ then $X \to \{Y, Z\}$
d.	Pseudo transitivity rule -2	4.	If $X \to \{Y, Z\}$ then $X \to Y$ and $X \to Z$

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

$\boxed{\text{Ans (D)}}$

Decomposition $X \rightarrow YZ$ then $X \rightarrow Y$ & $X \rightarrow Z$

Union $X \rightarrow Y$, $X \rightarrow Z$ then $X \rightarrow YZ$.

[NAT]

#Q. Consider a relation schema R(A, B, C, D, E) and following table is an instance of relation R. F is set of functional dependencies hold on R.

S1: B does not functionally determine D. True.

S2: B functionally determine C and D not functionally determine E.

S3: C functionally determine E. : May or May Not

S4: C does not functionally determine D. True.

The Number of statements definitely always true (or we conclude)____?

A	B	C	D	E
a_1	1	5	d_2	3
a_2	2	6	d_3	4
a_3	2	6	d_4	4
a_4	3	7	d_5	5
a_5	3	7	d_6	5

$\boxed{\text{Ans (2)}}$

Relational Instance : Set of Records (Relation State).

Relation (extension)

By watching the Instances we

Conclude :

1. Trivial FD's are Valid.

$A \to A$

$B \to B$

$AB \to B$

$BC \to C$

$BD \to D$

$BD \to BD$

2. Rule out the FD Based on the extension (instance) (Relation State)

RDBMS

Arity / Degree

Cardinality

Domain

Relation Schema

Relational Instance : set of Record / SnapShot)

<u>RDBMS</u>

Relation intension $\rightarrow$ Schema.

<u>Relation Extension</u>. $\rightarrow$ <u>Relation State</u>.

<u>Schema</u> $\Rightarrow$ Table Abstraction

$\hookrightarrow$ STUDENT (Roll : integer, Name : String , CGPA ; integer)

Relation Instance : Set of Records

[MCQ]

#Q. Let a relation R(A, B, C, D, E) contain the following FDs: $A \to B$, $BC \to E$, $E \to D$, $D \to B$ then which of the following dependencies is member of the relation R.

A. $D \to C$ $(D)^+ = (DB)$

B. $E \to B$ $(E)^+ = (EDB\ldots)$

C. $A \to E$ $(A)^+ = (AB)$

D. $B \to E$ $(B)^+ = (B)$

$\boxed{\text{Ans } (B)}$

[MCQ]

#Q. If a functional dependency is reflexive, B is a subset of A and A is the set of attributes, then

(A) $B \rightarrow A$ holds

(B) $A \rightarrow B$ holds

(C) $AB \rightarrow C$ holds

(D) None of the mentioned

$A \rightarrow B$: $A \supseteq B$ (B is subset of A].

$\boxed{\text{Ans (B).}}$

[MCQ]

#Q. Let relation R(A, B, C, D, E, F, G, H) satisfy the following functional dependencies

$A \rightarrow B$, $CH \rightarrow A$, $B \rightarrow E$, $BD \rightarrow C$, $EG \rightarrow H$, $DE \rightarrow F$

Which of the following FDs is also guaranteed to be satisfied by R?

A. $ACG \rightarrow DH$

B. $CGH \rightarrow BF$

$(CGH)^+ = [CGHABE]$

C. $BFG \rightarrow AE$

D. $BDG \rightarrow AE$

$(ACG)^+ = [ACGBEH]$

$(BFG)^+ = [BFGEH$

$(BDG)^+ = [BDGEHCA]$

$\boxed{\text{Ans (D)}}$

[NAT]

#Q. Consider the relation R(A, B, C) with the following set of functional dependencies

$F = \{A \rightarrow B, B \rightarrow C\}$

Where F^+ is closure of F, the total number of functional dependencies in F^+ is

$\phi \rightarrow \phi \quad = 1.$

$(A)^+ = (ABC) \Rightarrow 2^3 = 8.$

$A \rightarrow \phi,\ A \rightarrow A,\ A \rightarrow B,\ A \rightarrow C,\ A \rightarrow AB,\ A \rightarrow BC,\ A \rightarrow AC,\ A \rightarrow ABC$

$(B)^+ = (BC) = 2^2 = 4.$

$(C)^+ = (C) = 2^1 = 2$

$C \rightarrow \phi,\ C \rightarrow C.$

$\boxed{\text{Ans } (43)}$

$(AB)^+ = (ABC) = 2^3 = 8.$

$(BC)^+ = (BC) = 2^2 = 4.$

$(AC)^+ = (ABC) = 2^3 = 8.$

$(ABC)^+ = (ABC) = 8$

[MCQ]

#Q. R {X, Y, Z, W} having FD's {X → Y; Y → Z; Z → W; W → X} so number of candidate keys

A 1

B 2

C 3

D 4

$(X)^+ = [XYZW]$

X is c.k

If $X_{\text{Attribute}} \rightarrow$ [Prime Attribute]

$W \rightarrow X$ W is ck

$Z \rightarrow W$ Z is ck

$Y \rightarrow Z$ Y is ck

Ans (D)

[MCQ]

#Q. If a relation R(A, B, C, D, E) holds the following dependencies:
$AB \rightarrow C, C \rightarrow D, D \rightarrow E, E \rightarrow A, D \rightarrow B.$
Then how many candidate keys can be made out of it ______.

A 2

B 3

C 1

D 4

PA = [A, B, E

$(A)^+ = [A)$ $(AB)^+ = (ABCDE)$
$(B)^+ = (B)$

$\boxed{\text{AB is CK}}$ — 1

$E \rightarrow A$

$(EB)^+ = (ABCDE)$ $\boxed{\text{EB is CK}}$ — 2
$(E)^+ = [EA)$

$D \rightarrow B$

~~AD~~ ~~ED~~

$(D)^+ = [DBEAC]$

$\boxed{\text{D is CK.}}$ — 3

$C \rightarrow D$

C is CK

AB
EB
D
C

Ans

[MSQ]

#Q. A relation schema R = (A, B, C, D, E)

$A \to BC$

$CD \to E$

$B \to D$

$E \to A$

The candidate keys are

A. A, CD, B, E

B. A, BC, CD and E

C. A, B, E

D. A, BC, CD

[MCQ]

#Q. Let R (A, B, C, D, E, F) be a relational schema in which the following dependencies are known to hold.

$A \rightarrow BC$

$E \rightarrow AF$

Which of the following is a candidate key of R?

$(E)^+ = \{EAFBC\}$

$(ED)^+ = \{ABCDEF\}$

A. DE

B. AE

C. DEA

D. AF

[NAT]

#Q. Consider the universal relation $R = \{A, B, C, D, E, F, G, H, I, J\}$ and the set of functional dependencies $F = \{\{A, B\} \rightarrow \{C\}, \{A\} \rightarrow \{D, E\}, \{B\} \rightarrow \{F\}, \{F\} \rightarrow \{G, H\}, \{D\} \rightarrow \{I, J\}\}$. What is the key for R? Decompose R into 2NF and then 3NF relations.

$(AB)^+ = [ABCDEFGHIJ]$

$(A)^+ = (ADEIJ)$

$(B)^+ = [BFGH]$

$\boxed{AB \text{ is C.K.}}$ Ans

[NAT]

#Q. Compute the closure of the following set F of functional dependencies for relation schema R(A, B, C, D, E).

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

List the candidate keys for R.

4 CK

A, E, CD, CB.

[NAT]

P.A = [A, B, E, G, F, C

Consider the following relation R(ABCDEFGHI) and the functional dependencies set F

F: [AB → CDHI, AF→D, DE→F, C→G, F→E, G→ A]

The number of candidate keys is relation R is 6. Ans

ABE
GBE
ABF
GBF
CBF
CBE

Ans

$(ABE)^+ = (ABCDEFGHI)$

$\boxed{\text{ABE is CK}}$ — ①

G→A

$\boxed{\text{GBE is CK}}$ — ②

F→E

ABF
GBF

ABDE ABE ✓

GBDE GBE ✓

C → G

CBF

CB~~D~~E

[NAT]

A relation $R(A_1, A_2, A_3 \ldots\ldots\ldots A_{11})$ and maximum number of candidate key possible is 462. Ans

n: # of Attributes.

Soln Maximum Number of C.K $= {}^{n}C_{\lfloor \frac{n}{2} \rfloor} \Rightarrow {}^{11}C_{\lfloor \frac{11}{2} \rfloor} \Rightarrow {}^{11}C_5$

$\boxed{\text{Ans } (462)}$

$$\Rightarrow \frac{11 \times \cancel{10} \times \overset{3}{\cancel{9}} \times \overset{2}{\cancel{8}} \times 7 \times \cancel{6!}}{\cancel{5} \times \cancel{4} \times \cancel{3} \times \cancel{2} \quad \cancel{6!}}$$

$= 33 \times 14$

$= 462$ Ans

[NAT]

Consider a Relation schema R with A, B, C, D, E, and F attributes R(ABCDEF). If in a relation R every '3' attribute form a candidate keys the total number of super keys are ____.

n Attribute

Every 3 Attribut form a Ck.

$^nC_{n-3}$ $^nC_{n-2}$ $^nC_{n-1}$ ^nC_n

Max # Ck

$^6C_3 = 20$

6 Attribute

Every 3 Attribute CK.

$^6C_3 + {}^6C_4 + {}^6C_5 + {}^6C_6$.

$20 + 15 + 6 + 1$

$= \underline{42}$ Super key Ans

n : is # Attributes

Max # CK = $^{n}C_{\lfloor \frac{n}{2} \rfloor}$

Total Maximum # S.K = $2^{n} - 1$

[NAT]

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

$$\{A \to BC, B \to D, CD \to E, E \to A\}$$

Then the number of super keys possible are ____

$(C)^+ = (C)$
$(B)^+ = BD$
$(D)^+ = (D)$
$(BD)^+ = (BD)$

4 C.K : A, E, CD, CB

C
B
D
BD

Not a keys.

Total Maximum Number of Super keys $= 2^n - 1 \Rightarrow 2^5 - 1 = 31$ Super key

Total Super key $= 31 - 4 = 27$ Super key

A, E, CD, CB

$\cancel{A}$ BCDE $= 2^4 = 16$

$\cancel{E}$ BCD $= 2^3 = 8$

$\cancel{CD}$ B $= 2^1 = 2$

CB $= 1$

27

[MCQ]

H.W

#Q. Consider

$F = \{A \rightarrow BC, B \rightarrow A, C \rightarrow A\}$ The set of FD's

$G = \{A \rightarrow B, B \rightarrow C, C \rightarrow A\}$ The set of FD's

Then which of the following is true?

A. F covers G

B. G cover F

C. F and G are equivalent

D. None of the above

[MCQ]

H.W

#Q. Consider the following three relation schemas

R_1 (A, B, C, D) with FD's: $A \rightarrow B, B \rightarrow C, AC \rightarrow D$

R_2 (A, B, C, D) With FD's: $A \rightarrow B, B \rightarrow C, A \rightarrow D$

R_3 (A, B, C, D) With FD's: $A \rightarrow B, B \rightarrow C, C \rightarrow D$

Which of the following options is correct with respect to above three schemas?

A. R_1 and R_2 are functionally equivalent

B. R_1 and R_3 are functionally equivalent

C. R_2 and R_3 are functionally equivalent

D. All R_1, R_2 and R_3 are functionally equivalent

[MCQ]

H.W

#Q. Which of the following is equivalent minimal cover for relation R(A, B, C, D, E, F) with FD's: $AB \rightarrow C$; $B \rightarrow CD$; $D \rightarrow EF$; $B \rightarrow F$

A
$B \rightarrow C$
$AB \rightarrow C$
$D \rightarrow E$
$B \rightarrow F$

B
$B \rightarrow C$
$B \rightarrow D$
$D \rightarrow F$
$B \rightarrow F$

C
$B \rightarrow C$
$B \rightarrow D$
$D \rightarrow E$
$D \rightarrow F$

D
$AB \rightarrow C$
$B \rightarrow CD$
$D \rightarrow E$
$D \rightarrow B$

[MCQ]

H.W

Consider the following set of FD's F

F:{$A \to B$, $ABCD \to E$, $EE \to G$, $EF \to H$, $ACDF \to EG$}

Which of the following is a minimal cover for the above given FD set?

A) $A \to B$, $ACD \to E$, $EE \to H$, $ADF \to G$

B) $A \to B$, $EF \to G$, $EF \to H$, $ADF \to G$

C) $A \to B$, $ACD \to E$, $EF \to G$, $EF \to H$

D) $A \to B$, $AD \to E$, $EF \to H$, $ADF \to G$

[NAT]

H.W

#Q. Suppose that we decompose the schema r(A, B, C, D, E) into

r_1 (A, B, C)

r_2 (A, D, E)

Show that this decomposition is a lossless decomposition if the following set F of functional dependencies holds:

$A \rightarrow BC$

$CD \rightarrow E$

$B \rightarrow D$

$E \rightarrow A$

[MCQ]

H.W

#Q. Consider a schema R(A, B, C, D) and following functional dependencies.

$A \rightarrow B$

$B \rightarrow C$

$D \rightarrow B$

Then decomposition of R into R_1 (A, B), R_2 (B, C) and R_3 (B, D) is

A. dependency preserving and lossless join

B. lossless join but not dependency preserving

C. dependency preserving but not lossless join

D. not dependency preserving and not lossless join

2 mins Summary

Topic

DBMS 01 : DBMS (Part-01)

Topic

THANK - YOU

CS & IT ENGINEERING

Database Management System

Lecture No.- 02

By- Vijay Agarwal Sir

Recap of Previous Lecture

Topic Functional Dependencies

Topic Key Concept

Topics to be Covered

Topic Equalities between FD sets

Topic Minimal Cover

Topic Properties of Decomposition

Topic Normal Form & NF Decomposition

[MCQ]

#Q. Consider

$F = \{A \to BC, B \to A, C \to A\}$ The set of FD's

$G = \{A \to B, B \to C, C \to A\}$ The set of FD's

Then which of the following is true?

A. F covers G

B. G cover F

C. F and G are equivalent

D. None of the above

F cover G

$A \to B$ $(A)^+ = (ABC$

$B \to C$ $(B)^+ = (BAC$

$C \to A$ $(C)^+ = (CA \ldots)$

True

G cover F

$A \to BC$ $(A)^+ = (ABC)$

$B \to A$ $(B)^+ = BCA$

$C \to A$ $(C)^+ = (CA)$

True

[MCQ]

#Q. Consider the following three relation schemas

R_1 (A, B, C, D) with FD's: $A \to B, B \to C, AC \to D$

R_2 (A, B, C, D) With FD's: $A \to B, B \to C, A \to D$

R_3 (A, B, C, D) With FD's: $A \to B, B \to C, C \to D$

Which of the following options is correct with respect to above three schemas?

A. R_1 and R_2 are functionally equivalent

B. R_1 and R_3 are functionally equivalent

C. R_2 and R_3 are functionally equivalent

D. All R_1, R_2 and R_3 are functionally equivalent

$R(ABCD)\ [A \to B,\ B \to C,\ AC \to D]$

$A \to B$

$B \to C$

$A \to D \quad (A)^+ = (ABCD)$

$R_1 \equiv R_2$

$R_2(ABCD)\ [A \to B,\ B \to C,\ A \to D]$

$A \to B$

$B \to C$

$AC \to D \quad (AC)^+ = (ABCD)$

True.

R_1

$R_3(ABCD)\ [A \to B,\ B \to C,\ C \to D]$

$A \to B$

$B \to C$

$AC \to D \quad (AC)^+ = (ABCD)$

$A \to B$

$B \to C$

$C \to D \quad (C)^+ = (C)$

[MCQ]

#Q. Which of the following is equivalent minimal cover for relation R(A, B, C, D, E, F) with FD's: $AB \rightarrow C$; $B \rightarrow CD$; $D \rightarrow EF$; $B \rightarrow F$

A
$B \rightarrow C$
$AB \rightarrow C$
$D \rightarrow E$
$B \rightarrow F$

B
$B \rightarrow C$
$B \rightarrow D$
$D \rightarrow F$
$B \rightarrow F$

C
$B \rightarrow C$
$B \rightarrow D$
$D \rightarrow E$
$D \rightarrow F$

D
$AB \rightarrow C$
$B \rightarrow CD$
$D \rightarrow E$
$D \rightarrow B$

$AB \to C \quad B \to CD \quad D \to EF, \quad B \to F$

Step 1 $\quad \underline{AB \to C}, B \to C, B \to D, D \to E, D \to F, B \to F$

Step 2 $\quad AB \to C \quad (A)^+ = (A) \quad$ B is Not extra

$(B)^+ = (BCDEF) \quad$ A is Not extra.

Step 3: $\cancel{① AB \to C} \quad ② \underline{B \to C} \quad ③ B \to D \quad ④ D \to E \quad ⑤ D \to F \quad \cancel{⑥ B \to F}$

$(AB)^+ = (ABCDEF) \quad (B)^+ = (BDEF) \quad (B)^+ = (BCF) \quad (D)^+ = (DF) \quad (D)^+ = (DE) \quad (B)^+ = (BCDEF)$

$B \to C, \; B \to D, \; D \to E, \; D \to F$

[MCQ]

Consider the following set of FD's F

F:{A→B, ABCD→E, EE→G, EF →H, ACDF→EG}

Which of the following is a minimal cover for the above given FD set?

(A) A→B , ACD→E, EE→H, ADF→G

(B) A→B , EF→G, EF→H, ADF→G

(C) A→B , ACD→E, EF→G, EF→H

(D) A→B , AD→E, EF→H, ADF→G

Ans [C]

[NAT]

#Q. Suppose that we decompose the schema r(A, B, C, D, E) into

r_1 (A, B, C)

r_2 (A, D, E)

Show that this decomposition is a lossless decomposition if the following set F of functional dependencies holds:

A → BC

CD → E

B → D

E → A

$r_1(ABC) \cap R_2(ADE) = A$

$(A)^+ = (ABC \ldots]$ SK of R_1

lossless

CHASE TEST

	A	B	C	D	E
ABC	a	a	a		
ADE	a	a	a	a	a

lossless

[MCQ]

#Q. Consider a schema R(A, B, C, D) and following functional dependencies.

$A \rightarrow B$ $\quad$ $B \rightarrow C$

$C \rightarrow D$ $\quad$ $D \rightarrow B$

Then decomposition of R into R_1 (A, B), R_2 (B, C) and R_3 (B, D) is

A. dependency preserving and lossless join

B. lossless join but not dependency preserving

C. dependency preserving but not lossless join

D. not dependency preserving and not lossless join

Ans (A)

$R(ABCD)$ $[A \to B,\ B \to C,\ C \to D,\ D \to B]$

$R_1(AB)$ $R_2(BC)$ $R_3(BD)$

Lossless ?

$R_1(AB) \cap R_2(BC) = B \Rightarrow (B)^+ = (BC\ldots)$ S.K of R_2

$R_{12}(ABC) \cap R_3(BD) = B \Rightarrow [B]^+ = [\underline{B}C\underline{D}]$ S.K of $\underline{R_3}$

$R_{123}(ABCD)$ Lossless Join

$R(ABCD)\ [A \to B,\ B \to C,\ C \to D,\ D \to B]$

$R_1(AB)$	$R_2(BC)$	$R_3(BD)$
$A \to B$	$B \to C$	$B \to D$
	$C \to B$	$D \to B$

$(C)^+ = (CDB)$

$C \to B$ & $B \to D$

$C \to D$.

[MCQ]

#Q. If D_1, D_2, ... D_n are domains in a relational model, then the relation is a table, which is a subset of

$r \subset D_1 \times D_2 \times D_3 \cdots \times D_n$

A. $D_1 \oplus D_2 \oplus \ldots\ldots \oplus D_n$

B. $D_1 \times D_2 \times \ldots\ldots \times D_n$

C. $D_1 \cup D_2 \cup \ldots\ldots \cup D_n$

D. $D_1 \cap D_2 \cap \ldots\ldots \cap D_n$

[MCQ]

#Q. Which one is correct with respect to RDBMS?

A. Primary key $\subseteq$ super key $\subseteq$ candidate key

B. Primary key $\subseteq$ candidate key $\subseteq$ super key

C. Super key $\subseteq$ candidate key $\subseteq$ primary key

D. Super key $\subseteq$ primary key $\subseteq$ candidate key

[MCQ]

#Q. The maximum number of super keys for the relation schema R(A, B, C, D) with AB and CD as Keys is

AB, CD

A 7

B 16

C 8

D None of these

$\# \text{Super key} = 2^{4-2} + 2^{4-2} - 2^{4-4}$

$\Rightarrow 2^2 + 2^2 - 2^0$

$= 4 + 4 - 1 \Rightarrow 7$ Ans

AB, CD

AB

ABCD

AB . CD

CDA

ABC CDB = 7 Ans

ABD

ABCD ~~CDAB~~

[MCQ]

select

P.K

C.K is minimal of superkey

#Q. Which of Primary the keys following can be options called is as correct?

S_1: Primary keys can be called as minimal super key . True

S_2: Candidate keys can store null values

S_3: Primary keys can store null values

S_4: An attribute of an entity can be composite

A) S_1 and S_3 are true

B) S_1 and S_4 are true

C) S_2 and S_3 are true

D) S_1 , S_2 and S_4 are true

[MCQ]

#Q. If R is a relation in relational data Model and Al, A2, ... An are the attributes of relation R, what is the cardinality of R expressed in terms of domain of attributes?

A. |R| <= |dom(Al) X dom(A2).. X dom(An)|

B. |R| >= |dom(Al)Xdom(A2)..dom(An)|

C. |R| = max (|dom(Al)|, |dom(A2)| ... |dom(An)|)

D. |R| = min (|dom(Al)|, |dom(A2)|... |dom(An)|

[MCQ]

Consider the relation R(ABCDEFGHIKKLM) with the following functional dependencies set:

{A→E, A→BCD, EFG→H, F→GH, I→J, K→LM}

The number of revenant FD is ___ 1 Ans

A → E $(A)^+ = (ABCD)$

A → B $(A)^+ = (AECD)$

A → C $(A)^+ = (AEBD)$

A → D $(A)^+ = (AEBC)$

EFG → H $(EFG)^+ = (EFGH)$

F → G

F → H $(F)^+ = (FG$

I → J

K → L

K → M

EFG → H

[MCQ]

#Q. Consider the following relation with given functional dependencies.

A(R, S, T, U, V)

FD's: {RS → T, RS → U, U → R, ST → U, ST → V}

What is the highest normal form of relation A?

Key|Prime Attribute: = [R, S, U, T]

Candidate key: [SR, SU, ST]

A 1 NF

B 2 NF

Check 2NF ? R is 2NF

C 3 NF

Check 3NF ✓ R is in 3NF

U → R; U is Not Super key But R is Key|Prime Attribut

D BCNF

Check BCNF

U → R; U is Not Super key Not in BCNF.

Checking Condition

2NF : Proper Subset of Cand. key $\rightarrow$ Non key Attribute

Violation of 2NF

3NF : $X \rightarrow y$; X : Super key

or

y : key | Prime Attribute

BCNF $X \rightarrow y$ X : Super key.

[NAT]

Home Work

#Q. Consider a relational Schema R (A, B, C, D, E, F, G, H, I, J) with following FD's set F: [$AB \to C$, $BD \to EF$, $AD \to GH$, $A \to I$, $H \to J$]

If a relation R is decomposed into Lossless Join and Dependency Preserving 2NF decomposition, then minimum number of table required in this Decomposition is ____.

Candidate key = ABD

Note: If Relation R has only 1 C.K then R always is in 1NF But may or may not in 2NF, 3NF, BCNF.

eg R(ABCDE) [AB → C, C → D, B → E]

Candidate key - (AB)

B → E
Violation of 2NF } Not in 2NF.

Note: If every Candidate key is a Simple Candidate key (No Composite key) the R is in 2NF But May or may Not in 3NF & BCNF.

Q. $R(ABCDE)$ $\{A \to B, B \to C, C \to D, D \to E, C \to A\}$

Candidate key = $\{A, C, B\}$

R is in 2NF

But

$\underbrace{D \to E}_{\text{Violate 3NF}}$ $\left\{ \begin{array}{l} D \text{ is Not Super key} \\ E \text{ is Non Prime Attribute} \end{array} \right\}$

Note: If all attribute are Prime/Key Attribute then R is in 3NF But may or may Not in BCNF

R(ABCD) {A → B, B → C, C → A}

C.K = {AD, BD, CD}

All Attribute are Key/Prime so R is in 3NF

X
A → B
B → C
C → A
} X: Not super key.

