Branch : CSE & IT Batch : Hinglish

Database Management System
FD's & Normalization

DPP 05

[MCQ]

1. Assume a relation R = (P Q R S T U) and functional dependencies: F = {PQ → RU, RT → Q, U → S}, consider the following two statements:

S_1: The decomposition of R into PQRT and PQSTU is a dependency preserving decomposition.

S_2: The decomposition of R into PQRT and PQSTU is a lossless decomposition.

Which of the statement is/are TRUE?

(a) Only S_1 is true.
(b) Only S_2 is true.
(c) Both S_1 and S_2 are true.
(d) Both S_1 and S_2 are false.

[MCQ]

2. Consider the following two decomposition of R(P Q R S T U) with the set of dependencies

F = {PQ → R, PR → Q, PS → T, Q → S, QR → P, T → U}.

S_1: R_1(PQ), R_2(QR), R_3(PQST), R_4(TU)

S_2: R_1(PQR), R_2(PRST), R_3(PSU)

Which of the statements is are dependency preserving and lossless-join decomposition of R?

(a) S_1 Only (b) S_2 Only
(c) Both S_1 and S_2 (d) None of these

[MCQ]

3. Consider a relation STUDENT (Name, Subject, Location, Marks).

Name	Subject	Location	Marks
Madhav	Operating System	Noida	96
Madhav	DBMS	Noida	100

Student is decomposed into following

1. STU $_{Sub\ 1}$ (Name, Subject, Location) and STU $_{Sub\ 2}$ (Name, Location, Marks).

2. STU $_{Sub\ 1}$ (Name, Location) and STU $_{Sub\ 2}$ (Subject, Marks).

Which of the following is True?

(a) 1 is lossy but 2 is lossless
(b) 1 is lossless but 2 is lossy
(c) Both 1 and 2 are lossless
(d) Both 1 and 2 are lossy

[MCQ]

4. Consider a relation R(P, Q, R, S, T, U, V, W) be a relation schema, in which of the following FD sets are known to hold = {P → Q, P → R, P → S, PT → W, T → S, T → U}. Suppose we decompose the relation into two relations, R_1(PQRS), and R_2(STUVW). The above decomposition is

(a) lossless join and dependency preserving.
(b) lossless join but not dependency preserving.
(c) dependency preserving but not lossless join.
(d) neither dependency preserving nor lossless join.

[MCQ]

5. Let R(P, Q, R, S, T, U) be a relational schema, in which of the following FD' sets are known to hold {PQ → R, PR → Q, PS → T, QR → R, Q → U}

Suppose we decompose the relation R into four relations R_1(PQ), R_2(QR), R_3(PQST) and R_4(TU).

Then the above decomposition is:

(a) dependency preserving and lossless join.
(b) lossless join but not dependency preserving.
(c) dependency preserving but not lossless join.
(d) neither dependency nor lossless join.

[MCQ]

6. Consider the following statements

S_1: The decomposition R_1, R_2 ….. R_n for a relation schema R are said to be lossless if their natural join results in the original relation R.

S_2: The decomposition R_1, R_2 ….. R_n for a relation schema R are said to be lossy if their natural join results into addition of extraneous tuples with the original relation R.

(a) Only S_1 is true
(b) Only S_2 is true
(c) Both S_1 and S_2 are true
(d) Neither S_1 nor S_2 are true

[MCQ]

7. Consider the relation R(P, Q, R