Note If R is in 3NF & every C.K is simple CK then R is in BCNF

$R(ABC)$ $(A \to B,\ B \to C,\ C \to A)$

$CK: (A, B, C)$

R is in BCNF.

[MSQ] [2 Marks]

Consider a relation schema R(ABCDE) with the functional dependencies F.

F: [A→BE, A→D, A→C, B→D]

We decompose the relation R into two relation schemes R_1(ABCE) & R_2(BD).

$(A)^+ = (ABEDC)$

$(B)^+ = (B \to D)$

ABCE	BD
A→BE	B→D
A→C	
A→B	

A→D

(A) Decomposition is in 3NF

(B) Lossless Join Decomposition

(C) Dependency Not preserving decomposition

(D) Decomposition is in BCNF.

$R(ABCDE)$ $[A \to BE,\ A \to D,\ A \to C,\ B \to D]$

$R_1(ABCE) \cap R_2(BD) = (B)$

$(B)^+ = (BD)$ Super key of R_2 — Lossless Join

CHASE TEST

	A	B	C	D	E
$R_1(ABCE)$	a	a	a	a	a
$R_2(BD)$		a		a	

Lossless

[MCQ]

#Q. Suppose you are given a relation R with four attributes ABCD. For the set of FDs assuming those are the only dependencies that hold for R, do the following

$(C)^+ = [CDA]$

$(B)^+ = (BCDA)$ B is CK

$C \rightarrow D$, $C \rightarrow A$, $B \rightarrow C$

Suppose, the relation is decomposed into 3 relations AC, BC, CD. Which of the following is true about decomposition?

R_1 R_2 R_3

AC	BC	CD
	$B \rightarrow C$	$C \rightarrow D$

A. Lossless, dependency preserving, BCNF

B. Lossless, not dependency preserving, BCNF

C. Not lossless, dependency preserving, 3NF

D. Not lossless, not dependency preserving, 3NF

[NAT]

Standard Book

#Q. Show that the following decomposition of the schema R is not a lossless decomposition:

(A, B, C)

(C, D, E)

Hint: Give an example of a relation r on schema R such that

$$\Pi_{A,B,C}(r) \bowtie \Pi_{C,D,E}(r) \neq r$$

Lossy

A	B	C	D	E
A_1	B_1	C_1	d_1	e_1
A_2	B_2	C_1	d_2	e_2

[MCQ]

H.W

#Q. Consider a relation R(P Q R S T U) with set of FD's : $\{PQ \to R, QR \to P, PR \to Q, Q \to S, R \to T\}$

If the relation R is decomposed into Lossless and Dependency Preserving BCNF decomposing, then the minimum number of relation required in this decomposition?

A 1

B 2

C 3

D None of these

[MCQ]

#Q. Consider the following

S_1: Foreign key allows null values.

S_2: Every binary tables is in BCNF.

Which of the following is true?

A. Both S_1 and S_2 are true

B. S_1 is true

C. S_2 is true

D. None of these

$\boxed{\text{Ans (A)}}$

[MCQ]

#Q. Which of the following is not a condition for $X \rightarrow Y$ in Boyce code normal form?

A. $X \rightarrow Y$ is trivial

B. X is the super-key for the relational schema R

C. Y is the super-key for the relational schema R

D. All of the mentioned

$\boxed{\text{Ans (C).}}$

BCNF

① $X \rightarrow y$

X : Super key

② Binary Relation . BCNF.

③ $X \rightarrow y$ Trivial

$X \supseteq y$ $AB \rightarrow A$

[MCQ]

#Q. Consider the schema together with the functional dependency $(\underline{A \rightarrow} B, DE \rightarrow F, B \rightarrow C)$.

The highest normal form of the above relation is

C.K : ADE

A. 1 NF ✓

B. 2 NF

C. 3 NF

$\underline{A \rightarrow B}$

Violation of 2NF

D. BCNF

[MCQ]

#Q. Let R(ABCDE) be a relational schema and f = {$AB \rightarrow CD$, $ABC \rightarrow E$, $C \rightarrow E$} be the set of functional dependencies, what is the highest normal form of R?

A 1 NF

B 2 NF

C 3 NF

D BCNF

$(AB)^+ = (ABCDE)$

AB is Candidate key.

Non key Attribute = [C, D, E]

	2NF	3NF	BCNF
$AB \rightarrow CD$	✓	✓	✓
$ABC \rightarrow E$	✓	✓	✓
$C \rightarrow E$	✓	✗	✗

[NAT]

Home work

Consider a relation R with four Attributes A.B.C & D with the following FD's.

FD-I $C \to D$, $C \to A$, $B \to C$

FD-II $ABC \to D$, $D \to A$

FD-III $A \to B$, $BC \to D$, $A \to C$

FD-IV $AB \to C$, $AB \to D$, $C \to A$, $D \to B$

How many above FD are satisfied the 3NF (Third Normal From) for a relation schema R(ABCD) is__?

[MCQ] 2M 2020, 2M 2022

#Q. Indicate which of the following statements are true:

A relation database which is in 3NF may still have undesirable data redundancy because there may exist

A transitive functional dependencies.

Not Nonkey → Prime Attribute

Redundancy

3NF ✓

BCNF ✗

B non-trivial functional dependencies involving prime attributes on the right side.

C non-trivial functional dependencies involving prime attributes only on the left side.

D non-trivial functional dependencies involving only prime attributes.

R(ABCD)(AB→CD, D→A)

C.k : (AB, DB)

D → A

3NF But Not in BCNF.

3NF

$X \rightarrow y$

X : Super key.

OR

y : key / Prime Attribute

BCNF

$X \rightarrow y$

X : Super key.

[NAT]

Home work

Consider a relational schema R(ABCDEFGHIJK) with the following FD's set F

F: [AB→C, BD →EF, AD →GH, A→I, H→JK]

If a relation R is decomposed into lossless join & Dependency preserving 2NF & 3NF Decomposition. The minimum number of tables (Relation) required for 2NF decomposition R is 'A' and for 3NF decomposition of R is 'B' respectively then the value of 2A + B is___________.

Common Data for question

Suppose you are given relation

R(X, Y, Z, W) with functional dependencies

$XY \rightarrow Z$, $ZW \rightarrow X$ and $Y \rightarrow W$

Candidate key:

$\cancel{(XW)^+ = [XW]}$

$(XY)^+ = [XYZW]$

$(X)^+ = [X]$ ×

$(Y)^+ = [YWX$ ×

$\boxed{XY \text{ is CK}}$ — ①

P.A = [X, Y

$ZW \rightarrow X$

$(ZWY) - [ZWXY]$

X ZW ZY WY X

(ZWX) WY

✓ $[ZY]^+ = [ZYWX]$

[MCQ]

#Q. How many keys (minimal) are there in R?

A 1

B 2

C 3

D 4

XY, YZ Ans

[MCQ]

#Q. The highest normal form of R is

A. 1 NF

B. 2 NF

C. 3 NF

D. BCNF

$\boxed{\text{Ans (A)}}$

Non key Attribute = W

C.K = [XY, YZ]

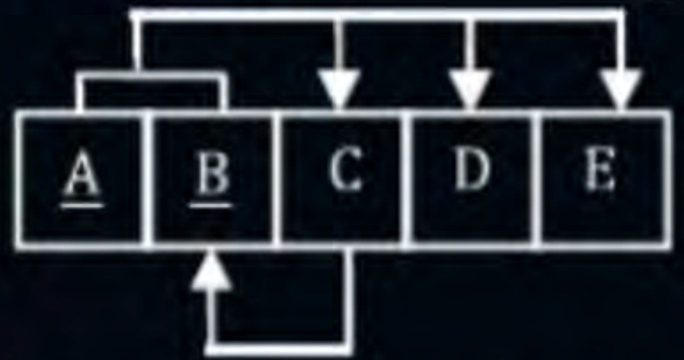
R(XYZW) [XY → Z, ZW → X, Y → W]

CHECK 2NF ?

Proper Subset of CK → Y → W a Non key Attribute } Not in 2NF

[MCQ]

#Q. Consider the following table



The table is in which normal form?

A First normal form

B Second normal form

C Third normal form but not BCNF

D BCNF

R(ABCDE)

[AB → CDE , C → B]

Candidate key = (AB, AC)

Non key Attribute = (D, E)

AB → CDE 2NF ✓ 3NF ✓ BCNF ✓

C → B 2NF ✓ 3NF ✓ Not in BCNF

C is Not super key.

[NAT]

H.W.

Consider the following relational schema R(ABCDE) with functional dependencies:
$\{AB \rightarrow C, D \rightarrow E, E \rightarrow A, D \rightarrow B\}$

The number of additional relations are required to convert it into lossless join & Dependency Presenting 2NF & 3NF Decomposition is__________

[MCQ]

H.W

#Q. Consider the following table Faculty (facName, dept, office, rank dateHired)

facName	dept	Office	rank	dateHired
Ravi	Art	A101	Professor	1975
Murali	Math	M201	Assistant	2000
Narayanan	Art	A101	Associate	1992
Lakshmi	Math	M201	Professor	1982
Mohan	CSC	C101	Professor	1980
Sreeni	Math	M203	Associate	1990
Tanuja	CSC	C101	Instructor	2001
Ganesh	CSC	C105	Associate	1995

Continue

(Assume that no faculty member within a single department has same name. Each faculty member has only one office identified in office). 3NF refers to third normal form and BCNF refers to Boyce-Code normal form. Then faculty is

A. not in 3NF, in BCNF

B. in 3 NF, not in BCNF

C. in 3 NF, in BCNF

D. Not in 3 NF, not in BCNF

Common Data for Question

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

$AB \rightarrow CD, AF \rightarrow D, DE \rightarrow F, C \rightarrow G, F \rightarrow E, G \rightarrow A$

Common Data for Question

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

$AB \rightarrow CD, AF \rightarrow D, DE \rightarrow F, C \rightarrow G, F \rightarrow E, G \rightarrow A$

6 CK

H.W

[MCQ]

#Q. How many candidate keys does the relation R have?

A 2

B 4

C 5

D 6

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

$AB \rightarrow CD$, $AF \rightarrow D$, $DE \rightarrow F$, $C \rightarrow G$, $F \rightarrow E$, $G \rightarrow A$

[MCQ]

#Q. The highest normal form of above relation is

A 3NF

B 2NF

H.W

C 1NF

D BCNF

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

$AB \rightarrow CD$, $AF \rightarrow D$, $DE \rightarrow F$, $C \rightarrow G$, $F \rightarrow E$, $G \rightarrow A$

[MCQ]

#Q. Consider a Relational schema R(A, B, C) with FD set:

$AB \rightarrow C$

$C \rightarrow B$

Which of the following statements is correct with respect to the question "R(A, B, C) can be decomposed into dependency preserving BCNF form"?

A. Probably YES

B. Probably NO

C. Not at all possible

D. Absolutely it is possible

[MCQ]

#Q. Given the following two statements: [A→B, B→C, C→A] Ck: A, B, C.

S1: A relation where attributes do have cyclic dependencies within themselves will always be in BCNF.(& single attributes keys)

S2: Only the dependency preservation property can differentiate between 3NF and BCNF

BCNF Defination ⇓ Differente

Which of the following is correct?

A. S_1 is true and S_2 is false

B. Both S_1 and S_2 are true

C. S_1 is false but S_2 is true

D. Both S_1 and S_2 are false

$\boxed{\text{Ans (A)}}$

But

$R(ABCD)$ $\{A \to B, B \to C, C \to A\}$

$Ck: \{AD, BD, CD\}$

But Not in BCNF

[MCQ]

#Q. Given the following two statements

S_1: 2NF allows Nonprime to non-prime (NP $\rightarrow$ NP) dependencies but relocks prime to prime (prime $\rightarrow$ prime) dependencies

S2: If there is a dependency $\alpha \rightarrow \beta$ and if only if α is a super key then the relation is in BCNF.

Which of the following is correct?

A. S_1 is true and S_2 is false

B. S_1 is false and S_2 is true

C. Both are false

D. Both are true

2 mins Summary

Topic

Topic

DBMS 02 : DBMS (Part-02)

THANK - YOU

CS & IT ENGINEERING

Database Management System

Lecture No.- 03

By- Vijay Agarwal Sir

Recap of Previous Lecture

- **Topic** Equalities between FD sets
- **Topic** Minimal Cover
- **Topic** Properties of Decomposition
- **Topic** Normal Form & NF Decomposition

Topics to be Covered

Topic — Normal Form & NF Decomposition

Topic — Transaction Concept

Topic — Serializable & Recoverable Schedule

Topic — Lock Based Protocol

COA

24 Nov.

9AM

Fast track

YouTube

ACID Property

A

C

I

D

[MCQ]

#Q. If the following information is found in log of stable storage while performing two transactions

1. $< T_0$, START $>$
2. $< T_0$ A, 900,890 $>$
3. $< T_0$, B, 500,510 $>$
4. $< T_0$, COMMITS $>$
5. $< T_1$ STARTS $>$
6. $< T_0$, C,2000,1900 $>$
7. $<T_1$, COMMITS $>$

If the data base is crashed after instruction set 6, and sub-term is using "differed data base modification technique to retrieve the information back, then which options is correct with respect to recovery condition

Commit ⇒ successfully executed

Redo List

Not Commit ⇒ Undo List

Checkpoint

A

UNDO(T_1)
REDO (T_0)
RESTART (T_1)

B

UNDO (T_1)
UNDO(T_0) RESTART (T_1)

C

REDO (T_0)
REDO (T_1)

$\boxed{\text{Ans (A)}}$

D

None of the above

[MCQ]

#Q. Assertion (a): The following schedule is conflict serializable schedule.

Reason (r): There is a cycle in this schedule.

R- W
W-R
W-W

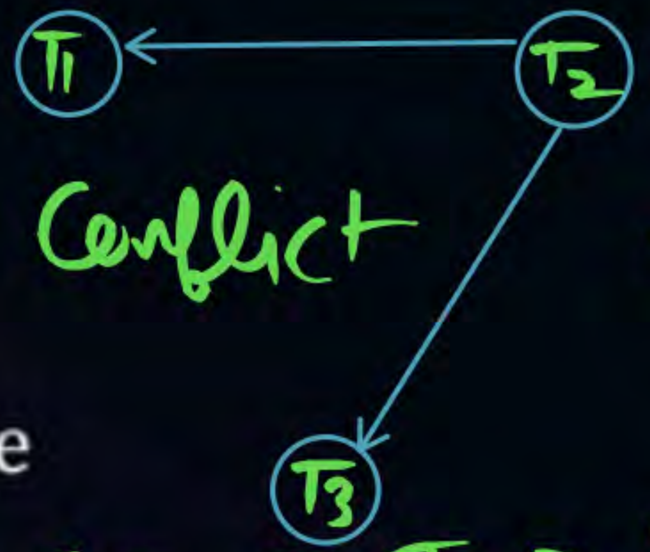
T1	T2	T3
		R(d)
	R(a)	
R(c)		
	W(a)	
	R(b)	
	R(c)	
		R(e)
R(a)		
		R(b)
	R(d)	
W(a)		
		W(b)
R(e)		

A. Both (a) and (r) are true and (r) is not correct reason for (a)

B. Both (a) and (r) are false

C. (a) is true but (r) is not true

D. None of these



conflict

(T2 T1 T3)
(T2 T3 T1)

[MSQ]

Consider the following schedules:

S: $R_1(C)\ R_1(A)\ W_1(A)\ R_1(B)\ R_2(B)\ R_2(C)\ W_2(B)\ R_3(B)\ W_1(A)\ W_2(C)\ W_2(A)\ W_3(C)$
$W_3(A)\ W_3(B)\ C_2\ C_3\ C_1.$

Which of the following is/are true about the schedule S?

A. Schedule is conflict serializable

B. Schedule is ~~conflict~~ Not Recoverable

C. Schedule is not conflict serializable

D. Schedule is Recoverable but not cascadeless

Ans (A) & (D)

T1	T2	T3
R(C)		
R(A)		
W(A)		
R(B)		
	R(B)	
	R(C)	
	W(B)	
		R(B)
W(A)		
	W(C)	
	W(A)	
		W(C)
		W(A)
		W(B)
	commit	
		commit
commit		

Uncommitted/ Dirty Read

so

Not Cascadeless

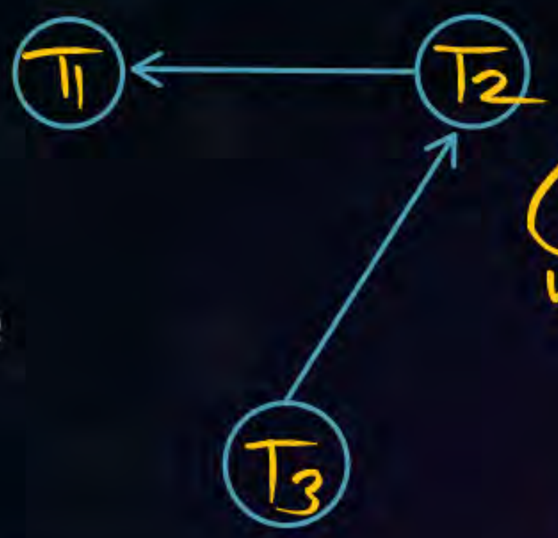
[MCQ]

#Q. A schedule

S: T_2: Read A; T_3: Read B; T_2: Write A; T_1 Read A; T_3: Write B T_2: Read B; T_1 Write A; T_2: Read C; T_2: Write C; T_1 Read C;

Is the above schedule is serializable if yes it is equivalent to which serial schedule.

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



A) $T_1 : T_2 : T_3$

B) It is not serializable

C) $T_2 : T_1 : T_3$

D) $T_3 : T_2 : T_1$

$\langle T_3\ T_2\ T_1 \rangle$

$\boxed{\text{Ans (D)}}$

[MCQ]

#Q. Consider the following two statements:

S_1: A serial schedule with 'n' number of transactions can generate n different conflict serialization schedule. Depends on the Read & write operation on Data Item in a schedule

S_2: A concurrent schedule with 'n' number of transactions can generate more than n serial schedule. ✗

Which of the following options are always correct?

Concurrent = Serial + Non Serial

A. SI in true where S2 is false

B. S2 is true where SI is false

C. Both the statements are true

D. Both the statements are false ✓

$\rightarrow 2! = 2$ Serial Schedule.

GATE 2015

T_1 :

T_2 :

$T_1 \rightarrow T_2 : 1$

$T_2 \rightarrow T_1 : 53$

Total Conflict Serializable $= 54$ Ans

[MCQ]

#Q. Consider the following transactions:

T_1: $R_1(x)$ $W_1(x)$ $R_1(y)$ $W_1(y)$

T_2: $W_2(y)$ $W_2(x)$

The number of non-serial schedules between T_1 and T_2 which are serializable?

Ans (D)

A 2

B 13

C 15

D None of these

'0' Ans

T_1: $R_1(X)$ $W_1(X)$, $R_1(y)$, $W_1(y)$

T_2: $W_2(y)$ $W_2(X)$

$T_1 : 4$

$T_2 : 2$

$T_1 \rightarrow n_1$ operation

$T_2 \rightarrow n_2$ operation

Total # Concurrent schedule $= \dfrac{(n_1 + n_2)!}{(n_1)!\,(n_2)!} \rightarrow \dfrac{(4+2)!}{(4!)(2!)}$

$= \dfrac{\cancel{6}^{3} \times 5 \times \cancel{4!}}{\cancel{2} \times \cancel{4!}} = 15$

serial schedule $= 2!$ = 2 serial schedule

Concurrent = Serial schedule + Non Serial schedule

Non serial $= 15 - 2 = 13$

$T_1: R_1(x)\ W_1(x),\ R_1(y),\ W_1(y)$

$T_2: W_2(y)\ W_2(X)$

Serial

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

$\langle T_1, T_2 \rangle$

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

$\langle T_2, T_1 \rangle$

$T_1: R_1(X)\ W_1(X),\ R_1(y),\ W_1(y)$

$T_2: W_2(y)\ W_2(X)$

Non Serial $\Rightarrow$ Serializable

(i) Conflict ?

(ii) View ?

T_1	T_2
R(X)	
	W(y)
	W(X)
W(X)	
R(y)	
W(y)	

CNC

T_1	T_2
	W(y)
R(x)	
W(X)	
R(y)	
W(y)	
	W(X)

CNC

Not Conflict

T_1: $R_1(X)$ $W_1(X)$, $R_1(y)$, $W_1(y)$

T_2: $W_2(y)$ $W_2(X)$

Non Serial ⇒ Serializable

(i) Conflict

(ii) View ?

T_1	T_2
R(X)	
	W(y)
	W(X)
W(X)	
R(y)	
W(y)	

Final write fail

T_1	T_2
R(X)	
W(X)	
R(y)	
W(y)	
	W(y)
	W(X)

T_1	T_2
	W(y)
	W(X)
R(X)	
W(X)	
R(y)	
W(y)	

T_1	T_2
	W(y)
R(X)	
W(X)	
R(y)	
W(y)	
	W(X)

final write

Lock Based Protocol :

[MCQ]

Consider the two transaction T_1 and T_2 with time stamp with 10 and 20 respectively. $r(x)$ & $w(x)$ denote read & write operation respectively on Data item X.

Consider the following schedule:

S: $r_1(x)\ r_1(y)\ r_2(y),\ r_2(x)\ w_2(y)\ w_1(y)\ w_2(x)$

Which of the following statements is correct?

Ans (c)

A Schedule S is allowed under Time stamp protocol.

B Schedule S is allowed under Thoms write Rule.

C Schedule S is Not Serializable.

D Schedule S is view Serializable.

S: $r_1(x)\, r_1(y)\, r_2(y)\, r_2(x)\, w_2(y)\, w_1(y)\, w_2(x)$

T_1	T_2
r(x)	
r(y)	
	r(y)
	r(X)
	w(y)
w(y)	
	w(X)

View
1. Initial Read
2. Final Write
3. Write - Read sequence

Cycle Not Conflict & Not View.

T_1	T_2
r(x)	
r(y)	
W(y)	
	r(y)
	r(X)
	W(y)
	W(X)

Final write only Fail

$\langle T_1\ T_2 \rangle$

T_1	T_2
	r(y)
	r(x)
	W(y)
	W(x)
r(x)	
r(y)	
W(y)	

$\langle T_2, T_1 \rangle$

Initial Read on x & y in T_1 Fail

S: $r_1(x)\, r_1(y)\, r_2(y)\, r_2(x)\, w_2(y)\, w_1(y)\, w_2(x)$

10	20
T_1	T_2
$r(X)$	
$r(y)$	
	$r(y)$
	$r(X)$
	$w(y)$
$w(y)$	
	$w(X)$

I: TSP

$R \rightarrow W$
$W \rightarrow R$
$W \rightarrow W$.

$w_2(y) - w_1(y)$: Not TSP

$r_2(y) - w_1(y)$ Not TSP.

$TS(T_1): 10\ ,\ TS(T_2): 20$

$TS(T_1) < TS(T_2)$

$T_1 \rightarrow T_2$

All conflict operations order must be $T_1 \rightarrow T_2$ (T_1 followed by T_2)

S: $r_1(X)\, r_1(y)\, r_2(y)\, r_2(X)\, w_2(y)\, w_1(y)\, w_2(X)$

T_1 (10)	T_2 (20)
r(X)	
r(y)	
	r(y)
	r(X)
	w(y)
w(y)	
	w(X)

II. Thomas write Rule. (TWR)

R → W
W → R
W → W.

→ obselete write Allowed

$w_2(y) - w_1(y)$: yes allowed in TWR.

$r_2(y) - w_1(y)$ Not allowed Under TWR.

$TS(T_1): 10$, $TS(T_2): 20$

$TS(T_1) < TS(T_2)$

$\boxed{T_1 \rightarrow T_2}$

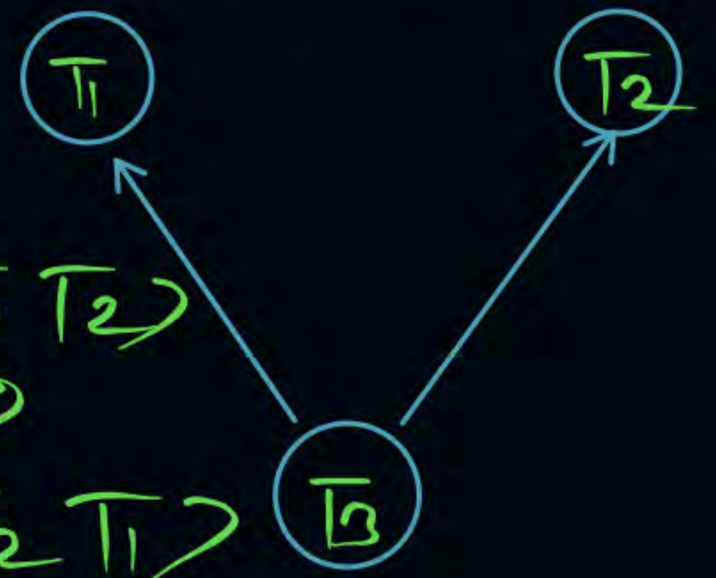
All Conflict operations order must be $T_1 \rightarrow T_2$ (T_1 followed by T_2)

[MCQ]

#Q. Consider the following schedule for transactions T_1, T_2 and T_3

Which options is true in relating to serialization of the above?

T_1	T_2	T_3
R(X)		
W(X)		
		R(Y)
		R(Z)
		W(Y)
		W(Z)
	R(Z)	
R(Y)		
W(Y)		



$\langle T_3\ T_1\ T_2 \rangle$

or

$\langle T_3\ T_2\ T_1 \rangle$

A $T_3 \rightarrow T_1 \rightarrow T_2$

B $T_3 \rightarrow T_2 \rightarrow T_1$

C Both $T_3 \rightarrow T_1 \rightarrow T_2$ and $T_3 \rightarrow T_2 \rightarrow T_1$

D None of the above

$\boxed{\text{Ans [C].}}$

[MCQ]

#Q. Consider the following schedule S of transactions T_1 & T_2 with A as data item S:$r_1(a)$ $w_2(a)$ w_1 (a) c_1,c_2

Which of the following is true, about the schedule S?

A ~~S is conflict serializable but also recoverable.~~

B ~~S is view serializable but also recoverable.~~

C S is recoverable but not view serializable.

D None of the above

Ans [C].

$r_1(a)\ w_2(a)\ w_1(a)\ C_1\ C_2$

T_1	T_2
r(a)	
	W(a)
W(a)	
Commit	
	Commit

Not Strict Rec

No WR

So Recoverable ✓

Cascadeless ✓

Not Strict Recoverable.

Cycle Not Conflict, & Not View

T_1	T_2
r(a)	
W(a)	
	W(a)

$\langle T_1\ T_2 \rangle$

final write Fail.

T_1	T_2
	W(a)
r(a)	
W(a)	

$\langle T_2, T_1 \rangle$ ✗

Initial Read fail.

T_1	T_2
W(A)	
	R(A)
C/R	
	• Commit

Recoverable

T_1	T_2
W(A)	
C/R	
	R(A)

Cascadeless

T_1	T_2
W(A)	
C/R	
	R(A)/W(A)

Strict Recoverable.

[MCQ]

$T_1 : 1 \quad T_2 : 2 \quad T_3 : 3.$

#Q. Which of the following schedule is allowed under basic timestamp protocol?

S_1: $r_1(x), r_3(x), w_1(x), r_2(x), w_2(x)$

S_2: $r_1 x), r_3(x), w_3(x), w_1(x), r_2(x)$

S_3: $r_3(x), r_2(x), w_3(x), r_1(x), w_1(x)$

S_4: $r_1(x), r_3(x), r_2(x), w_1(y), w_3(x)$

(a)

T_1	T_2	T_3
r(x)		
		r(x)
w(x)		
	r(x)	
	w(x)	

NOT TSP

NOT TWR

(b)

T_1	T_2	T_3
r(x)		
		r(x)
		w(x)
w(x)		
	r(x)	

Not TSP.

NOT TWR

A S_1

B S_2

C S_3

D S_4

[MCQ]

$T_1 : 1 \quad T_2 : 2 \quad T_3 : 3.$

#Q. Which of the following schedule is allowed under basic timestamp protocol?

S_1: $r_1(x), r_3(x), w_1(x), r_2(x), w_2(x)$ ©

S_2: $r_1 x), r_3(x), w_3(x), w_1(x), r_2(x)$

S_3: $r_3(x), r_2(x), w_3(x), r_1(x), w_1(x)$

S_4: $r_1(x), r_3(x), r_2(x), w_1(y), w_3(x)$

T_1	T_2	T_3
		r(x)
	r(x)	
		w(x)
r(x)		
w(x)		

Not TSP

Not TWR

T_1	T_2	T_3
r(x)		
		r(x)
	r(x)	
w(y)		
		w(x)

$T_1 \to T_2 \to T_3$

YES TSP ✓

YES TWR ✓

A S_1

B S_2

C S_3

D S_4 ✓

[MCQ]

H.W

Consider the following four schedule involving Two Transactions (Indicated by the subscript using read & write on data item a denoted by R(A) & W(B) respectively. Which of the following schedule is view serializable but not conflict serializable?

A. $R_1(A)\ W_1(A)\ R_2(A)\ R_1(B)\ R_2(B)\ W_2(B)$ $\rightarrow W_2(B)$.

B. $R_1(A)\ W_1(A)\ W_2(A)\ R_1(B)\ W_1(B)\ R_2(B)$

C. $R_1(A)\ W_2(A)\ W_1(A)\ R_1(B)\ W_1(B)\ W_2(B)$

D. $R_2(A)\ W_1(A)\ W_2(B)\ W_1(B)\ W_2(A)\ W_1(A)$

[MCQ]

#Q. Consider the following schedule S of transactions T_1, T_2 & T_3 with x, y data items, C_1, C_2 & C_3 are commit

S: $R_3(x), R_1(x), R_2(x), w_1(y), R_2(y), w_2(x), C_3, C_1, C_2$

Which of the following is true, about the schedule S?

T_1	T_2	T_3
		R(x)
R(x)		
	R(x)	
W(y)		
	R(y)	
	W(X)	
		Commit
Commit		
	Commit	

Recoverable

Not Cascadeless

A. ~~S is non-recoverable~~

B. S is recoverable, but has a cascading abort

Rollback

C. S does not have a cascading abort

D. S is strict

[MCQ]

#Q. Which of the following statement is/are incorrect?

1. A schedule following strict two phase locking protocol is conflict serializable as well as recoverable → True
2. Checkpoint in schedules are inserted to ensure recoverability

→ Minimize the Redo - undo operation.

A Only 1

B Only 2

C Both 1 and 2

D None

[MCQ]

H.W

#Q. Consider the following schedule S of transaction T_1 and T_2

Which of the following statements is correct?

T_1	T_2
Read(X)	
Write(X)	
	Read(X) Write(X) Commit:
Read(X) Write(X) Commit	

A. S in conflict-Serializability but not recoverable

B. S is conflict-Serializability and also recoverable

C. S is neither conflict-Serializability nor recoverable

D. S is not conflict-Serializability but recoverable

[MCQ]

H.W

#Q. Consider the following schedules S1 & S2

S_1: Lock -s(A); r(A); lock-x(B); unlock(A);r(B); w(B); commit unlock(B)

S_2: Lock-s(A); r(A); Lock-x(B); r(B); w(B); commit unlock(A); unlock(B);

Which of the following true?

A. S_1 is rigorous 2PL and S_2 is conservative 2 PL.

B. S_1 is simple 2PL and S_2 is strict 2PL.

C. S_1 is strict 2PL and S_2 is rigorous 2PL.

D. None

[MCQ]

H.W

#Q. Consider the following schedule S_1, S_2

S_1: $r_2(x), r_2(y), r_1(x), r_1(y), w_1(x), w_2(x)$

S_2: $r_2(x), r_2(y), w_2(x), r_1(x), r_2(y)$

Which of the following is correct?

A. S_1 results in lost-update problem & dirty read S_2 results in dirty read

B. S_1 results in lost-update problem & unrepeatable read & S_2 results in unrepeatable read

C. S_1 results in lost-update problem & unrepeatable read & S_2 results in dirty read

D. None

2 mins Summary

Topic One

Topic Two

Topic Three

Topic Four

43

Topic Five

Lock Based Protocol :

THANK - YOU

CS & IT ENGINEERING

Database Management System

Lecture No.- 04

By- Vijay Agarwal Sir

Recap of Previous Lecture

Topic Normal Form & NF Decomposition

Topic Transaction Concept

Topic Serializable & Recoverable Schedule

Topic Lock Based Protocol

Topics to be Covered

Topic ER Model Concept

Topic ER Model to RDBMS Conversion

Topic Foreign Key Concept

[MCQ]

#Q. Match the following

	List-I	List-II
2	a. 	1. One to one relationship
3	b.  M:N	2. Relationship
4	c.  M:1	3. Many to many relationship
1	d.  1:1	4. Many to one relationship

Codes:

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

Ans [C]

[MCQ]

#Q. Database ___ which is the logical design of the database, and the database _
_ which is a snapshot of the data in the database at a given instant in time.

A instance, schema

B relation, schema

C relation, domain

D schema, instance

$\boxed{\text{Ans (D)}}$

[MCQ]

Consider the Relation R(a, b, c) and S(c, d, e) where c is primary key of R and d is the primary key of S. Relation R contain 6000 tuples and relation S contains 7000 tuples, what will be the maximum number of tuples possible in $R \bowtie S$?

A. 6000

B. 12000

C. 13000

D. 7000

F.K

R(a, b, c)   S(c, d, e)

c is P.K   d : is P.K

Referenced Relⁿ   Referencing Relⁿ

6000   7000

$R \bowtie S = 7000$ Maximum

(Maximum Tuples # Tuples in the Referencing Relⁿ)

[MCQ]

#Q. Consider the following ER model

The minimum number of tables needed to represent the given ER model is

A 2

B 3

C 1

D None of these

Foreign Key Concept

⇓

Referencing Relation

1. ON DELETE NO ACTION
2. ON DELETE CASCADE
3. ON DELETE SET NULL

[NAT]

Consider the following table with two attributes A and C, where A is primary key and C is foreign key referencing A with on delete cascade.

The number of tuples that must be additionally deleted to preserve referential integrity when the tuple (4, 5) deleted is___?

P.K

A	C
~~3~~	~~4~~
~~4~~	~~5~~
5	6
~~7~~	~~4~~
~~9~~	~~7~~
~~11~~	~~4~~
8	6
12	13
~~10~~	~~9~~
6	8
13	12

(4, 5) Primary key '4' Deleted

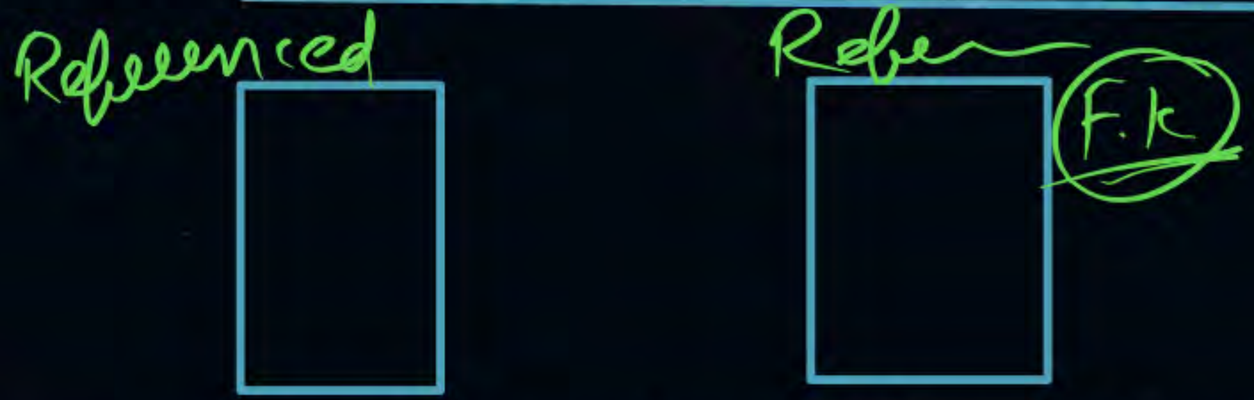
(3, 4) (7, 4) (11, 4)

(C (10, 9)

5 Ans

[MCQ]

#Q. Which of the following in true regarding referential integrity?



~~A~~ Every primary-key value must match a primary-key value in an associated table.

~~B~~ Every primary-key value must match a foreign-key value in an associated table.

C Every foreign-key value must match a primary-key value in an associated table.

D Every foreign-key value must match a foreign-key value in an associated table.

[MCQ]

#Q. When mapping a many-to-many unary , relationship into a relation which of the following is true?

A One relation is created

B Two relations are created

C Three relations are created

D Four relations are created

Unary.

Q.

Let R (a, b, c) and s(d, e, f) be two relation in which d is the foreign key of S that refers to the primary key of R. Consider the following four operations on R and S.

R(abc) s(d e f)

(i) Insert into R

(ii) Insert into S

Referencing Rel

(iii) Delete from R

(iv) Delete from S

Delete x

Insert x

Which of the following is true about the referential integrity constraint above?

A. None of (i), (ii), (iii), or (iv) can cause its violation

B. All of (i), (ii), (iii), and (iv) can cause its violation

C. Both (i) and (iv) can cause its violation

D. Both (ii) and (iii) can cause its violation

MCQ

Suppose $R_1(\underline{A}, B)$ and $R_2(\underline{C}, D)$ are two relation schemes. Let r_1 and r_2 be the corresponding relation instances. B is a foreign key that refers to C in R_2. If data in r_1 and r_2 satisfy referential integrity constraints, which of the following is ALWAYS TRUE?

F.K $\quad R_1(\underline{A}\,B) \quad R_2(\underline{C}\,D)$

Referencing Rel

A. $\Pi_B(r_1)-\Pi_C(r_2)=\phi$

B. $\Pi_C(r_2)-\Pi_B(r_1)=\phi$

C. $\Pi_B(r_1)=\Pi_C(r_2)$

D. $\Pi_B(r_1)-\Pi_C(r_2)\neq\phi$

$\boxed{\text{Ans}|A}$

B
5
5
7
7

C	D
5	
6	
7	
8	

[MCQ]

#Q Consider the following schema with 3 relation P, Q and R. In relation P having 3 attributes C, D and E in which C is the primary key. Relation Q having 2 attributes B and C in which B is primary key and attribute C is foreign key reference to the primary key of relation P, with on delete cascade. Relation R having 2 attributes A and B in which A is primary key and attribute B is foreign key reference to the primary key of relation Q on delete set NULL. Here domain of all attributes A, B, C, D and E are integer. Suppose the content of relation P, Q and R are given below:

ON DELETE SETNULL

ON DELETE CASCADE

P.K

R(A B)

A	B
1	1
2	2

NULL

NULL

Q(B C)

B	C
1	1
2	1
3	1

Delet

P.k 1,2,3

PK

P(C D E)

C	D	E
1	1	2
2	1	3
3	1	4
4	2	5

P.K [1,2,3,4]

Continue

When all record in the table P deleted (Deleted from P) then what tuples will relation R contain?

A. (1, NULL) (2, NULL) (3, NULL)

B. (1, NULL) (2, NULL) (3, 1)

C. (1, 1) (2, 2)

D. (1, NULL) (2, NULL)

$\boxed{\text{Ans (D)}}$

NAT

Consider the following tables T1 and T2.

In table T1, **P** is the primary key and **Q** is the foreign key referencing **R** in table T2 with on-delete cascade and on-update cascade. In table T_2, **R** is the primary key and **S** is the foreign key referencing **P** in table T1 with on-delete set NULL and on-update cascade. In order to delete record ⟨3,8⟩ from table T1, the number of additional records that need to be deleted from table T1 is

ON DELETE SET NULL

ON DELETE CASCADE

T_1	
P P.K	Q F.K
2	2
~~3~~	~~8~~
7	3
5	8
6	9
8	5
9	8

T_2	
R P.K	S F.K
2	2
8	~~3~~ NULL
3	2
9	7
5	7
7	2

ON DELETE CASCADE
ON UPDATE CASCADE

'0'

[MCQ]

Domain Age +ve Integer

#Q. Match the following with respect to RDBMS:

List-I	List-II
a. Entity integrity — 4	1. Enforces some specific business rule that do not fall into entity or domain
b. Domain integrity — 3	2. Rows can't be deleted which are used by other
c. Referential integrity — 2	3. Enforces valid entries for a column
d. User defined integrity — 1	4. No column duplicate rows in a table

Ans (B)

Codes:

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

[MCQ]

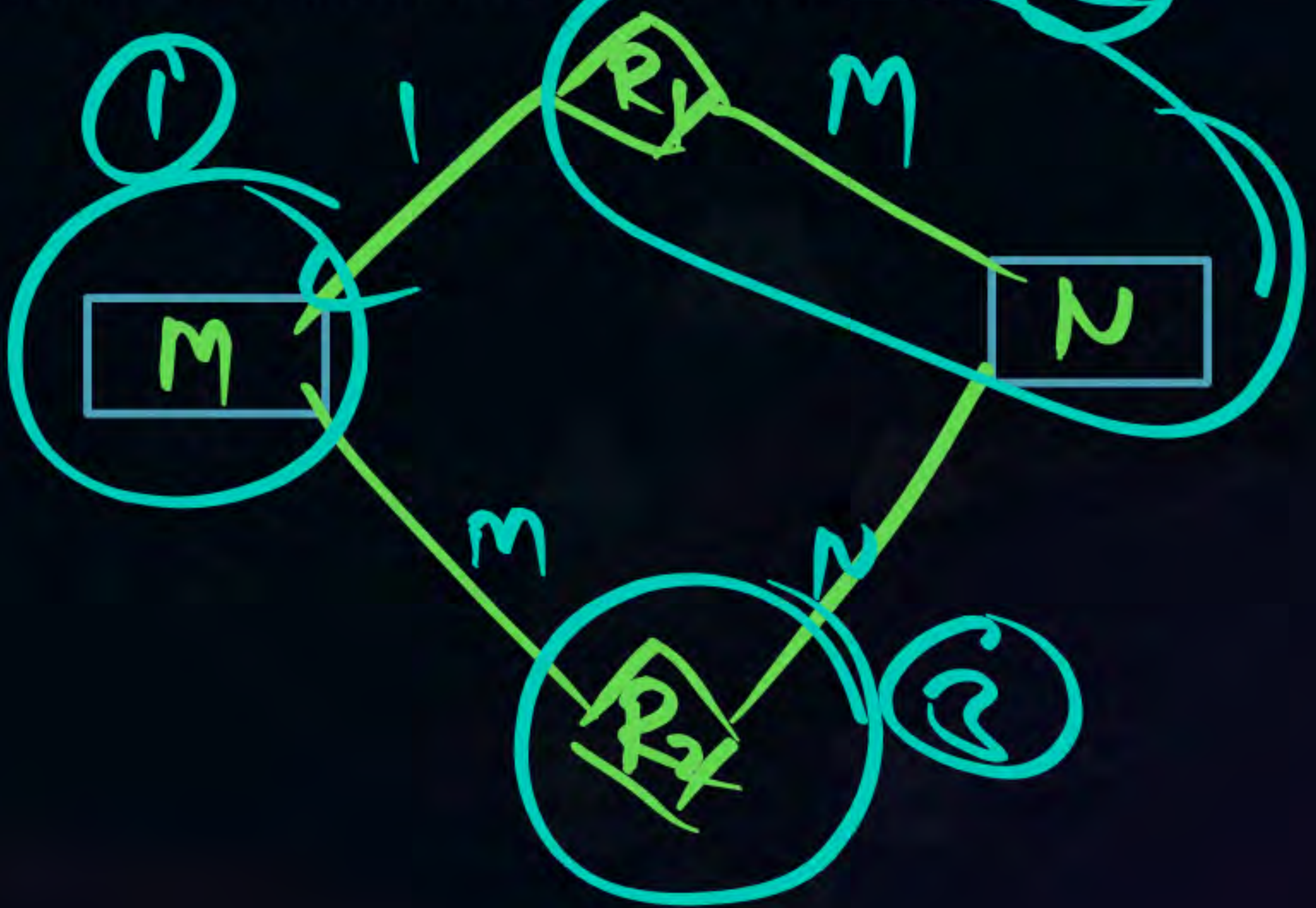
#Q. Let M and N be two entities in an E-R diagram with simple single value attributes. R_1 and R_2 are two relationship between M and N, where as R_1 is one-to-many and R_2 is many-to-many. The minimum number of tables required to represent M, N, R_1 and R_2 in the relational model are ___

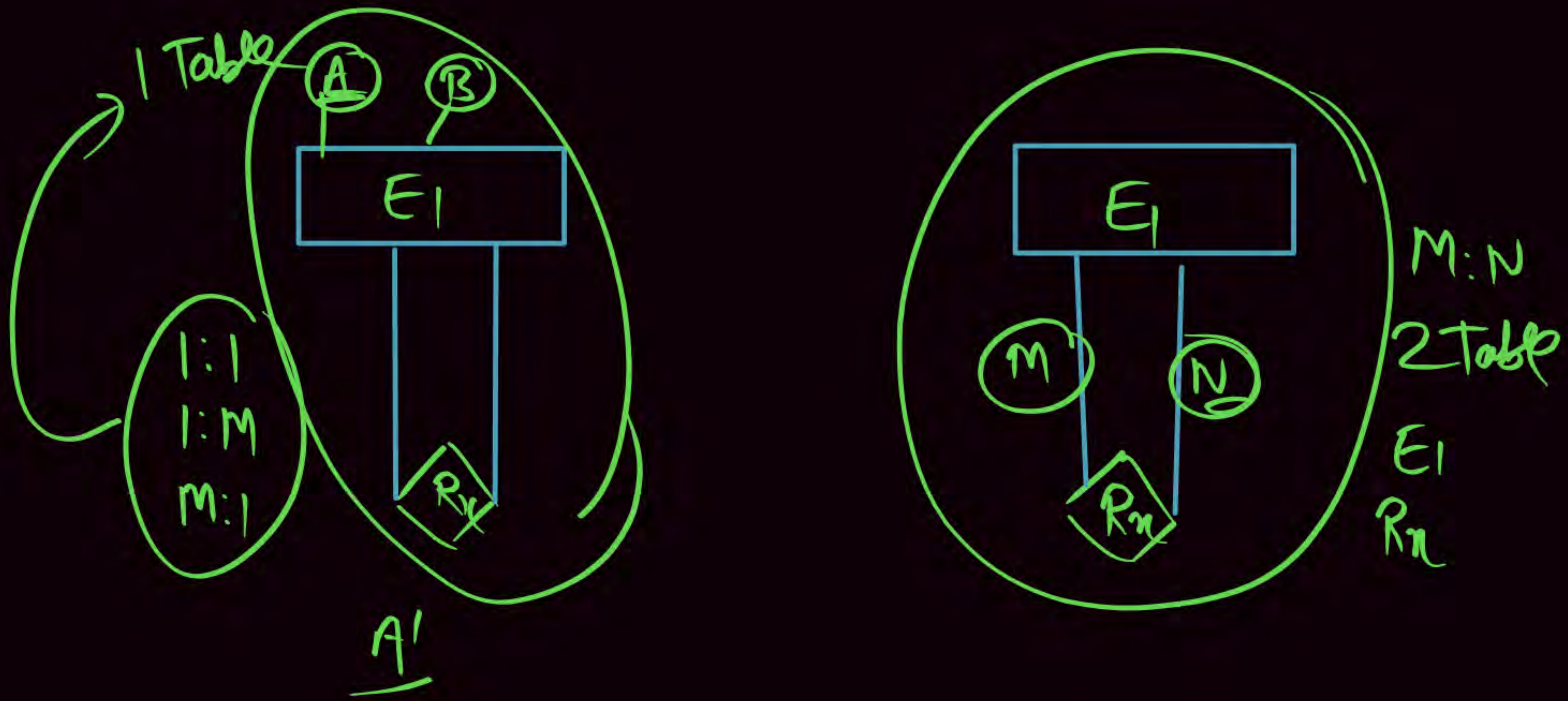
A 4

B 6

C 7

D 3

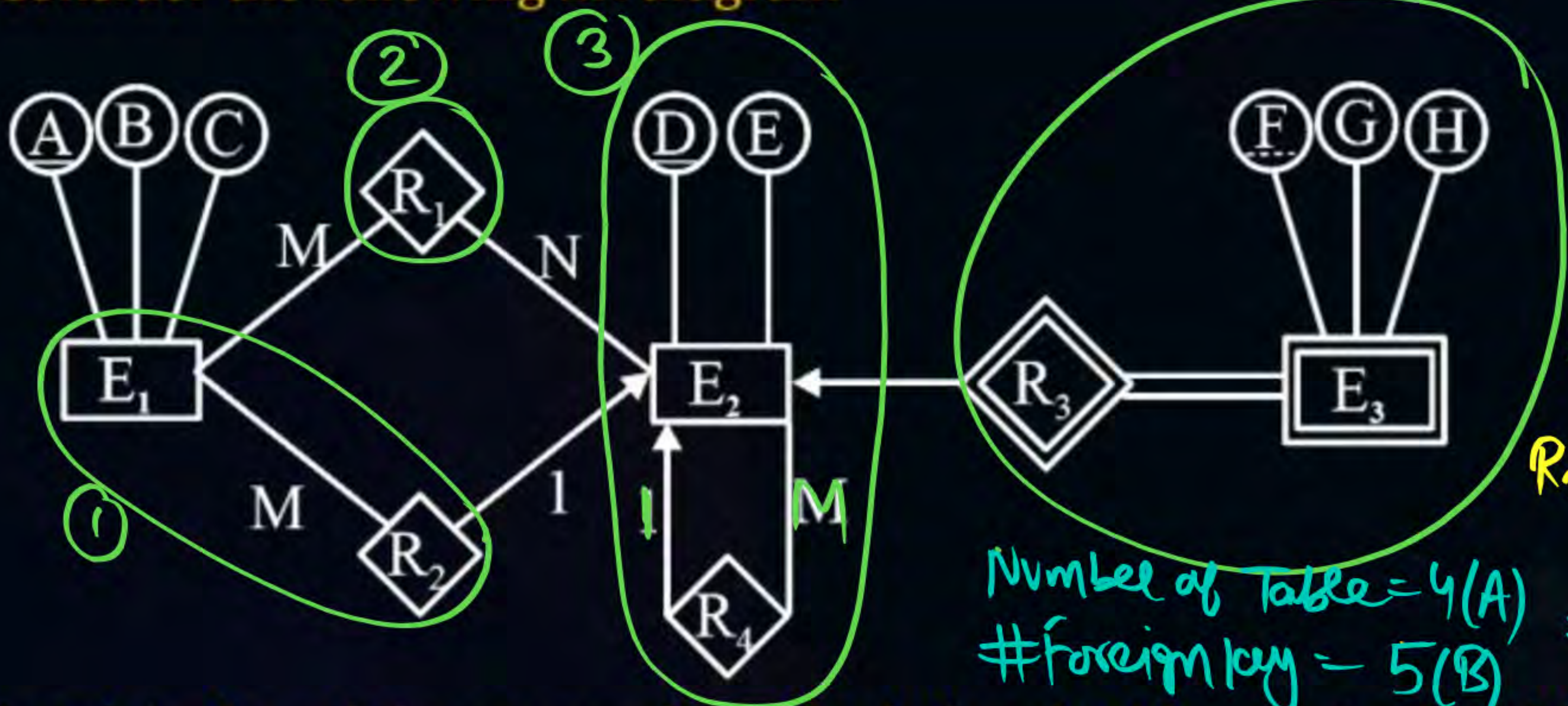




1 Table
A
B
E1
1:1
1:M
M:1
R
A'
E1
M
N
R
M:N
2 Table
E1
R

NAT] [2 Marks]

Consider the following ER diagram



1F.K

E_1R_2(A B C D) : 1FK (D)

R_1 (A D) : 2 FK(A,D)

E_2R_4(D E D_1) : 1 FK(D_1)

R_3E_3(F G H D) : 1FK(D)

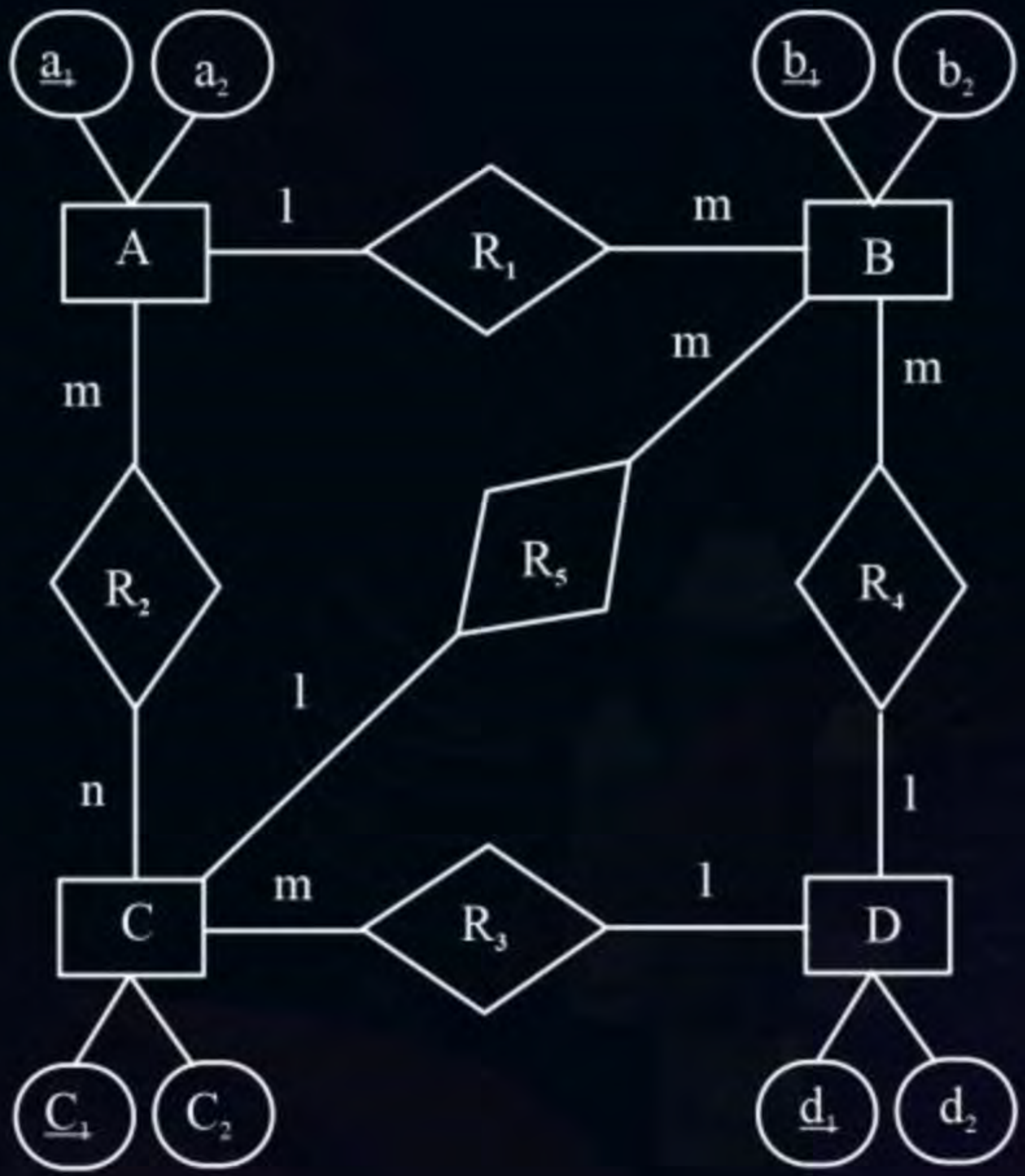
Number of Table = 4 (A)

#foreign key = 5 (B)

⇒ 2A + B ⇒ 2×4+5 = 13 Ans

Let A is the minimum number of relational table required and B is the minimum number of foreign key required for conversion of ER into relational table then value of 2A + B is 13. Ans

Common data for Question No. 1,2 & 3 Consider the following ER-diagram



[MCQ]

#Q. The minimum number of tables needed to represent A, B, C, D, R_1, R_2, R_3, R_4, R_5 is

A 3

B 4

C 5

D 6

[MCQ]

#Q. Above ER diagram, consists of Entity types B and D. These are connected by R4 which does not have its own attribute.

Which one of the following is correct?

A) Relationship R4 is many to one so R4 can be merged with that of B.

B) Relationship R4 is many to one so R4 can be merged with that of D.

C) Both a and b

D) None of these

[MCQ]

#Q. Which of the following is a correct attribute set for one of the tables for the correct answer to the above question?

A (a_1, b_1, c_1)

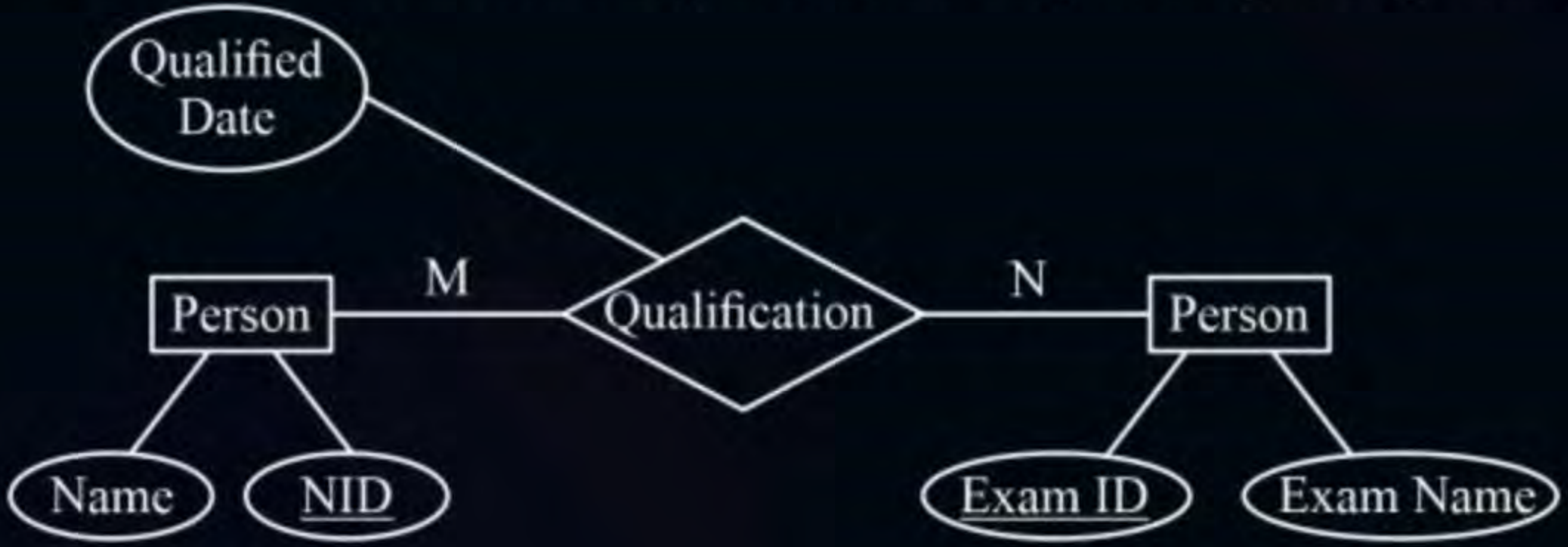
B (b_1, b_1, c_1, a_1)

C (c_1, c_2)

D (a_1, a_2)

[MCQ]

#Q. Consider the following relationship entity diagram (ERD)



Which of the following possible relations will not hold if the above ERD is mapped into a relation model?

A. Person (NID, Name)

B. Qualification (NID, ExamID, QualifiedDate)

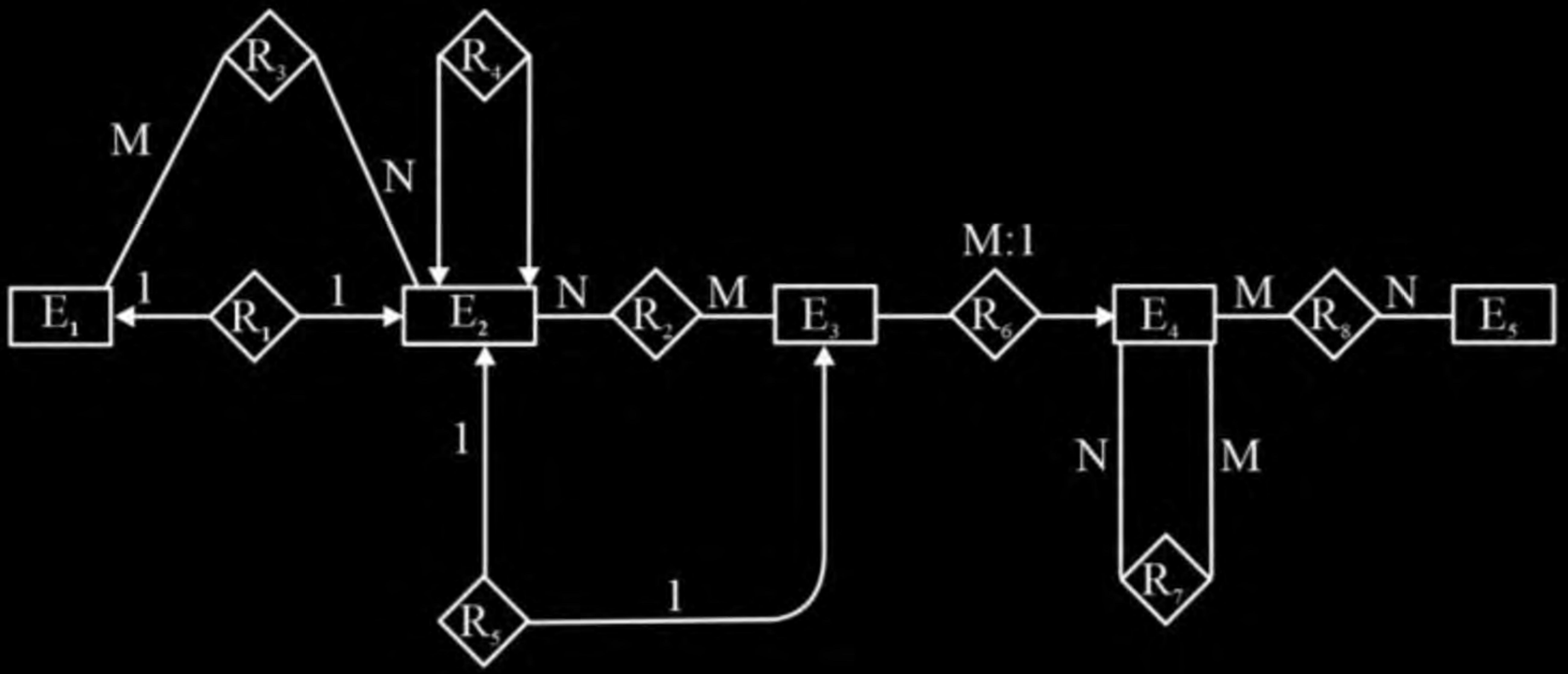
C. Exam (ExamID, NID, ExamName)

D. Exam (ExamID, ExamName)

[NAT]

Consider the following ER diagram:

The minimum number of RDBMS table required for this ER diagram is ___.



[MCQ]

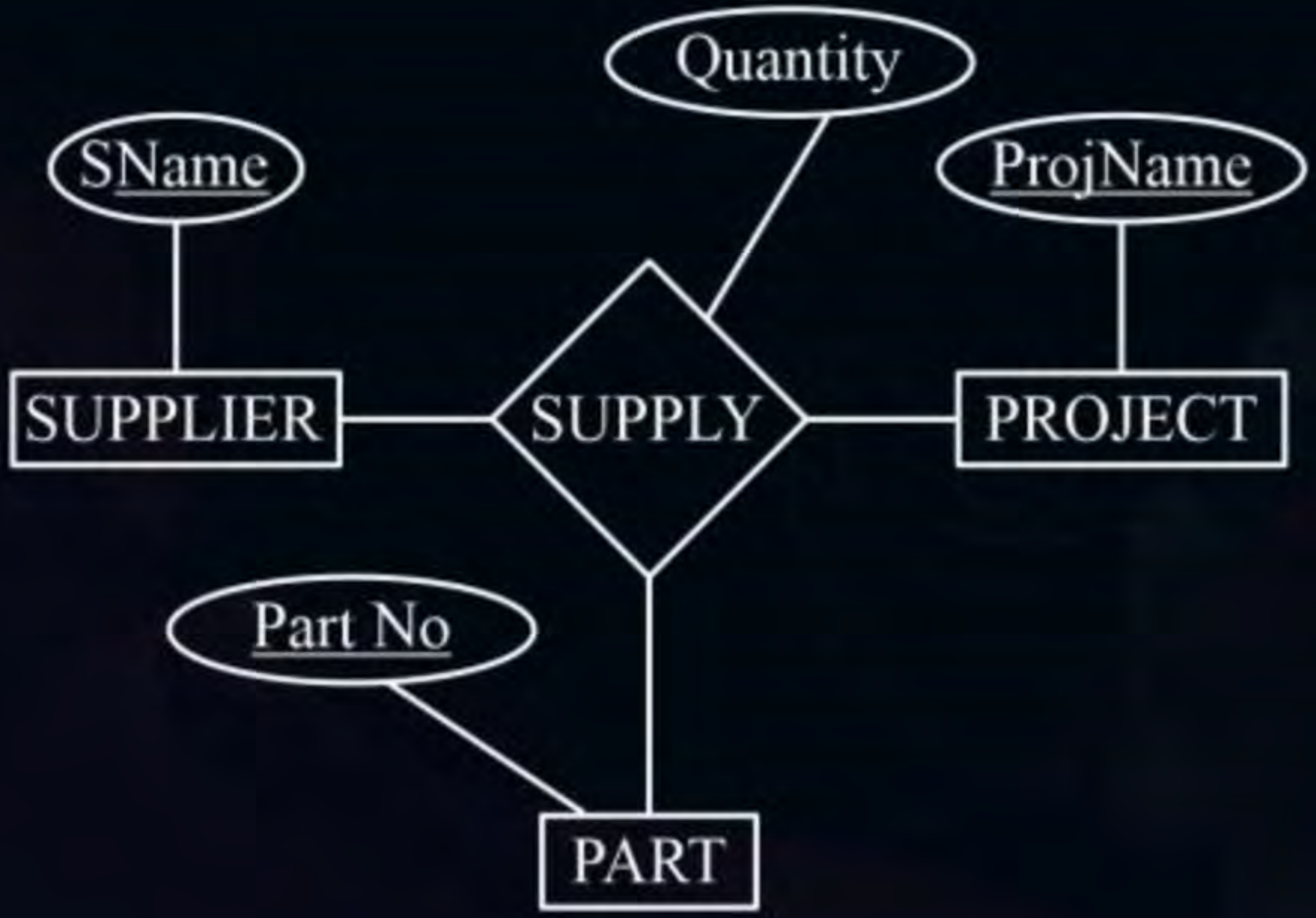
#Q. What will be the number of relations if we follow ER-to-Relational Mapping Algorithm?

A 3

B 4

C 5

D 6



2 mins Summary

Topic

DBMS (Part 04)

Topic

THANK - YOU

CS & IT ENGINEERING

Database Management System

Lecture No.- 05

By- Vijay Agarwal Sir

Recap of Previous Lecture

- **Topic**: ER Model Concept
- **Topic**: ER Model to RDBMS Conversion
- **Topic**: Foreign Key Concept

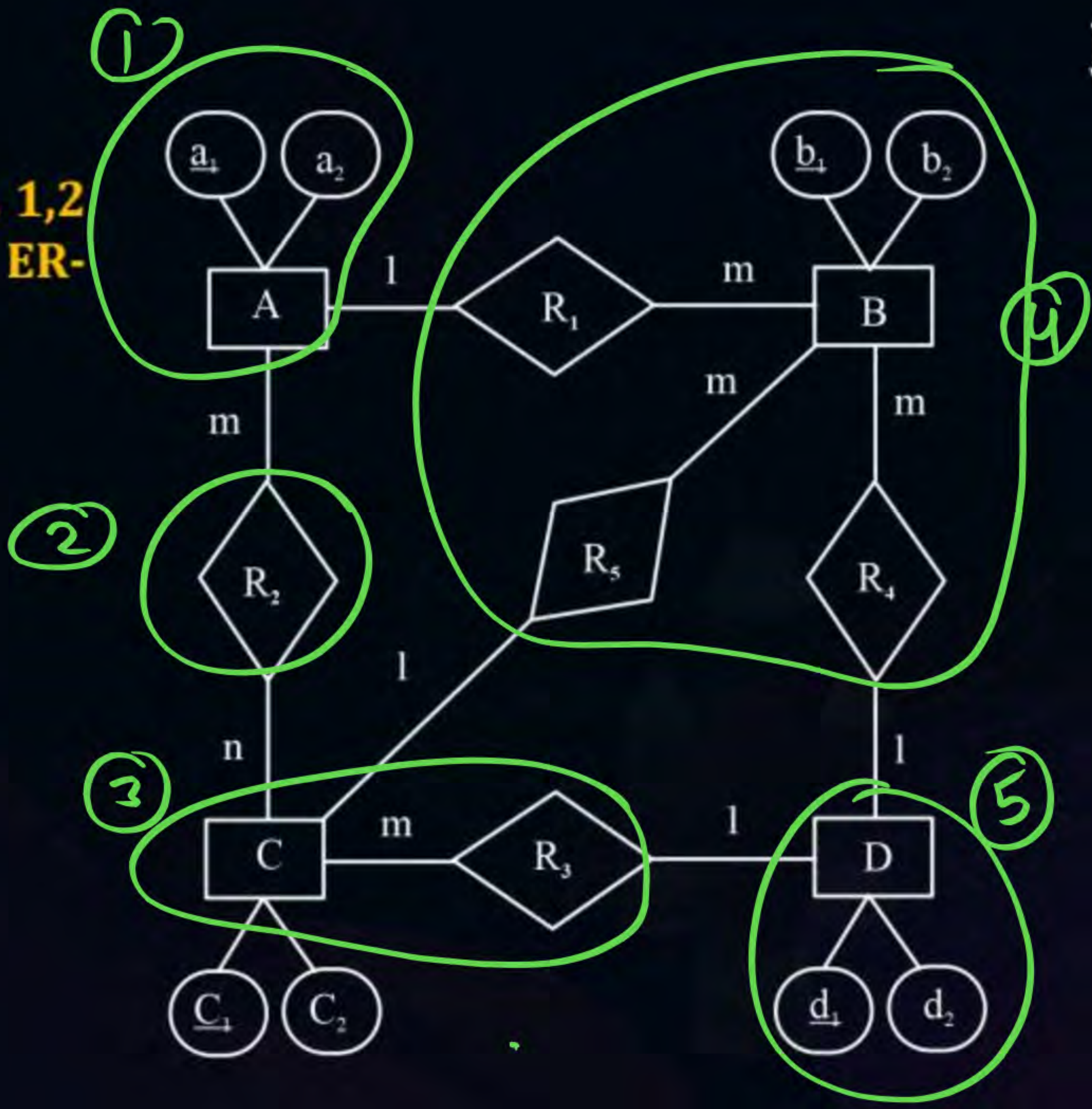
Topics to be Covered

Topic Foreign Key Concept

Topic Relational Algebra

Topic Structured Query Language

Common data for Question No. 1,2 & 3 Consider the following ER-diagram



[MCQ]

#Q. The minimum number of tables needed to represent A, B, C, D, R_1, R_2, R_3, R_4, R_5 is

A 3

B 4

C 5

D 6

[MCQ]

#Q. Above ER diagram, consists of Entity types B and D. These are connected by R4 which does not have its own attribute.

Which one of the following is correct?

A. Relationship R4 is many to one so R4 can be merged with that of B.

B. Relationship R4 is many to one so R4 can be merged with that of D.

C. Both a and b

D. None of these

Ans(A)

[MCQ]

#Q. Which of the following is a correct attribute set for one of the tables for the correct answer to the above question?

A (a_1, b_1, c_1)

B (b_1, b_1, c_1, a_1)

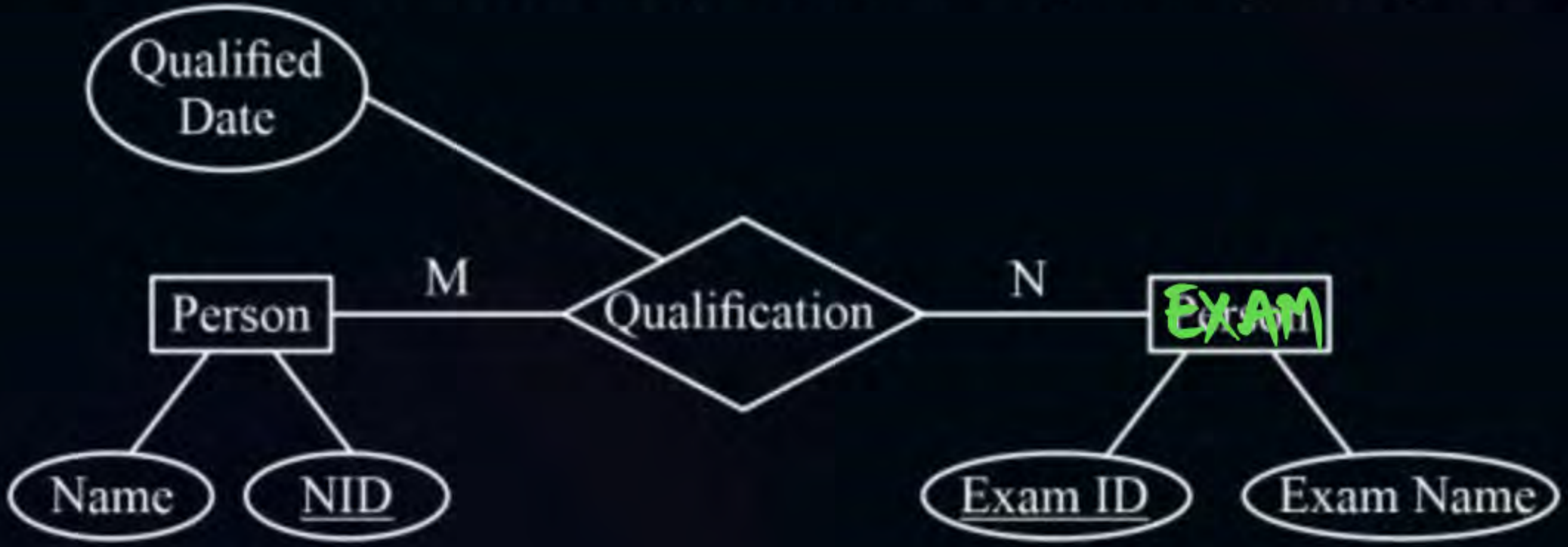
C (c_1, c_2)

D (a_1, a_2)

$\boxed{\text{Ans (D).}}$

[MCQ]

#Q. Consider the following relationship entity diagram (ERD)



Ans (C).

Which of the following possible relations will not hold if the above ERD is mapped into a relation model?

A. Person (NID, Name)

B. Qualification (NID, ExamID, QualifiedDate)

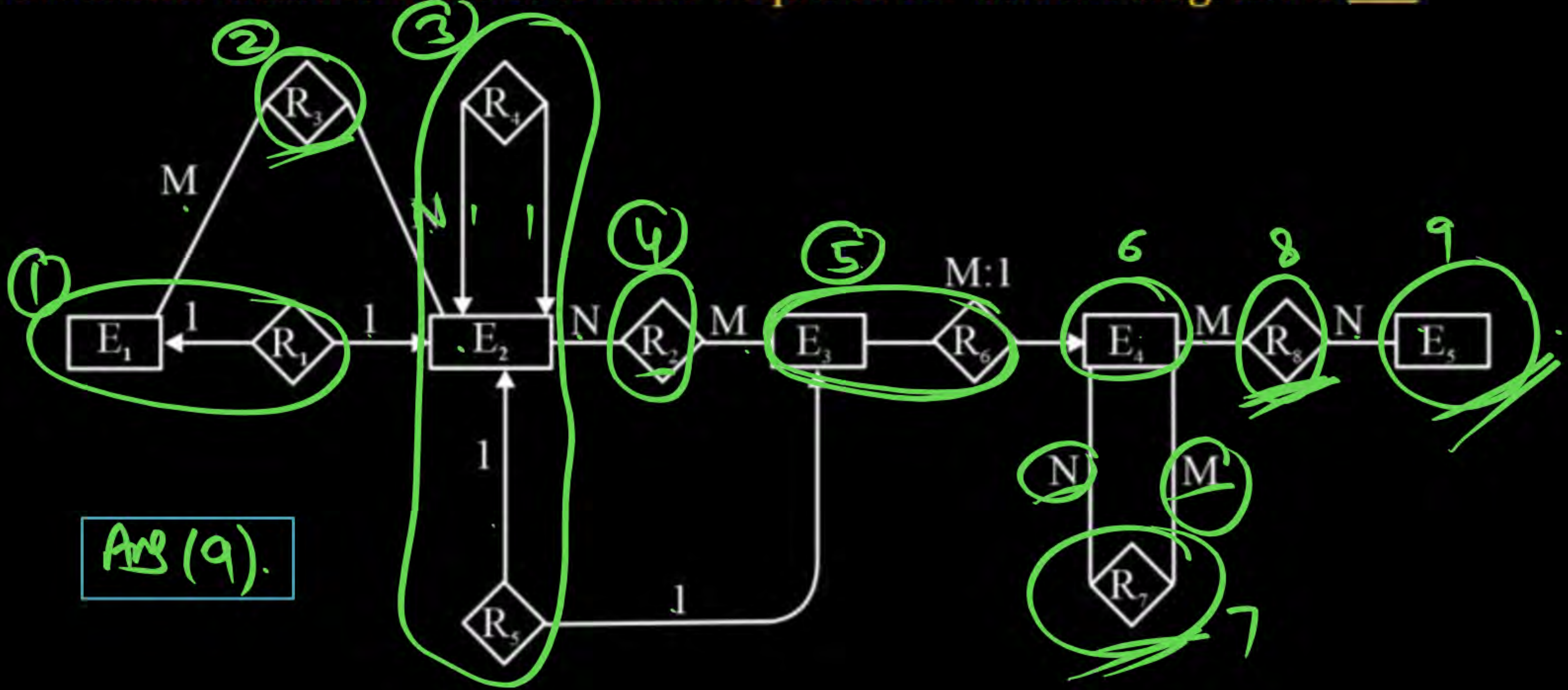
C. Exam (ExamID, NID, ExamName)

D. Exam (ExamID, ExamName)

[NAT]

Consider the following ER diagram:

The minimum number of RDBMS table required for this ER diagram is ___.



[MCQ]

#Q. In SQL, relations can contain null values, and comparisons with null values are treated as unknown. Suppose all comparisons with null value are treated as false. Which of the following pairs in not equivalent?

A. $x = 5$, not (not($x = 5$))

B. $x = 5$, $x > 4$ and $x < 6$ where x is an integer

C. $x \neq 5$, not ($x = 5$)

D. None of the above

[MCQ]

#Q. A table T1 in a relational database has the following rows and columns.

Roll no.	Marks
1	15
2	25
3	30
4	Null

The following sequence of SQL statements was successfully executed on table T1.

Update T1 set marks = marks + 5

Select avg(marks) from T1

What is the output of the select statement?

Direction for the Question

A company maintains records of sales made by its salespersons and pays them commission based on each individual's total sales made in a year.

This data is maintained in a table with following schema:

salesinfo = (salespersonid, totalsales, commission)

In a certain year, due to better business results, the company decides to further reward its salespersons by enhancing the commission paid to them as per the following formula:

If commission <= 50000, enhance it by 2%

If 50000 < commission < = 100000, enhance it by 4%

If commission > 100000, enhance it by 6%

The IT staff has written three different SQL scripts to calculate enhancement for each slab, each of these script is to run as a separate transaction as follows:

Continues..

T1 Update salesinfo

Set commission = commision * 1.02

Where commission < = 50000;

T2 Update salesinfo

Set commission = commission * 1.04

Where commission < = 50000 and commission

is < = 100000;

T3 Update salesinfo

Set commission = commission * 1.06

Where commission > 100000;

Continues..

[MCQ]

#Q. Which of the following options of running these transactions will update the commission of all salespersons correctly?

A Execute TI followed by T2 by followed by T3

B Execute T2, followed by T3; T1 running concurrently throughout

C Execute T3, followed by T2: T1 running concurrently throughout

D Execute T3 followed by T2 by followed by TI

[MCQ]

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

A $\sigma_{C1}(\sigma_{C2}(R_1)) \rightarrow \sigma_{C2}(\sigma_{C1}(R_1))$

B $\sigma_{C1}(\pi_{A1}(R_1)) \rightarrow \pi_{A1}(\sigma_{C1}(R_1))$

C $\sigma_{C1}(R_1 \cup R_2) \rightarrow \sigma_{C1}(R_1) \cup \sigma_{C1}(R_2)$

D $\pi_{A1}(\sigma_{C1}(R_1)) \rightarrow \sigma_{C1}(\pi_{A1}((R_1))$

Direction for Question

Consider a database with three relation instances shown below. The primary keys for the Drivers and Cars relation are did and cid respectively and the records are stored in ascending order of these primary keys as given in the table. No indexing is available in the database.

D: Drivers relation

did	dname	rating	Age
22	Karthikeyan	7	25
29	Salman	1	33
31	Boris	8	55
32	Amoldt	8	25
58	Schumacher	10	35
64	Sachin	7	35
71	Senna	10	16
74	Sachin	9	35
85	Rahul	3	25
95	Ralph	3	53

R : Reserves relation

did	cid	Day
22	101	10/10/06
22	102	10/10/06
22	103	08/10/06
22	104	07/10/06
31	102	10/11/06
31	103	06/11/06
31	104	12/11/06
64	101	05/09/06
64	102	08/09/06
74	103	08/09/06

C : Cars relation

did	cname	colour
101	Renault	Blue
102	Renault	Red
103	Ferrari	Green
104	Jaguar	red

[MCQ]

#Q. What is the output of the following SQL query?

```
select D.dname
from Drivers D
where D.did in (
select R.did
from Cars C, Reserves R
where R.cid=C.cid and C.colour = 'red'
intersect
    select R.did
    from Cars C, Reserves R
    where R.cid=C.cid and C.colour='green')
```

A. Karthikeyan, Boris

B. Sachin, Salman

C. Karthikeyan, Boris, Sachin

D. Schumacher, Senna

[MCQ]

#Q. The relation book (title, price) contains the titles and prices of different books. Assuming that no two books have the same price, what does the following SQL gives as output:

```
select title
from book as B
where (select count (*)
          from book as T
where T. price > B. Price) < 5
```

A Titles of the four most expensive books

B Titles of the fifth most inexpensive books

C Titles of the fifth most expensive books

D Titles of the five most expensive books

[MCQ]

#Q. Consider the table employee (empId, name, department, salary) and the two queries Q_1 , Q_2 below. Assuming that department 5 has more than one employee, and we want to find the employees who get higher salary than anyone in the department 5, which one of the statements is TRUE of any arbitrary employee table?

Q_1 : Select e.empId

From employee e

Where not exists

(Select * From employee s Where s.department = "5" and s.salary >=e.salary)

Q_2 : Select e. empId

From employee e

Where e. salary> Any

(Select distinct salary From employee s Where s.department = "5"

Continues...

A. Q_1 is the correct query

B. Q_2 is the correct query

C. Both Q_1 and Q_2 produce the same answer

D. Neither Q_1 nor Q_2 is the correct query

Direction for Question

Consider two tables in a relational database with columns and rows as follows:

Table : Student

Roll_no	Name	Dept_id
1	ABC	1
2	DEF	1
3	GHI	2
4	JKL	3

Table : Department

Dept_id	Dept_name
1	A
2	B
3	C

Roll_no is the primary key of the Student table, Dept_id is the primary key of the Department table and Student. Dept_id is a foreign key from Department. Dept_id

[MCQ]

#Q. What will happen if we try to execute the following two SQL statements?

(i) update Student set Dept_id = Null where Roll_no = 1

(ii) update department set Dept_id = Null where Dept_id = 10

A Both (i) and (ii) will fail

B (i) will fail but (ii) will succeed

D Both (i) and (ii) will succeed

C (i) will succeed but (ii) will fail

NULL

UNKnown

Truth Table

NULL

unknown value

Unexisted value

2 NULL are Not equal

Random ASCII Value
Assigned by the DBMS.

NOTE:

I. Arithmetic operation with NULL gives result NULL.

NULL

Any arithmetic operation

Any value = NULL (Result)

II. Comparison operation with NULL gives result unknown (Truth value)

NULL	Comparison operation	Anything = Unknown (Truth value)

<, >, <=, >=, < > =

Not equal

Topic : Database Management System

NOTE: Unknown is the third truth value.

In SQL

Truth value

1. **True**
2. **False**
3. **Unknown**

Difference between Unknown and NULL:

Unknown → **Truth value**

V/S

NULL → **Attribute value**

NOTE: Arithmetic operation with NULL gives result NULL.

NULL	Any arithmetic operation	Any value = NULL (Result)

Example:

NULL + 100 ⇒ NULL
NULL – 100 ⇒ NULL
NULL × 100 ⇒ NULL
NULL ÷ 100 ⇒ NULL

Topic : Database Management System

NOTE: I

II. Comparison with NULL gives result unknown (Truth value)

NULL → Comparison operation → Anything = Unknown (Truth value)

<, >, <=, >=, < > =

Example:

NULL > 50 ⇒ Unknown

NULL = 100 ⇒ Unknown

NULL = NULL ⇒ Unknown

NULL <> 400 ⇒ Unknown

Topic : Database Management System

NOTE:

In general : if Condition result

- True → Tuple passes
- False → Tuples fails
- Unknown → Tuples fails

OR

Discard the tuple when result is false or unknown.

True [T] = 1

False [F] = 0

Unknown [U] = 1/2

NOT(True) = 0 [F]

NOT[False] = 1 [T]

NOT[Unknown] = 1 - 1/2 = 1/2 (unknown)

A OR B = max(A, B)

A AND B = min (A, B)

Topic : Database Management System

OR

Truth Table

OR (max) OPERATION	[1] Truth	[0] False	(½) Unknown
True [1]	T	T	T
False [0]	T	F	U
Unknown [½]	T	U	U

AND

min AND operation	1 Truth	0 False	½ Unknown
1 T	T	F	U
0 F	F	F	F
½ U	U	F	U

Hint:

True = 1

False = 0

Unknown = 1/2

NOT operation

NOT(True) = False[0]

NOT[False] = True[1]

NOT[Unknown] = Unknown[1/2]

1 – 1/2 = ½ [Unknown]

Hint:

A or B = Max (A, B)

A and B = Min (A, B)

True = 1

False = 0

Unknown = 1/2

A OR B = Max(A, B)

A AND B = Min(A, B)

I: OR

False ∨ False = F ⇒ max(0, 0) = 0 (F)

True ∨ False = T ⇒ max(1, 0) = 1 [T]

True ∨ True = T = max(1, 1) = 1 [T]

False ∨ True = T = max(0, 1) = 1 [True]

True = 1

False = 0

Unknown = 1/2

A OR B = Max(A, B)

A AND B = Min(A, B)

AND

True ∧ False = False

False ∧ True = False

True ∧ True = True

False ∧ False = False

min(1, 0) = 0 [F]

min(0, 1) = 0 [F]

min(1, 1) = 1 [T]

min(0, 0) = 0 [F]

Topic : Database Management System

Number 1 $\boxed{\text{AND}}$ Number 2 $\Rightarrow$ Output minimum value

Number 1 $\boxed{\text{OR}}$ Number 2 $\Rightarrow$ Output maximum value

A or B = Max (A, B)

A and B = Min (A, B)

OR

A $\overset{OR}{\vee}$ B = Max (A, B)

A $\wedge$ B = Min (A, B)

(AND)

False = 0

True = 1

1

F V F

I. $\boxed{\text{OR}}$

Eg: False $\vee$ False = max(0, 0) = 0 = False

False $\vee$ True = max (0, 1) = 1 = True

True $\vee$ True = max (1, 1) = 1 = Ture

II. AND

Eg: True $\wedge$ False = min(1, 0) = 0 = False

True $\wedge$ True = min (1, 1) = 1 = True

False $\wedge$ False = min (0, 0) = 0 = False

True = 1
False = 0
Unknown = 1/2

NOT$_A$ = 1 − A

NOT (True) = False

NOT (false) = True

NOT (unknown) = unknown

NOT(True) = 1 – 1 = 0 [false]

NOT (False) = 1 – 0 = 1 [True]

NOT (unknown) = 1 – ½ = ½ [unknown]

True = 1

False = 0

Unknown = $\frac{1}{2}$

A OR B = Max(A, B)

A AND B = Min(A, B)

I: $\boxed{\text{OR}}$

False V Unknown = U $\Rightarrow$ max(0, $\frac{1}{2}$) = $\frac{1}{2}$ [U]

True V Unknown = T $\Rightarrow$ max(1, $\frac{1}{2}$) = 1 [T]

Unknown V Unknown = U = max($\frac{1}{2}$, $\frac{1}{2}$) = $\frac{1}{2}$ [U].

True = 1

False = 0

Unknown = 1/2

A OR B = Max(A, B)

A AND B = Min(A, B)

AND

True ∧ Unknown = U

False ∧ Unknown = F

Unknown ∧ Unknown = U

min(1, 1/2) = 1/2 (U)

min(0, 1/2) = 0 (F)

min(1/2, 1/2) = 1/2 (U)

OR (Max)

Unknown Truth table

I. **OR**

Number 1 $\boxed{\text{OR}}$ Number 2 ⇒ Output maximum value.

Unknown **OR** True = True
Unknown **OR** False = Unknown
Unknown **OR** Unknown = Unknown

Example

Max(1/2, 1) = 1 [True]
Max(1/2, 0) = ½ [Unknown]
Max(1/2, 1/2) = ½ [Unknown]

Topic : Database Management System

AND

Unknown Truth table

II. AND

Number 1 $\boxed{\text{AND}}$ Number 2 ⇒ Output minimum value.

Unknown AND True = Unknown
Unknown AND False = False
Unknown AND Unknown = Unknown

Example

Min(1/2, 1) = 1/2 [Unknown]
Min(1/2, 0) = ½ [False]
Max(1/2, 1/2) = ½ [Unknown]

Topic : Database Management System

Hint:

True: 1

False 0

Unknown : ½

So Truth table

Max

OR	True	False	Unknown
True	T	T	T
False	T	F	U
Unknown	T	U	U

Min

AND	True	False	Unknown
True	T	F	U
False	F	F	F
Unknown	U	F	U

Topic : Database Management System

Standard Book.

OR

x	y	x AND y	x OR y	NOT x
True	True	True	True	False
True	Unknown	Unknown	True	False
True	False	False	True	False
Unknown	True	Unknown	True	Unknown
Unknown	Unknown	Unknown	Unknown	Unknown
Unknown	False	False	Unknown	Unknown
False	True	False	True	True
False	Unknown	False	Unknown	True
False	False	False	False	False

Truth table for three-Valued logic

[MCQ]

#Q. 1 Consider the following Query

x − y

X	Y
7	7
NULL	NULL
5	4
1	NULL
NULL	NULL
NULL	0
9	7

Compan

= 0 = 0 ⇒ True

= NULL = 0 = Unknown

= 1 = 0 = False

= NULL = 0 = Unknown

= NULL = 0 = Unknown

= NULL = 0 = Unknown

= 2 = 0 = False.

Select *

FROM R

WHERE x − y = 0

Arithmatic operation

Comparsion operator

$\boxed{\text{Ans (1)}}$

What is the number of tuples returned by the above SQL query?

Ans. (1)

Sol. WHERE x – y = 0 comparison operation

$7 - 7 \Rightarrow 0$	$= 0 \Rightarrow$ True
Null – Null $\Rightarrow$ Null	$= 0 \Rightarrow$ Unknown
$5 - 4 \Rightarrow 1$	$= 0 \Rightarrow$ False
1 – Null $\Rightarrow$ Null	$= 0 \Rightarrow$ Unknown
Null – Null $\Rightarrow$ Null	$= 0 \Rightarrow$ Unknown
Null – 0 $\Rightarrow$ Null	$= 0 \Rightarrow$ Unknown
$9 - 7 = 2$	$= 0 \Rightarrow$ False

Only 1 tuple in the output.

X	Y
7	7
NULL	NULL
5	4
1	NULL
NULL	NULL
NULL	0
9	7

[MCQ]

#Q. Consider the following SQL query:

R

A	B	C
10	35	65 ✓
20	45	60 ✓
30	15	NULL → Unknown
40	25	55 → False
50	30	70 ✓

Select *

From R

WHERE C > 55.

What is the number of tuples returned by the above SQL query?

Ans. (3)

Sol.

A	B	C	
10	35	65	True ✓
20	45	60	True ✓
30	15	NULL	Unknown
40	25	55	False
50	30	70	True ✓

$C > 55$

3 Tuples returned in the output.

[MCQ]

#Q. Consider the given relation R and S.

R(AB)	
A	B
5	16
8	9
11	5
14	7
17	6
20	3

C	S(CD) D
8	9
6	5
11	3
NULL	12
16	13
NULL	14

Any ∃ OR

Select *

FROM R

OR

WHERE B > Any (Select C from S)

The number of tuples return in the result of given SQL queries is ___

Ans. (3)

Sol. Any $\Rightarrow$ Work like 'OR'

B > Any

$$\begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix}$$

16 > Any

$$\begin{array}{c} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} \begin{matrix} \text{True} \\ \text{True} \\ \text{True} \\ \text{Unknown} \\ \text{True} \\ \text{Unknown} \end{matrix} \\ \hline \text{True} \end{array}$$

9 > Any

$$\begin{array}{c} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} \begin{matrix} \text{True} \\ \text{True} \\ \text{False} \\ \text{Unknown} \\ \text{False} \\ \text{Unknown} \end{matrix} \\ \hline \text{True} \end{array}$$

5 > Any

$$\begin{array}{c} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} \begin{matrix} \text{False} \\ \text{False} \\ \text{False} \\ \text{Unknown} \\ \text{False} \\ \text{Unknown} \end{matrix} \\ \hline \text{False} \end{array}$$

$$7 > \text{Any}\quad \begin{array}{cc} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} & \begin{array}{c} \text{False} \\ \text{True} \\ \text{False} \\ \text{Unknown} \\ \text{False} \\ \text{Unknown} \end{array} \\ \hline \multicolumn{2}{c}{\text{True}} \end{array}$$

$$6 > \text{Any}\quad \begin{array}{cc} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} & \begin{array}{c} \text{False} \\ \text{False} \\ \text{False} \\ \text{Unknown} \\ \text{False} \\ \text{Unknown} \end{array} \\ \hline \multicolumn{2}{c}{\text{False}} \end{array}$$

$$3 > \text{Any}\quad \begin{array}{c} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} \\ \hline \text{False} \end{array}$$

[MCQ]

#Q. Consider the following Query:

Select *

FROM R

WHERE A > 6 and (B >C or C > 5)

R

A	B	C
5	8	NULL
9	NULL	9
11	7	5
NULL	9	7

What is the number of tuple (record) resulted by the above SQL query.

Ans.

Sol.

A	**B**	**C**
5	8	NULL
9	NULL	9
11	7	5
Null	9	7

(i)

A > 6 and (B > C or C > 5)

A	**B**	**C**
5	8	NULL

A > 6 and (B > C or C > 5)

False and (unknown or unknown)

False and Unknown = False

(ii)

A	B	C
9	NULL	9

A > 6 and (B > C or C > 5)

True and (unknown or True)

True and True = Ture.

This tuple return in the output.

(iii)

A	B	C
11	7	5

A > 6 and (B > C or C > 5)

True and (True or False)

True and True = True.

This tuple return in the output.

(iv)

A	B	C
NULL	9	7

A > 6 and (B > C or C > 5)

unknown AND (True or True)

Unknown AND True = unknown .

So, 2 tuple in the output.

A	B	C
9	NULL	9
11	7	5

[MCQ]

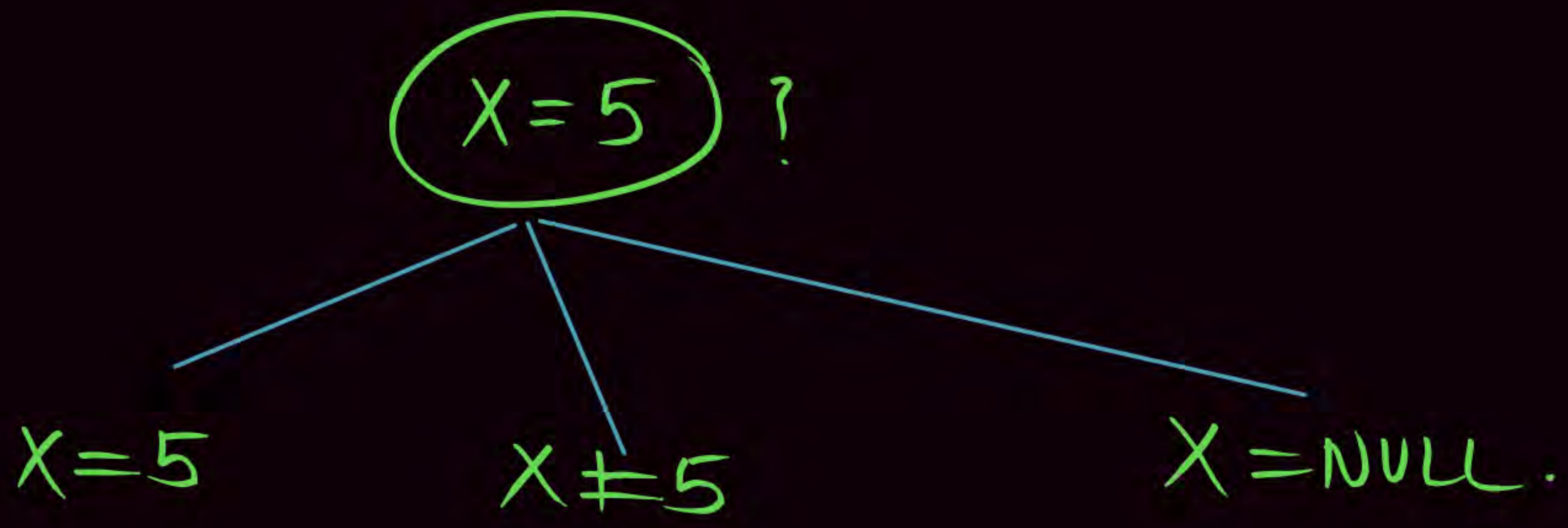
#Q. In SQL, relations can contain null values, and comparisons with null values are treated as unknown. Suppose all comparisons with null value are treated as false. Which of the following pairs in not equivalent?

A $x = 5$, not (not($x = 5$))

B $x = 5$, $x > 4$ and $x < 6$ where x is an integer

C $x \neq 5$, not ($x = 5$)

D None of the above


X=5 ?
X=5
X≠5
X=NULL.

2 mins Summary

Topic

DBMS (Part 05)

Topic

THANK - YOU

CS & IT ENGINEERING

Database Management System

Lecture No.- 06

By- Vijay Agarwal Sir

Recap of Previous Lecture

Topic Foreign Key Concept

Topic Relational Algebra

Topic Structured Query Language

Topics to be Covered

Topic Relational Algebra

Topic Structured Query Language

[MCQ]

#Q. A table T1 in a relational database has the following rows and columns.

Roll no.	Marks	
1	15	+5
2	25	+5
3	30	+5
4	Null	+5

R.No	Marks
1	20
2	30
3	35
4	NULL

$$\frac{20+30+35}{3}$$

$$\frac{85}{3} \Rightarrow 28.3$$

The following sequence of SQL statements was successfully executed on table T1.

Update T1 set marks = marks + 5

Select avg(marks) from T1

What is the output of the select statement? ________

NULL + 5 = NULL

Note Aggregate function (Min, max, AVG, SUM, Count) Always Discard/Ignore the NULL Value then Perform the Operation.

Direction for the Question

A company maintains records of sales made by its salespersons and pays them commission based on each individual's total sales made in a year.

This data is maintained in a table with following schema:

salesinfo = (salespersonid, totalsales, commission)

In a certain year, due to better business results, the company decides to further reward its salespersons by enhancing the commission paid to them as per the following formula:

If commission <= 50000, enhance it by 2%

If 50000 < commission < = 100000, enhance it by 4%

If commission > 100000, enhance it by 6%

The IT staff has written three different SQL scripts to calculate enhancement for each slab, each of these script is to run as a separate transaction as follows:

Continues..

T1 Update salesinfo

Set commission = commision * 1.02

Where commission < = 50000;

T2 Update salesinfo

Set commission = commission * 1.04

Where commission < = 50000 and commission is < = 100000;

T3 Update salesinfo

Set commission = commission * 1.06

Where commission > 100000;

If $\langle T_1, T_2, T_3 \rangle$

eg 49990 + 2%

T_1 < 50000 ⇒ 50k

T_2 50k to 1 lakh ⇒ 4%

T_3 > 1 lakh.

~~99990~~ ⇒ 4% ⇒ 1.01 lakh

T_3 ~~6%~~

Continues..

[MCQ]

#Q. Which of the following options of running these transactions will update the commission of all salespersons correctly?

A. Execute TI followed by T2 by followed by T3

B. Execute T2, followed by T3; T1 running concurrently throughout

C. Execute T3, followed by T2: T1 running concurrently throughout

D. Execute T3 followed by T2 by followed by TI

[MCQ]

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

A. $\sigma_{C1}(\sigma_{C2}(R_1)) \rightarrow \sigma_{C2}(\sigma_{C1}(R_1))$

B. $\sigma_{C1}(\pi_{A1}(R_1)) \rightarrow \pi_{A1}(\sigma_{C1}(R_1))$

C. $\sigma_{C1}(R_1 \cup R_2) \rightarrow \sigma_{C1}(R_1) \cup \sigma_{C1}(R_2)$

D. $\pi_{A1}(\sigma_{C1}(R_1)) \rightarrow \sigma_{C1}(\pi_{A1}((R_1))$

Direction for Question

Consider a database with three relation instances shown below. The primary keys for the Drivers and Cars relation are did and cid respectively and the records are stored in ascending order of these primary keys as given in the table. No indexing is available in the database.

D: Drivers relation

did	dname	rating	Age
22	Karthikeyan	7	25
29	Salman	1	33
31	Boris	8	55
32	Amoldt	8	25
58	Schumacher	10	35
64	Sachin	7	35
71	Senna	10	16
74	Sachin	9	35
85	Rahul	3	25
95	Ralph	3	53

R : Reserves relation

did	cid	Day
22	101	10/10/06
22	102	10/10/06
22	103	08/10/06
22	104	07/10/06
31	102	10/11/06
31	103	06/11/06
31	104	12/11/06
64	101	05/09/06
64	102	08/09/06
74	103	08/09/06

C : Cars relation

did	cname	colour
101	Renault	Blue
102	Renault	Red
103	Ferrari	Green
104	Jaguar	red

Red Did : [22, 22, 31, 31, 64]

INTERSECT

GREEN Did [22, 31, 74]

22, 31

[MCQ]

#Q. What is the output of the following SQL query?

```
select D.dname
from Drivers D
where D.did in (
select R.did
from Cars C, Reserves R
where R.cid=C.cid and C.colour = 'red'
intersect
    select R.did
    from Cars C, Reserves R
    where R.cid=C.cid and C.colour='green')
```

22, 31

A. Karthikeyan, Boris

B. Sachin, Salman

C. Karthikeyan, Boris, Sachin

D. Schumacher, Senna

[MCQ]

#Q. The relation book (title, price) contains the titles and prices of different books. Assuming that no two books have the same price, what does the following SQL gives as output:

```
select title
from book as B
where (select count (*)
          from book as T
where T. price > B. Price) < 5
```

T B

A	10
B	20
C	30
D	40
E	50
F	2
G	60
H	5

A. Titles of the four most expensive books

B. Titles of the fifth most inexpensive books

C. Titles of the fifth most expensive books

D. Titles of the five most expensive books

[MCQ]

#Q. Consider the table employee (empId, name, department, salary) and the two queries Q_1 , Q_2 below. Assuming that department 5 has more than one employee, and we want to find the employees who get higher salary than anyone in the department 5, which one of the statements is TRUE of any arbitrary employee table?

Q_1 : Select e.empId
From employee e
Where not exists
(Select * From employee s Where s.department = "5" and s.salary >=e.salary)

Q_2 : Select e. empId
From employee e
Where e. salary> Any
(Select distinct salary From employee s Where s.department = "5"

Continues...

A. Q_1 is the correct query

B. Q_2 is the correct query

C. Both Q_1 and Q_2 produce the same answer

D. Neither Q_1 nor Q_2 is the correct query

Direction for Question

Consider two tables in a relational database with columns and rows as follows:

Table : Student

Roll_no	Name	Dept_id
1	ABC	1
2	DEF	1
3	GHI	2
4	JKL	3

Table : Department

Dept_id	Dept_name
1	A
2	B
3	C

Roll_no is the primary key of the Student table, Dept_id is the primary key of the Department table and Student. Dept_id is a foreign key from Department. Dept_id

[MCQ]

#Q. What will happen if we try to execute the following two SQL statements?

(i) update Student set Dept_id = Null where Roll_no = 1

(ii) update department set Dept_id = Null where Dept_id = 10

A Both (i) and (ii) will fail

B (i) will fail but (ii) will succeed

D Both (i) and (ii) will succeed

C (i) will succeed but (ii) will fail

UNKNOWN

True : 1

False : 0

Unknown : $\frac{1}{2}$

$A \text{ OR } B \Rightarrow Max(A, B)$

$A \text{ AND } B = Min(A, B)$

Topic : Database Management System

NOTE:

I. Arithmetic operation with NULL gives result NULL.

NULL

Any arithmetic operation

Any value = NULL (Result)

II. Comparison operation with NULL gives result unknown (Truth value)

NULL

Comparison operation

Anything = Unknown (Truth value)

<, >, <=, >=, < >

NOTE: Unknown is the third truth value.
In SQL

Truth value

1. True **2. False** **3. Unknown**

Difference between Unknown and NULL:

V/S

Truth value **Attribute value**

Topic : Database Management System

NOTE: Arithmetic operation with NULL gives result NULL.

NULL

Any arithmetic operation

Any value = NULL (Result)

Example:

NULL + 100 ⇒ NULL
NULL – 100 ⇒ NULL
NULL × 100 ⇒ NULL
NULL ÷ 100 ⇒ NULL

NOTE:

II. Comparison with NULL gives result unknown (Truth value)

NULL	Comparison operation	Anything = Unknown (Truth value)

<, >, <=, >=, < >

Example:

NULL > 50 ⇒ Unknown
NULL = 100 ⇒ Unknown
NULL = NULL ⇒ Unknown
NULL <> 400 ⇒ Unknown

Topic : Database Management System

NOTE:

In general : if Condition result

- True → Tuple passes
- False
- Unknown

False, Unknown → Tuples fails

OR

Discard the tuple when result is false or unknown.

Topic : Database Management System

Truth Table

OR (max)	Truth	False	Unknown [½]
True [1]	T	T	T
False [0]	T	F	U
Unknown [½]	T	U	U

min

AND	Truth	False	Unknown ½
T	T	F	U
F	F	F	F
U	U	F	U

Hint:

True = 1

False = 0

Unknown = 1/2

NOT(True) = False[0]

NOT[False] = True[1]

NOT[Unknown] = Unknown[1/2]

1 – 1/2 = ½ [Unknown]

Hint:

A or B = Max (A, B)

A and B = Min (A, B)

Topic : Database Management System

Number 1 AND Number 2 $\Rightarrow$ Output minimum value

Number 1 AND Number 2 $\Rightarrow$ Output maximum value

A or B = Max (A, B)

A and B = Min (A, B)

OR

$A \vee B = \text{Max}(A, B)$

$A \wedge B = \text{Min}(A, B)$

False = 0

True = 1

I. OR

Eg: $\text{False} \vee \text{False} = \max(0, 0) = 0 = \text{False}$

$\text{False} \vee \text{True} = \max(0, 1) = 1 = \text{True}$

$\text{True} \vee \text{True} = \max(1, 1) = 1 = \text{Ture}$

II. AND

Eg: True $\wedge$ False = min(1, 0) = 0 = False

True $\wedge$ True = min (1, 1) = 1 = True

False $\wedge$ False = min (0, 0) = 0 = False

$$\boxed{\begin{array}{l}\text{True} = 1\\ \text{False} = 0\\ \text{Unknown} = 1/2\end{array}}$$

$NOT_A = 1 - A$

NOT (True) = False

NOT (false) = True

NOT (unknown) = unknown

NOT(True) = 1 – 1 = 0 [false]

NOT (False) = 1 – 0 = 1 [True]

NOT (unknown) = 1 – ½ = ½ [unknown]

Unknown Truth table

I. OR

Number 1 OR Number 2 ⇒ Output maximum value.

	Example
Unknown OR True = True	Max(1/2, 1) = 1 [True]
Unknown OR False = Unknown	Max(1/2, 0) = ½ [Unknown]
Unknown OR Unknown = Unknown	Max(1/2, 1/2) = ½ [Unknown]

Unknown Truth table

II. AND

Number 1 AND Number 2 ⇒ Output minimum value.

Example

Unknown AND True = Unknown	Min(1/2, 1) = 1/2 [Unknown]
Unknown AND False = False	Min(1/2, 0) = ½ [False]
Unknown AND Unknown = Unknown	Max(1/2, 1/2) = ½ [Unknown]

Topic : Database Management System

Hint:

True: 1

False 0

Unknown : ½

So Truth table

Max

OR	True	False	Unknown
True	T	T	T
False	T	F	U
Unknown	T	U	U

Min

AND	True	False	Unknown
True	T	F	U
False	F	F	F
Unknown	U	F	U

OR

x	y	x AND y	x OR y	NOT x
True	True	True	True	False
True	Unknown	Unknown	True	False
True	False	False	True	False
Unknown	True	Unknown	True	Unknown
Unknown	Unknown	Unknown	Unknown	Unknown
Unknown	False	False	Unknown	Unknown
False	True	False	True	True
False	Unknown	False	Unknown	True
False	False	False	False	False

Truth table for three-Valued logic

[MCQ]

#Q. Consider the following Query

X	Y
7	7
NULL	NULL
5	4
1	NULL
NULL	NULL
NULL	0
9	7

Select *

FROM R

WHERE x – y = 0

What is the number of tuples returned by the above SQL query?

Ans. (1)

Sol. WHERE x – y = 0 comparison operation

$7 - 7 \Rightarrow 0$	$= 0 \Rightarrow$ True
Null – Null $\Rightarrow$ Null	$= 0 \Rightarrow$ Unknown
$5 - 4 \Rightarrow 1$	$= 0 \Rightarrow$ False
1 – Null $\Rightarrow$ Null	$= 0 \Rightarrow$ Unknown
Null – Null $\Rightarrow$ Null	$= 0 \Rightarrow$ Unknown
Null – 0 $\Rightarrow$ Null	$= 0 \Rightarrow$ Unknown
$9 - 7 = 2$	$= 0 \Rightarrow$ False

Only 1 tuple in the output.

X	Y
7	7
NULL	NULL
5	4
1	NULL
NULL	NULL
NULL	0
9	7

[MCQ]

#Q. 2 Consider the following SQL query:

R

A	B	C	
10	35	65	T
20	45	60	T
30	15	NULL	Unknown
40	25	55	False
50	30	70	True

Select *

From R

WHERE C > 55.

What is the number of tuples returned by the above SQL query?

Ans. (3)

Sol.

A	B	C	
10	35	65	True
20	45	60	True
30	15	NULL	Unknown
40	25	55	False
50	30	70	True

$C > 55$

3 Tuples returned in the output.

[MCQ]

#Q.3 Consider the given relation R and S.

R(AB)	
A	B
5	16
8	9
11	5
14	7
17	6
20	3

C S(CD)	
8	9
6	5
11	3
NULL	12
16	13
NULL	14

$\boxed{\text{Ans(3)}}$

Select *

FROM R

WHERE B > Any (Select C from S)

The number of tuples return in the result of given SQL queries is ___

OR

16 > Any

8 → T
6 → T
11 → T
NULL → U
16 → F
NULL → U

True

Ans. (3)

Sol. Any $\Rightarrow$ Work like 'OR'

B > Any

$$\begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix}$$

16 > Any

$$\begin{array}{cc} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} & \begin{array}{c} \text{True} \\ \text{True} \\ \text{True} \\ \text{Unknown} \\ \cancel{\text{True}}\ \text{False} \\ \text{Unknown} \end{array} \\ \hline \text{True} & \end{array}$$

9 > Any

$$\begin{array}{cc} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} & \begin{array}{c} \text{True} \\ \text{True} \\ \text{False} \\ \text{Unknown} \\ \text{False} \\ \text{Unknown} \end{array} \\ \hline \text{True} & \end{array}$$

5 > Any

$$\begin{array}{cc} \begin{pmatrix} 8 \\ 6 \\ 11 \\ \text{NULL} \\ 16 \\ \text{NULL} \end{pmatrix} & \begin{array}{c} \text{False} \\ \text{False} \\ \text{False} \\ \text{Unknown} \\ \text{False} \\ \text{Unknown} \end{array} \\ \hline \textit{Unknown} & \end{array}$$

7 > Any

8	False
6	True
11	False
NULL	Unknown
16	False
NULL	Unknown

True

6 > Any

8	False
6	False
11	False
NULL	Unknown
16	False
NULL	Unknown

Unknown

3 > Any

8	F
6	F
11	F
NULL	U
16	F
NULL	U

~~False~~ Unknown

[MCQ]

A > 6 AND (B > C OR C > 5)

5 > 6 [F] AND [Unk OR U. = False

#Q.4 Consider the following Query:

Select *

FROM R

WHERE A > 6 and (B >C or C > 5)

R

A	B	C
5	8	NULL
9	NULL	9
11	7	5
NULL	9	7

What is the number of tuple (record) resulted by the above SQL query.

Ans. ② Ans

Sol.

A	B	C
5	8	NULL
9	NULL	9
11	7	5
Null	9	7

(i)

Ist Tuple

A	B	C
5	8	NULL

A > 6 and (B > C or C > 5)

False and (unknown or unknown)

False and Unknown = False

A > 6 and (B > C or C > 5)

(ii)

A	B	C
9	NULL	9

A > 6 and (B > C or C > 5)

True and (unknown or True)

True and True = True.

This tuple return in the output.

(iii)

A	B	C
11	7	5

A > 6 and (B > C or C > 5)

True and (True or False)

True and True = True.

This tuple return in the output.

(iv)

A	B	C
NULL	9	7

A > 6 and (B > C or C > 5)

unknown AND (True or True)

Unknown AND True = unknown.

So, 2 tuple in the output.

A	B	C
9	NULL	9
11	7	5

[MCQ]

#Q. In SQL, relations can contain null values, and comparisons with null values are treated as unknown. Suppose all comparisons with null value are treated as false. Which of the following pairs in not equivalent?

A. x = 5, not (not(x = 5)) Equivalent

B. x = 5, x > 4 and x < 6 where x is an integer Equivalent.

C. x ≠5, not (x = 5)

D. None of the above

@ X=5. $\quad$ not (not (x = 5))

$\boxed{X=5}$

L.H.S ⇒ True

R.H.S $\underbrace{\text{NOT}\ (\underbrace{\text{NOT}\ (\underbrace{X=5}_{T})}_{F})}_{T}$: True.

$\boxed{X \neq 5}$

$X \neq 5$: False

$\underbrace{\text{NOT}\ (\underbrace{\text{NOT}\ (\underbrace{X=5}_{F})}_{T})}_{F}$ = False

$\boxed{X=\text{NULL}}$

X=NULL ⇒ False

NOT) (NOT (X=NULL) = False.

b $x = 5$. $x > 4$ & $(x < 6)$ x is an integer

$\boxed{x = 5}$

$x = 5$ True

T & T = True.

$\boxed{x \neq 5}$

$x \neq 5$: False

F & T = False.

T & F =

$\boxed{x = NULL}$

$x = NULL \Rightarrow$ False

N & N = False.

(c) $X \neq 5$, $\text{NOT}(x=5)$

$\boxed{X=5}$

$X \neq 5$: False

$\underbrace{\text{NOT}\,\underset{T}{\underline{(x=5)}}}_{F} = \text{False}$

$\boxed{X \neq 5}$

L.H.S = True

RHS $\underbrace{\text{NOT}\,\underset{F}{\underline{(X=5)}}}_{\text{True}} = \text{True}$

$\boxed{X=\text{NULL}}$

$X = \text{NULL} = \text{False}$

$\underbrace{\text{NOT}\,\underset{\text{False}}{\underline{(X=\text{NULL})}}}_{\text{True}}$ True

[NAT]

Consider the relation R and S & following Query Executed.

```
SELECT *
FROM R
WHERE A > (SLEECT Count(*)
           FROM S
           WHERE RC=SC)
```

R (ABC)

A	B	C
1	7	5
3	3	6
5	4	7

S (CDE)

C	D	E
5	5	3
6	2	8
6	4	1

Ans (2)

The number of tuples Returned by the above query is________.

A B C

RC=S.C

$\boxed{1\ 7\ 5} \Rightarrow Count = 1 \Rightarrow A > Count \Rightarrow (1) A > 1 \Rightarrow$ False

$\boxed{3\ 3\ 6} \Rightarrow Count = 2 \Rightarrow A > Count \Rightarrow A(3) > 2 \Rightarrow$ True ✓

$\boxed{5\ 4\ 7} \Rightarrow Count = 0 \Rightarrow A > Count \Rightarrow A(5) > 0 :$ True ✓

[MCQ]

#Q. [(Select eno from emp where deptno = 10) UNION
(Select eno from emp where deptno = 20)] is query 1,
(Select eno from emp where deptno = 10 or
deptno = 20) is query 2

I. Query 1 and Query 2 give same no. of rows.

II. Query 1 and Query 2 gives same no. of rows if there are no duplicates in eno.

III. The output of query 1 and query 2 look alike row by row if eno is a primary key for the relation emp.

A I only

B II only

C III only

D I & III

[MCQ]

#Q. Select ename

From deposit

10 20 30 40

Where bal < any (select assets from branch);

What is the output of the above query?

A. It prints the customer names whose balance amount is greater than at least one asset.

B. It prints the customer names whose balance amount is less than at least one asset.

C. It prints the customer names whose balance amount is less than maximum amount of assets.

D. None of the above

[MCQ]

H.W

#Q. Consider the Query

SELECT student name FROM student WHERE class name = (SELECT class-name FROM students WHERE math_marks = 100);

What will be the output?

A The list of names of student with 100 marks in mathematics.

B The names of all students of all classes in which at least one student has 100 marks in mathematics.

C The names of all students in all classes having 100 marks in mathematics.

D The names and class of all students whose marks in mathematics is 100.

[MCQ]

#Q. Consider the following ORACLE relations:

R(A, B, C) = {< 1,2,3 >, < 1,2,0 >, < 1,3,1 >.< 6,2,3 >,< 1,4,2 >, < 3,1,4 >}

S(B,C,D) = {< 2,3,7 >,< 1,4,5 >,< 1,2,3 >,< 2,3,4 >,< 3,1,4 >}

Consider the following two SQL queries SQ_1 and SQ_2:

SQ_1: SELECT RB, AVG(SB) FROM R, S
WHERE R · A = S · C AND S · D < 7 GROUP BY R · B;

SQ_2: SELECT DISTINCT S · B, MIN (S · C) FROM S GROUP BY S · B
HAVING COUNT (DISTINCT S · D) >1;

If M is the number of tuples returned by SQ_1 and N is the number of tuples returned by SQ_2 then

A. M = 4, N = 2

B. M = 5, N = 3

C. M = 2, N = 2

D. M = 3, N = 3

SQL:

R(ABC)

A	B	C
1	2	3
1	2	0
1	3	1
6	2	3
1	4	2
3	1	4

S(BCD)

B	C	D
2	3	7
1	4	5
1	2	3
2	3	4
3	1	4

R.A = S.C AND S.D < 7.

RA	RB	RC	SB	SC	SD
1	2	3	3	1	4
1	2	0	3	1	4
1	3	1	3	1	4
1	4	2	3	1	4
3	1	4	2	3	4

GROUP

2 - 2
1 - 2
3 - 1

R.B	Avg S.B
2	3
3	3
4	3
1	2

2	$\frac{3+3}{2}$ (Avg S.B)
3	3/1
4	3/1
1	2/1

M = 4

[MCQ]

Consider the two relation Enrolled and course are given below

Enrolled		
Sid	Cid	Fee
S_1	C_1	11K
S_1	C_2	25K
S_2	C_3	38K
S_3	C_4	40K
S_3	C_3	29K

Course		
Cid	Cname	Dept
C_1	OS	CS
C_2	DBMS	IT
C_3	EDC	EC
C_4	FM	ME

$$\pi_{sid\,cid}(\text{Enrolled}) / \pi_{cid}(\sigma_{Dept='CE'}(\text{Course}))$$

ϕ (Empty).

$\boxed{\text{Ans (3)}}$

$\boxed{S_1 \; S_2 \; S_3}$ Ans

The Number of tuples there in the Result when the above relational algebra Query executes is__________

$$\frac{\Pi_{AB}(R)}{\Pi_B(S)} \Rightarrow$$ 'A' which Pair every B value.

$$\Pi_{AB}(R) / \Pi_B(S) = \boxed{\Pi_A(R)} - \Pi_A\left[\underbrace{\Pi_A(R) \times \underbrace{\overset{\text{'CE'}}{\Pi_B(S)}}_{\text{Empty}}}_{\text{Empty}} - R\right]$$

Empty

RA: Distinct A

No Duplicates

[MCQ]

$R \cap S = S \cap R$

#Q. If R and S are two relations then R intersection S can be represented as

1. $R \cup (R - S)$
2. $S - (S - R)$
3. $R - (R - S)$
4. $(R \cup S) - [(R - S) \cup (S - R)]$

$R-(R-S)$, $S-(S-R)$

$(R \cup S) - [(R-S) \cup (S-R)]$

$R \cap S = 3, 4, 5$

$R: [1, 2, 3, 4, 5]$

$S: [3, 4, 5, 6, 7]$

A. 2 and 3 only

B. 1, 2 and 3 only

C. 3 and 4 only

D. 2, 3 and 4 only

$\boxed{\text{Ans (D)}}$

(d) $(1, 2, 3, 4, 5, 6, 7) - [1, 2, 6, 7] = [3, 4, 5]$

[MCQ]

#Q. Consider a schema R(A, B) and S(B, C) Q_1 and Q_2 are queries expressed in relation algebra. $Q_1 = \sigma_{(A=1)}(R \times S)$ $Q_2 = (\sigma_{(A=1)}R) \times S$ ("X" symbol refer to natural join)

R(AB) S(BC)

Q_1 : $\sigma_{A=1}(R \bowtie S)$

Q_2: $\sigma_{A=1}(R) \bowtie S$

A. Q_1 and Q_2 produce the same result

B. The answer of Q_1, always contain answer of Q_2

C. The answer of Q_2 always contain answer of Q_1

D. No relation between Q_1 and Q_2

[MCQ]

x : Sid
y : Sid

x : RollNo Name
y : Name RollNo
z : Name RollNo CGPA

#Q. What is the condition for the below expression to be true?

$\boxed{\Pi_x(\Pi_y(R))} = \Pi_y(\Pi_x(R))$ ✓

$= \Pi_x(\Pi_y(R))$ ✓

$= \Pi_x(\Pi y(\Pi z(R))$

A. $y \subseteq z, x \subseteq z, y = x$ ✓

B. $y \subseteq z, x \subseteq z, x \subset y$

C. $y \subseteq x, x \supseteq z, z \supseteq y$

D. $x \subseteq y, y \subseteq z$

Selection is Commutative

$$\sigma_{c_2}\left(\sigma_{c_1}(R)\right) = \sigma_{c_1}\left(\sigma_{c_2}(R)\right)$$

But Projection is Not Commutative

$$\Pi_A\left(\Pi_{AB}(R)\right) \not\equiv \Pi_{AB}\left(\Pi_A(R)\right)$$

[MCQ]

#Q. Consider three relations that are

$R(a, b) = \{(0,1), (4,5), (8,9)\}$

$S(b, c) = \{(1,2), (5,2), (5,6), (5,10), (13,10)\}$

$T(c, d) = \{(2,3), (6,7), (10,11), (10,3)\}$

The number of tuples in $R \bowtie S \bowtie T$, where $\bowtie$ is natural join is

A. 5

B. 8

C. 10

D. 13

R

A	B
0	1
4	5
8	9

S

B	C
1	2
5	2
5	6
5	10
13	10

$R \bowtie S$

A	B	C
0	1	2
4	5	2
4	5	6
4	5	10

T

C	D
2	3
6	7
10	11
10	3

A	B	C	D
0	1	2	3
4	5	2	3
4	5	6	7
4	5	10	11
4	5	10	3

5 Ans

[NAT]

Consider the following relations given below:

A

sno	pno
s1	p1
s1	p2
s1	p3
s1	p4
s2	p1
s2	p2
s3	p2
s4	p2
s4	p4

B1

pno
p2

B2

pno
p2
p4

B3

pno
p1
p2
p4

The number of tuples return by A/B_1 is x.

The number of tuples return by A/B_2 is y.

The number of tuples return by A/B_3 is z.

The value of x + y + z is ________?

S_1, S_2, S_3, S_4

x = 4

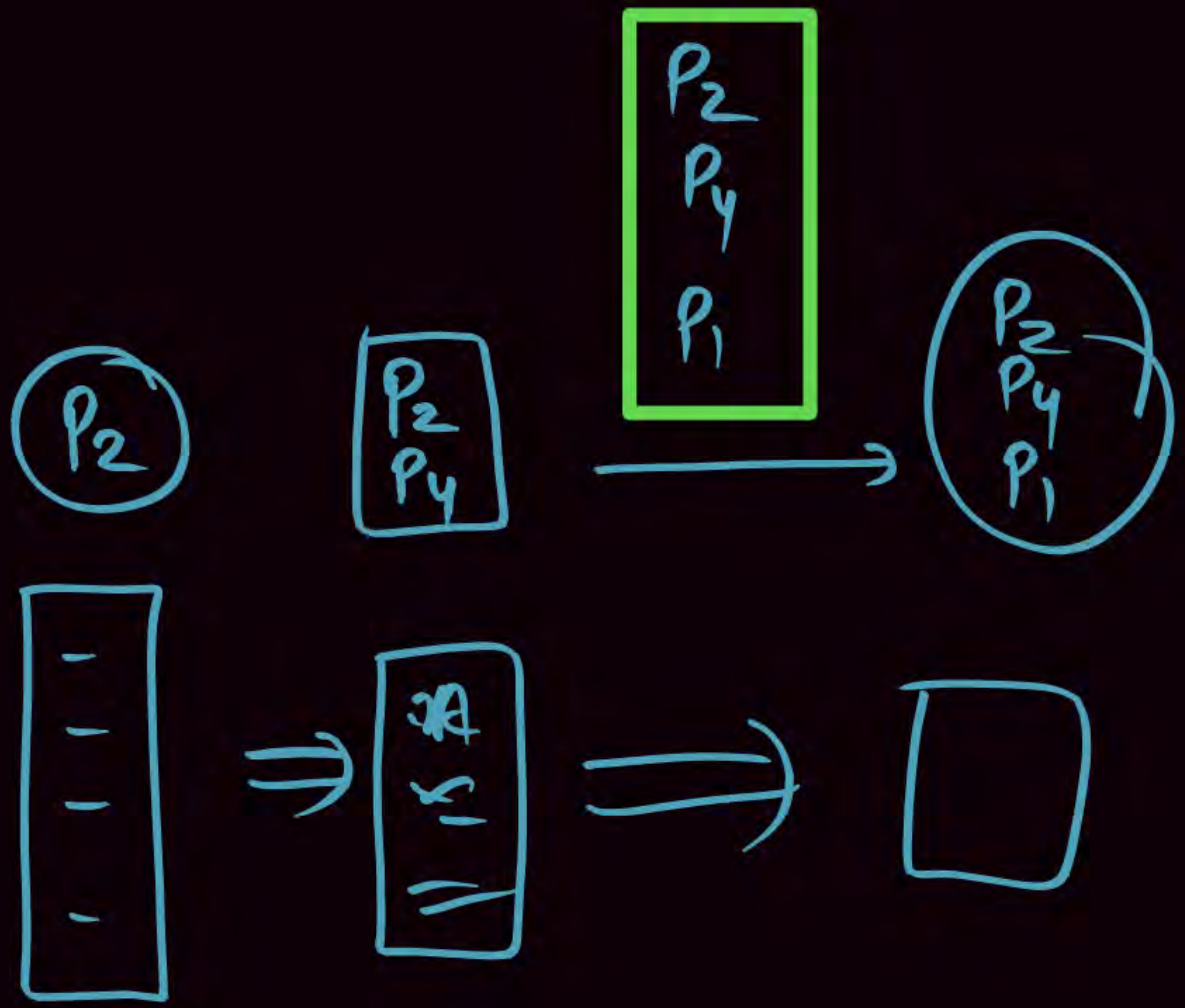
S_1, S_4

y = 2

S_1

z = 1

4+2+1 = 7 Ans


P_2
P_2
P_4
P_2
P_4
P_1
P_2
P_4
P_1

[NAT]

Consider the following relations given below:

A

sno	pno
s1	p1
s1	p2
s1	p3
s1	p4
s2	p1
s2	p2
s3	p2
s4	p2
s4	p4

B1

pno
p2

B2

pno
p2
p4

B3

pno
p1
p2
p4

The number of tuples return by A/B_1 is x.

The number of tuples return by A/B_2 is y.

The number of tuples return by A/B_3 is z.

The value of $x + y + z$ is________?

A/B_3

P_1: S_1, S_2 $\Rightarrow$ P_1, P_2: S_1 ✓, S_2 ✗ $\Rightarrow$ P_1, P_2, P_4: S_1

[MCQ]

Consider the following relation:

Student(snum: integer, sname: string, major: string, level: string, age: integer)

Class (name: string, meets-at: string, room: string, *fid*: integer)

Enrolled (snum: integer, cname: string)

Faculty (*fid*: integer, fname: string, deptid: integer)

The following query executed on above relations

```
SELECT   DISTINCT F.fname
FROM     Faculty F
WHERE    5 > (SELECT COUNT (E.snum)
         FROM Class C, Enrolled E
         WHERE C.name = E.cname
         AND C.fid = F.fid)
```

The output of above Query is-

A. Distinct Name is the faculty for whom the combined enrollment of the course that they teach is greater then five.

B. Distinct Name of the faculty for whom the combined enrollment of the course that they Not teach is greater than five.

C. Distinct Name of the faculty for whom the combined enrollment of the course that they teach is less than Five.

D. The Query give the Syntax Error.

2 mins Summary

Topic DBMS (Part 06)

Topic

THANK - YOU

CS & IT ENGINEERING

Database Management System

Lecture No.- 07

By- Vijay Agarwal Sir

Recap of Previous Lecture

Topic — Relational Algebra

Topic — Structured Query Language

Topics to be Covered

- **Topic** Relational Algebra
- **Topic** Structured Query Language
- **Topic** File Org & Indexing

[MCQ]

#Q. The relation book (title, price) contains the titles and prices of different books. Assuming that no two books have the same price, what does the following SQL gives as output:

```
select title
from book as B
where (select count (*)
        from book as T
where T. price > B. Price) < 5
```

> 10

A. Titles of the four most expensive books

B. Titles of the fifth most inexpensive books

C. Titles of the fifth most expensive books

D. Titles of the five most expensive books

B	Price
A	10
B	20
C	30
D	40
E	50
F	60
G	70

T	Price
A	10
B	20
C	30
D	40
E	50
F	60
G	70

$\boxed{\text{Ans (D)}}$

B	
A	10
B	20
C	30
D	40
E	50
F	60
G	70

T	
A	10
B	20
C	30
D	40
E	50
F	60
G	70

(T. Price > B. Price) Count less than < 5

T.Price > B.Price Count < 5

Count

A ⇒ 10 ⇒ A ⇒ 6 ✗

B = 20 ⇒ B = 5 ✗

C = 30 ⇒ C ⇒ 4 ✓

D = 40 ⇒ D = 3 ✓

E = 50 ⇒ D = 2 ✓

F = 60 ⇒ F = 1 ✓

G = 70 ⇒ F = 0 ✓

C
D
E
F
G

C
D
E
F
G

(T.Price > B.Price) Count < 5

~~I~~: 150
~~H~~: 100
~~B~~: 90
~~C~~: 70
~~F~~: 60

B

A	10
B	90
C	70
D	25
E	5
F	60
G	20
H	100
I	150
J	40

T.

A	10
B	90
C	70
D	25
E	5
F	60
G	20
H	100
I	150
J	40

(10) A $\Rightarrow$ 8 ✗

(90) B $\Rightarrow$ 2 ✓

(70) C $\Rightarrow$ 3 ✓

(25) D = 6 ✗

(5) E $\Rightarrow$ 9 ✗

(60) F 4 ✓

(20) G 7 ✗

(100) H 1 ✓

150 I 0 ✓

40 J 5 ✗

B
C
F
H
I

[MCQ]

#Q. Consider the table employee (empId, name, department, salary) and the two queries Q_1 , Q_2 below. Assuming that department 5 has more than one employee, and we want to find the employees who get higher salary than anyone in the department 5, which one of the statements is TRUE of any arbitrary employee table?

Q_1 : Select e.empId
From employee e
Where not exists
(Select * From employee s Where s.department = "5" and s.salary >=e.salary)

Q_2 : Select e. empId
From employee e
Where e. salary> Any
(Select distinct salary From employee s Where s.department = "5"

Continues...

A. Q_1 is the correct query

B. Q_2 is the correct query

C. Both Q_1 and Q_2 produce the same answer

D. Neither Q_1 nor Q_2 is the correct query

Direction for Question

Consider two tables in a relational database with columns and rows as follows:

Table : Student

F.K

Roll_no	Name	Dept_id
1	ABC	1
2	DEF	1
3	GHI	2
4	JKL	3

Referencing Relation

Table : Department

P.K

Dept_id	Dept_name
1	A
2	B
3	C

Referenced Reln

Roll_no is the primary key of the Student table, Dept_id is the primary key of the Department table and Student. Dept_id is a foreign key from Department. Dept_id

[MCQ]

#Q. What will happen if we try to execute the following two SQL statements?

(i) update Student set Dept_id = Null where Roll_no = 1

(ii) update department set Dept_id = Null where Dept_id = 1

A. Both (i) and (ii) will fail

B. (i) will fail but (ii) will succeed

D. Both (i) and (ii) will succeed

C. (i) will succeed but (ii) will fail

[MCQ]

Outer → Inner → outer.

#Q. Consider the schema:

Sailors (sid, sname, rating, age) with the following data:

S2

sid	sname	rating	age
22	Dustin	7	45
29	Borg	1	33
31	Pathy	8	55
32	Robert	8	25
58	Raghu	10	17
64	Herald	7	35
71	Vishnu	10	16
74	King	9	35
85	Archer	3	26
84	Bob	3	64
96	Flinch	3	17

For the query

Corelated

```
SELECT S. rating, AVG(S.age) AS average
FROM Sailors S
Where S.age >= 18
GROUP BY S. rating
HAVING 1 < (SELECT COUNT (*) FROM Sailors S2 where S. rating = S2.rating)
```

The number of rows returned is

A 6

B 5

C 4

D 3

Outer Query Result

1	33
3	45
7	40
8	40
9	35

3
7
8

Ans

1	33	1
3.	45	3
3.	45	3
3.	45	3
7		7
7		7
8		8
8		8
9.		9

Count(*)

$\rightarrow$ 1 >1 False

$\Rightarrow$ 3 >1 True

$\Rightarrow$ 2 >1 True.

$\Rightarrow$ 2 >1 True

$\Rightarrow$ 1 >1 False

22	Dustin	7	45
29	Brog	1	33
31	Pathy	8	55
32	Robert	8	25
74	King	9	35
85	Archer	3	26
84	Bob	3	64
64	Herbal	7	35

$$\frac{45+35}{2}$$

$$\frac{26+64}{2} = 45$$

1	33
3	45
7	40
8	40
9	35

1	33
3	43
7	40
8	40
9	35

Fundamental

+

Practices.

FROM

↓

WHERE

↓

GROUP By.

Corelated Nested Query

Outer Query → Inner Query → outer Query.

i=1
j=1 . . . m
i=2
i=3
. . .
i=n
j=1 . . m

[MCQ]

#Q. Database table by name Overtime allowance is given blow:

Employee	Department	OT-allowance
RAMA	Mechanical	5000
GOPI	Electrical	2000
SINDU	Computer	6000
MAHESH	Civil	1500

Ans (B).

Which is the output of the following SQL query?

Select count (*)
From ((Select Employee, Department
From Overtime_allowance as S natural join (Select Department, OT_allowance
From Overtime_allowance) as T)

A 16

B 4

C 8

D None of the above

Emp.	Dept.
RAMA	ME
GOPI	EE
SINDHU	CS
MAHESH	CE

$\bowtie$

Dept	O.T
ME	5000
EE	2000
CS	6000
CE	1500

CROSS Product $\Rightarrow$ 16 Tuple

But Natural Join = 4 Tuple

Common Data for next 2 Questions:

Consider the following database schema

SUPPLIERS(sid: integer, sname: string, address: string)

PART(pid: integer, pname: string, color: string)

CATALOG(sid: integer, pid: integer, cost: real)

[MCQ]

0 Tuple

#Q. What does the following SQL query return?

SELECT c.sid FROM CATLOG c, PART p WHERE (p.color = 'red' and p.color = 'green') and p.pid = c.pid;

A. ~~find sids of catalog who supply some red and green part~~

B. find the sids of catalog who supply some red or green parts

C. find sids of catalog who supply every red and every green part

D. None of these.

P1 A Red

P3 C Green

[MCQ]

#Q. What does the following SQL query return?

SELECT s.sid FROM SUPPLIERS s where s.address = '229 park street' OR s.sid IN (SELECT c.sid FROM PART p, CATALOG c where p.color ='red' AND p.pid = c.pid);

A. find sid of supplier who supply some red part or are at 229 park street

B. find sid of supplier who supply some red part and at 229 park street

C. find sid of supplier who supply all red part and at 229 park street

D. None of the above

[MCQ]

#Q. Consider the following relational schema:

Suppliers(sid:integer, sname: string, saddress: string)

Parts(pid:integer, pname:string, pcolor:string)

Catalog (sid:integer, pid:integer, pcost:real)

What is the result of the following query?

(SELECT Catalog.pid form Suppliers, Catalog
WHERE Suppliers.sid = Catalog.pid)
MINUS
(SELECT Catalog.pid from Suppliers, Catalog
WHERE Suppliers.sname <> 'sachin' and
Suppliers.sid = catalog.sid)

RAM
SHYAM
SACHIN
Ramesh

Pid
= SACHIN

RAM
SHYAM
RAMESH

- A pid of parts supplied by all except Sachin
- B pid of parts supplied only by Sachin
- C pid of parts available in catalog supplied by Sachin
- D pid of parts available in catalogs supplied by all except Sachin

[MCQ]

#Q. Consider a relation book (title, price) which contains the titles and prices of different books. Assuming that no two books have the same price, what does the following SQL query list?

```
SELECT title
FROM book AS B
WHERE (SELECT COUNT (*) FROM book AS T
WHERE T.price > B.price) < 7
```

A. Titles of the six most expensive books

B. Title of the sixth most expensive books

C. Titles of the seven most expensive book

D. Title of the seventh most expensive books

Common data for next 2 Questions:

Consider the schema:

Book (bookid, name, publisherid)

Author (authorid, name)

Publisher (publisherid, name)

Details (publisherid, bookid, authorid)

[MCQ]

#Q. What does the following query output?

Select distinct a.name
from author a, publisher p, book b, details d
Where b.bookid = d.bookid
and a.authorid = d.authorid
and d.publisherid = 'NewPub';

A. author names whose books are published by NewPub

B. unique author names whose books are published by NewPub

C. unique author names with books not published by NewPub

D. author names with books not published by NewPub

[MCQ]

#Q. Which query will print authorid, publisherid and the number of books of this combination sorted by author name?

A. select a.name, p.publisherid, count (*) from author a, publisher p, details d where d.publisherid = p.publisherid and a.authorid = d.authored group by a.name, p.publisherid order by a.name;

B. select d.authorid, d.publisherid count (*) from author a, details d where a.authorid = d.authored group by d.authorid, d.publisherid order by a.name;

C. select d.authorid, d.publisherid, sum (*) from author a, details d where a.authorid = d.authorid group by d.authorid, d.publisherid order by a.authorid;

D. select a.name, d.publisherid, sum (*) from author a, details d where a.authorid = d.authorid group by d.authorid, d.publisherid order by a.authorid;

[MCQ]

#Q. Consider the following relation schema

Employee (Eid, Ename, Dno, salary, address)

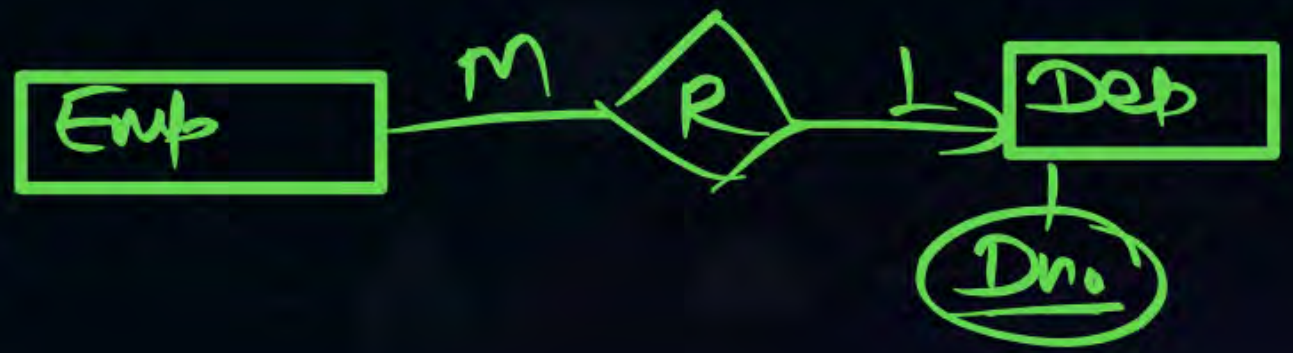
F.K

M to 1

and

Department (Dno, Dname), then what does the following SQL query retrieve?

```
Select Dname, Count (*)
From Department D, Employee E
Where D. Dno=E.Dno AND E. Salary > 40000
Group by Dname
Having count (*) > 5;
```



1. RDBMS
2. Transaction
3. ER & F.K
4. Query Lang.
5. File org & Indexing.

A. selects only department that have more than 5 employees who earns more than 40,000.

B. selects all departments employees who earn more than 40,000.

C. select all employees who earn 40,000.

D. None of these

[MCQ]

#Q. Consider a B^+ tree in which the maximum number of child nodes is 6. What is the minimum and maximum number of keys in such a tree?

ORDER [P] = 6

Min # keys = $\lceil P/2 \rceil - 1 \Rightarrow \lceil 6/2 \rceil - 1 \Rightarrow 3 - 1 = 2$

Max # keys = $P - 1 \Rightarrow 6 - 1 = 5$

A. 3 and 4

B. 3 and 5

C. 2 and 5

D. 2 and 4

[MCQ]

#Q. Match the following

List-I	List-II
a. Primary index — 3	1. Non key and ordering
b. Clustering index — 1	2. Non-key and Non-ordering
c. Secondary index (key) — 4	3. Key and ordering
d. Secondary Index(Non key) — 2	4. Key and Non ordering

Codes:

	a	b	c	b
A	4	1	3	2
B	3	1	4	2
C	3	2	4	1
D	4	2	3	1

[NAT]

In a B^+ tree, if the search key field value is 13 bytes and records pointer is a bytes long and block pointer 7 bytes, block size is 1024 bytes. Then the order of internal (non-leaf) node in B^+ tree is________.

[NAT]

A file has r = 20,000 STUDENT records of fixed length. Each records has the following fields: Name (30 bytes),Ssn (9 bytes) , Address (40 bytes), PHONE (10 bytes),Birth_date(8 bytes), Sex (1 byte), Major_dept_code (4 bytes), Minor_dept _code(4 bytes), Class_code (4 bytes, integer), and Degree_program(3 bytes). An additional byte one additional byte is used as a deletion maker. Having block size of 512 byte & Assume using unpanned origination.

Suppose the file is ordered by key filed Ssn & construct a sparse primary index on Ssn, with pointer size is 7 byte.

A: is the number of data block required.

B: is the total number of index block required [using] in multilevel index.

C: Is the number of level required is multilevel indexing then value of A + 2B + 4C is______.

2 mins Summary

Topic DBMS (Part 07)

Topic

THANK - YOU

CS & IT ENGINEERING

Database Management System

Lecture No.- 08

By- Vijay Agarwal Sir

Recap of Previous Lecture

- **Topic** Relational Algebra
- **Topic** Structured Query Language
- **Topic** File Org & Indexing

Topics to be Covered

Topic File Org & Indexing

Topic B & B+ Tree

[MCQ]

#Q. Consider a B^+ tree in which the maximum number of child nodes is 6. What is the minimum and maximum number of keys in such a tree?

1

A 3 and 4

B 3 and 5

C 2 and 5

D 2 and 4

[MCQ]

#Q. Match the following

2

List-I	List-II
a. Primary index	1. Non key and ordering
b. Clustering index	2. Non-key and Non-ordering
c. Secondary index (key)	3. Key and ordering
d. Secondary Index(Non key)	4. Key and Non ordering

Codes:

Done

	a	b	c	b
A	4	1	3	2
B	3	1	4	2
C	3	2	4	1
D	4	2	3	1

[NAT]

(3) In a B^+ tree, if the search key field value is 13 bytes and records pointer is a bytes long and block pointer 7 bytes, block size is 1024 bytes. Then the order of internal (non-leaf) node in B^+ tree is________.

B+ Tree: ORDER of Internal Node:

$$P * B_P + (P-1)\,\text{keys} \le \text{Block size}$$

$$P * 7 + (P-1)13 \le 1024$$

$$7P + 13P - 13 \le 1024$$

$$20P \le 1037$$

$$P = \left\lfloor \frac{1037}{20} \right\rfloor = \lfloor 51.85 \rfloor = 51 \text{ Ans}$$

[NAT]

(4) Navathe Book

A file has r = 20,000 STUDENT records of fixed length. Each records has the following fields: Name (30 bytes), Ssn (9 bytes), Address (40 bytes), PHONE (10 bytes), Birth_date(8 bytes), Sex (1 byte), Major_dept_code (4 bytes), Minor_dept_code(4 bytes), Class_code (4 bytes, integer), and Degree_program(3 bytes). An additional byte one additional byte is used as a deletion maker. Having block size of 512 byte & Assume using unpanned origination.

Suppose the file is ordered by key filed Ssn & construct a sparse primary index on Ssn, with pointer size is 7 byte.

A: is the number of data block required.

B: is the total number of index block required [using] in multilevel index.

C: Is the number of level required is multilevel indexing then value of A + 2B + 4C is 5338. Ans

Ans (5338)

Records = 20,000.

1 Record Size = 30 + 9 + 40 + 10 + 8 + 1 + 4 + 4 + 4 + 3 + 1 = 114 Byte

Block Size = 512 Key Size = 9 Byte Pointer = 7 Byte.

Block factor of DB file = $\left\lfloor \frac{512}{114} \right\rfloor$ = 4 Record/Block

Total # DB Blocks = $\left\lceil \frac{20000}{4} \right\rceil$ = 5000 Data Block.

One Index Record Size = $\underbrace{9+7}_{\text{key + Pointer}}$ = 16 Byte

Block factor of Index file = $\left\lfloor \frac{512}{16} \right\rfloor$ = 32 Index Record Per Block.

Primary : Sparse : Total # Index entries = 5000 (# DB Block)

1st Level : Total # Index Block = $\left\lceil \frac{5000}{32} \right\rceil$ = 157 Index Block

2nd Level Total # Index Block = $\left\lceil \frac{157}{32} \right\rceil$ = 5 Index Block

3rd Level Total # Index Block = $\left\lceil \frac{5}{32} \right\rceil$ = 1 Index Block

So Stop Here

Total 3 Level Required.

$\boxed{A = 5000}$

$B = 157 + 5 + 1 = \boxed{B = 163}$

$\boxed{C = 3}$

$A + 2B + 4C$

$5000 + 2(163) + 4(3)$

$5000 + 326 + 12$

$= 5338$ Ans

[NAT]

5 Consider a file of 5, 24, 288 records. Each records is 64 byte long and its key field is of size 8 byte. The file is ordered on a non-key field and the file organization is un-spanned. The file is stored in a file system with block size 1024 byte and the size of block pointer is 8 byte. If the secondary index built on the key field of the file and multilevel index scheme is used to store the secondary Index. The number of block required in the third level index is 2 Ans

2^{19}

$\boxed{\text{Ans } (2}$

Total # Records $= 2^{19}$ Key $= 8$ Byte & BP $= 8$ Byte   Block Size $= 1024$ Byte

One Index Record Size $= 8 + 8 = 16$ Byte

Bf of Index file $= \frac{1024}{16} = \frac{2^{10}}{2^4} = 2^6 = 64$ Records / Block.

Dense

$\# \text{Index entries} = 2^{19}$

First level

$\text{Total } \# \text{ Index Block} = \frac{2^{19}}{2^6} = 2^{13} \text{ Index Block}$

2nd Level

$\text{Total } \# \text{ Index Block} = \frac{2^{13}}{2^6} = 2^7 \text{ Index Block}$

3rd Level

$\text{Total } \# \text{ Index Block} = 2^7 / 2^6 = 2 \text{ Index Block}$ Avg

4th Level

$\text{Total } \# \text{ Index Block} = \left\lceil 2 / 2^6 \right\rceil = 1 \text{ Index}$

Total 4 Level

[MCQ]

6

#Q. Given a block can hold either 3 records or 10 key pointers. A database contains n records, then how many blocks do we need to hold the data file and the dense index

A 13n/30

Ans (A)

B n/3

C n/10

D n/30

Dense Index

Total # Records = n

entries = n

Block factor of DB File = 3 ⇒ Total # Data Block = $\frac{n}{3}$

Block factor of Index file = 10 ⇒ Total # Index Block = $\frac{n}{10}$

Total Block = $\frac{n}{3} + \frac{n}{10} \Rightarrow \frac{13n}{30}$ Ans

[MCQ]

7

#Q. Calculate the order of leaf (P_{leaf}) and non leaf (P) nodes of a B^+ tree based on the information given below.

Search key field = 12 field

Record pointer =10 bytes

Block pointer = 8 bytes

Block size = 1 KB

A $P_{leaf} = 51$ and $P = 46$

B $P_{leaf} = 47$ and $P = 52$

C $P_{leaf} = 46$ and $P = 51$

D $P_{leaf} = 52$ and $P = 47$

Internal Node

$$P * B_P + (P-1)\,key \le B.S$$

$$P \times 8 + (P-1)\,12 < 1024$$

$$8P + 12P - 12 \le 1024$$

$$20P \le 1036$$

$$P = \left\lfloor \frac{1036}{20} \right\rfloor = \lfloor 51.8 \rfloor$$

$$= 51$$

[MCQ]

8

#Q. The order of a leaf node in B^+ tree is the maximum number of (value, data record pointer) pairs it can hold. Given that the block size is IK bytes, data record pointer is 7 bytes long, the value field is 9 bytes long and a block pointer is 6 bytes long.

What is the order of the leaf node?

A 63

B 64

C 67

D 68

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

$P(7+9) + 6 \leq 1024$

$16P + 6 \leq 1024$

$16P \leq 1018$

$P = \left\lfloor \frac{1018}{16} \right\rfloor = 63$ Ans

[NAT]

9 Navathe Book

#Q. Suppose that the search field is a non-ordering key field, and we construct a B-tree on this field with p = 23. Assume that each node of the B-tree is 69% full on an average. Assume the level of the root Node in a B tree is 1. Then the total number of keys stored till at height 2 (level 3) is______.

ORDER = 23 ⇒ 69 % Full. ⇒ 23 × 0.69 = ~~16~~

Actual ORDER = 16

16 Pointer & 15 keys.

Avg Fan out = 16

ORDER = P (16)

Height/Level	Max #Node	Max # BP	Max #keys
0/1	1	P	P-1
1/2	P	P^2	$P(P-1)$
2/3	P^2	P^3	$P^2(P-1)$

$(P-1) = 16-1 = 15$

$15 = 15$

$16 \times 15 = 240$

$16^2 \times 15 = 3840$

Total #keys = 15 + 240 + 3840

= 4095 Ans

10 & 11

Common data for next Two Questions

Consider the following description

To construct B+ tree use the following values. Consider the database block size as 512 bytes, block pointer as 6 bytes, record pointer as 7 bytes and search key value as 9 bytes.

Block size = 512 Byte

B_p = 6 Byte

R_p = 7 Byte

key = 9 Byte.

[MCQ]

#Q. What is the order of B^+ tree internal node

A 23

B 32

C 34

D 44

$$p * B_p + (p-1) \le B.S$$

$$p * 6 + (p-1)9 \le 512$$

$$6p + 9p - 9 \le 512$$

$$15p \le 521$$

$$p = \frac{521}{15} = 34$$

Key order

Leaf Node

$$P(key + R_P) + 1\ B_P \le B.S$$

$$\Rightarrow P(9+7) + 6 \le 512$$

$$\Rightarrow 16P \le 506$$

$$P = \left\lfloor \frac{506}{16} \right\rfloor = 31$$

Order → (key, Record Pair)

$$P(\text{key} + R_P) + 1\,B_P.$$

Block Pointer order $\Rightarrow (P-1)(\text{key}+R_P) + 1\,B_P.$

[NAT]

12

Consider a data with 4700 keys (records) are going to be inseresting into B+ tree. Can hold 15 pointer (P = 15) Database using dense B+ tree for indexing assume level of the root node is 1. Let x is the minimum number of levels required y is the maximum number of levels required then what is the value of $2x + y$________

$\text{min BP} = \lceil P/2 \rceil = \lceil 15/2 \rceil = \lceil 7.5 \rceil = 8$ $\boxed{\text{ORDER} = 15}$

Maximum # keys $= P-1 = 15-1 = 14$ Max keys

Minimum # keys $= \lceil P/2 \rceil - 1 \Rightarrow \lceil 15/2 \rceil - 1 = 8-1 = 7$ Min key

we Maximum level getting if Each Node Contain Min keys & Min BP.

we getting Minimum Level if Each Node Contain Maximum keys & Max BP.

Note In a B+ Tree all keys are available at the Leaf Node.

Minimum Level (Max keys & BP) | Maximum Level (min key & min BP)

Ist Level $= \left\lceil \frac{4700}{14} \right\rceil = 336$ Node (keys)

2nd Level $= \left\lceil \frac{336}{15} \right\rceil = 23$ Node

3rd Level $= \left\lceil \frac{23}{15} \right\rceil = 2$ Node

4th Level $= \left\lceil \frac{2}{15} \right\rceil = 1$

Minimum 4 Level. $X = 4$

Ist Level $= \left\lceil \frac{4700}{7} \right\rceil = 672$ Node (keys)

2nd Level $= \left\lceil \frac{672}{8} \right\rceil = 84$

3rd Level $= \left\lceil \frac{84}{8} \right\rceil = 11$

4th Level $= \left\lceil \frac{11}{8} \right\rceil = 2$

5th Level $= \left\lceil \frac{2}{8} \right\rceil = 1$

$y = 5$ Maximum 5 Level.

$2x + y$

$2 * 4 + 5$

$8 + 5 = 13$ Ans

[NAT]

13

Assume the level of Root node in a B^+ Tree is 1. Then the maximum number of nodes in a B^+ Tree possible with order 5 and the number of level 6 is x & maximum number of distinct keys (Records) in a B^+ Tree of height 5 & order 5 is y. Then the value of x + y is ______.

$\Downarrow$ level 6

$x = 3906.$

$y = 12{,}500$

$x + y = 3906 + 12500$

$= 16{,}406$ Ans

ORDER : P

ORDER P = 5

B+ Tree

Height/Level	Max # Nodes		Max # BP	Max # keys	P-1 = 5-1 = 4
0/1	1	1	P	$(P-1)$	4 = 4
1/2	P	5	P^2	$P(P-1)$	5×4 = 20
2/3	P^2	25	P^3	$P^2(P-1)$	$5^2 \times 4$ = 100
3/4	P^3	125	P^4	$P^3(P-1)$	500
4/5	P^4	625	P^5	$P^4(P-1)$	2500
5/6	P^5	3125	P^6	$P^5(P-1)$	12500
		3906			

Height/Level	min # Nodes	Min # Bp	# keys.
0/1	1	$\lceil p/2 \rceil$	$\lceil p/2 \rceil - 1$
1/2	$\lceil p/2 \rceil$	$\lceil p/2 \rceil^2$	$\lceil p/2 \rceil \left(\lceil p/2 \rceil - 1 \right)$
⋮			

[MCQ]

14

#Q. A B-tree of order 5, the following keys are inserted as follows : 7,8,1,4,13,20,2,6,5. How many elements are present in the root of the tree?

A 2

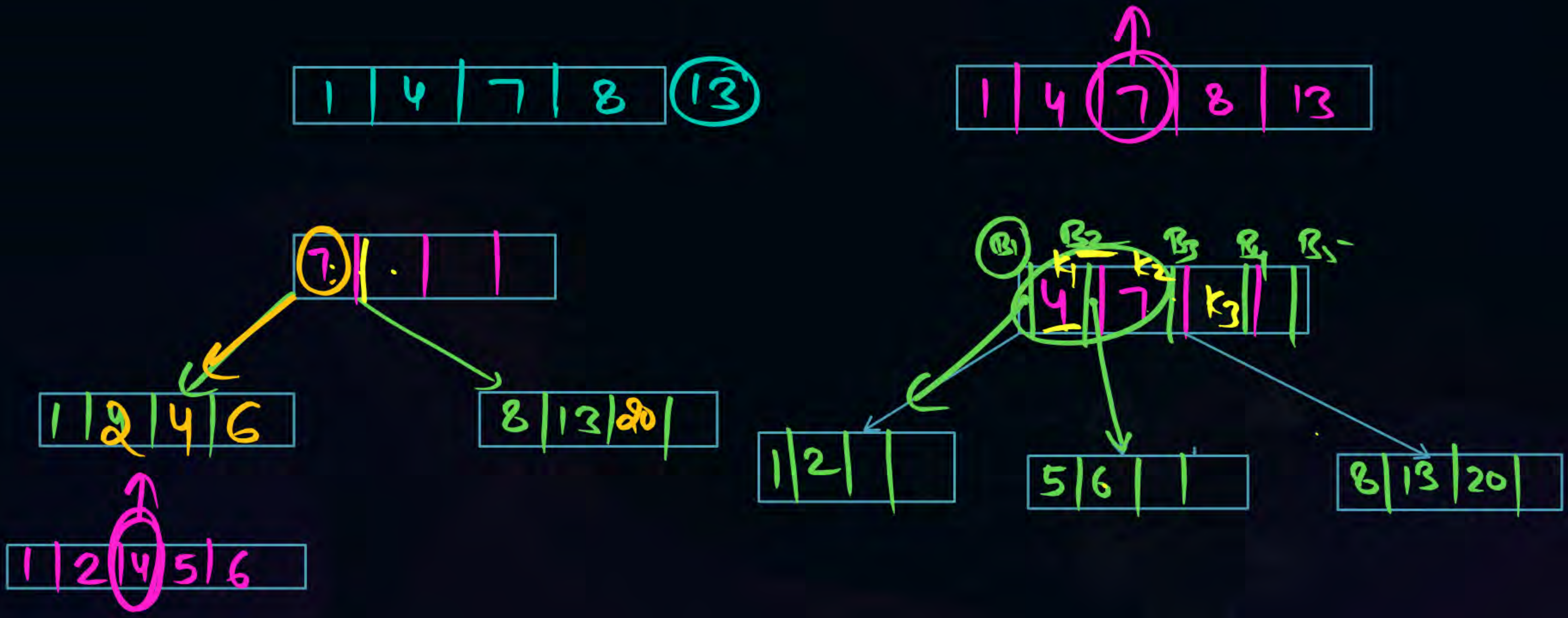
B 1

C 3

D 4

7, 8, 1, 4, 13, 20, 2, 6, 5

ORDER = 5
Max key = 4



[MCQ]

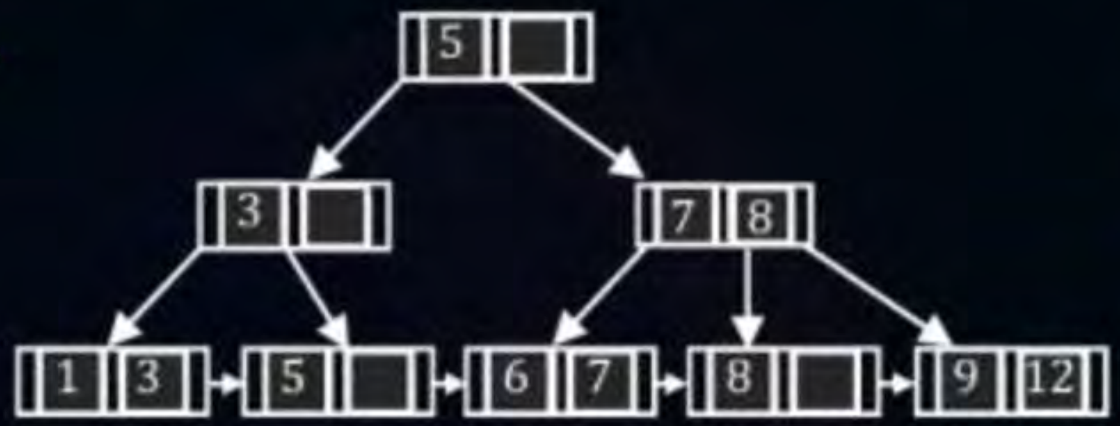
15

#Q. If following sequence of keys are inserted in a B^+ tree with (K = 3) pointers

8, 5, 1, 7, 3, 12, 9, 6

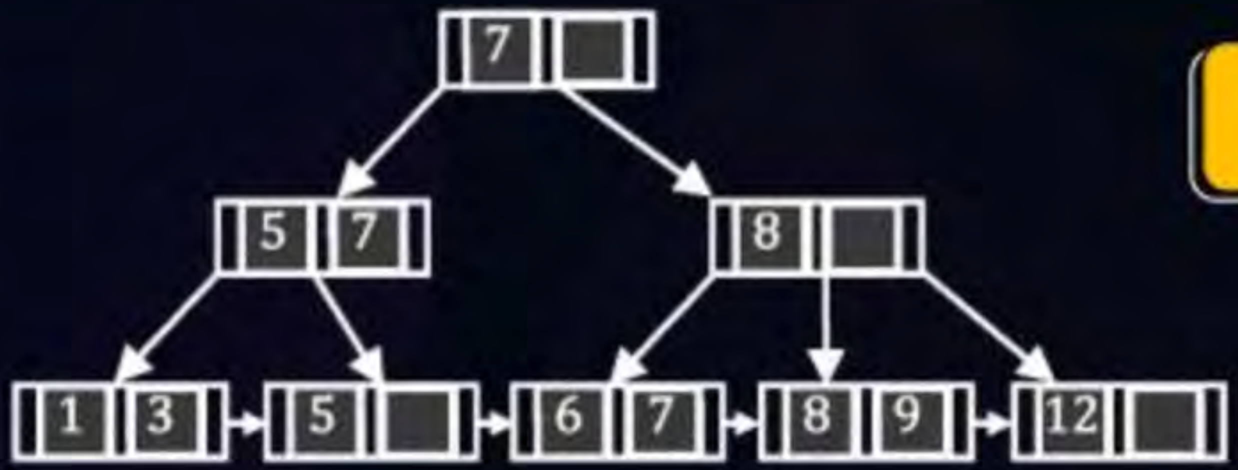
Which of the following shall be correct B+ tree?

A

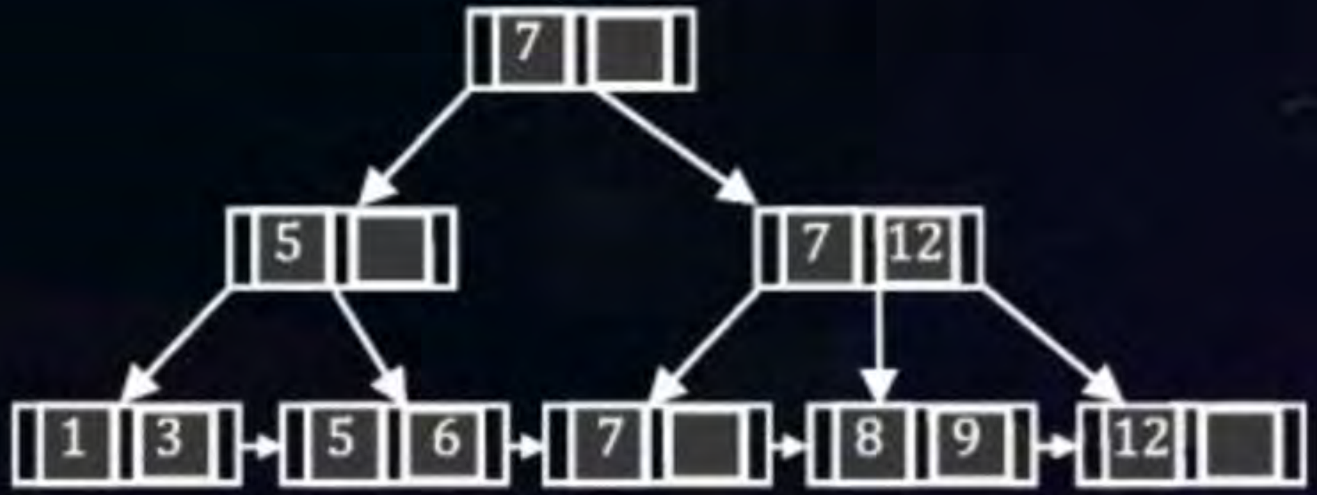


B

C



D

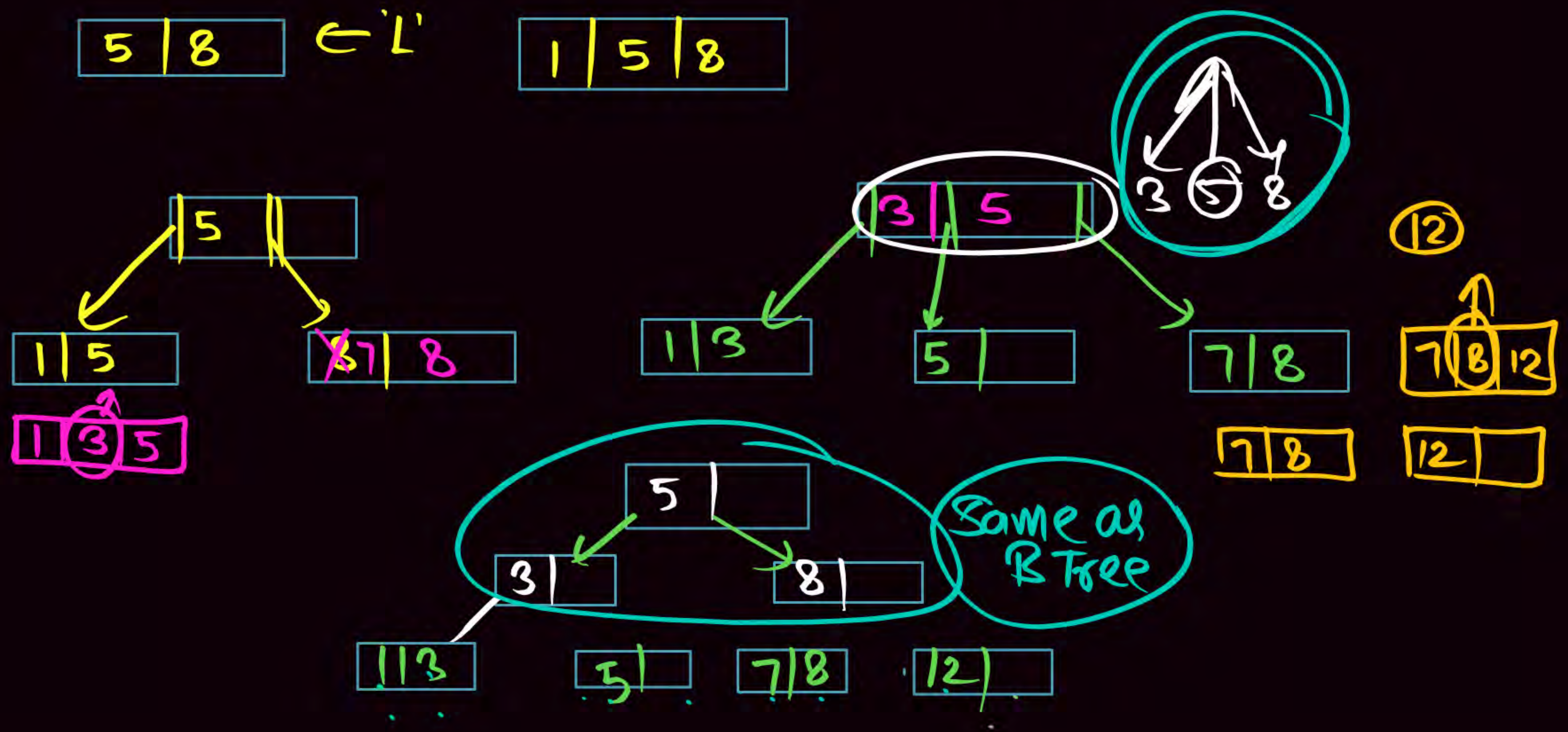


8, 5, 1, 7, 3, 12, 9, 6

ORDER = 3

B+ Tree

Left Biasing



Internal Node $\Rightarrow$ B & B+ Tree Same

leaf Node $\Rightarrow$ keys Copied in B+ Tree

2 mins Summary

Topic DBMS Part 08

Topic

THANK - YOU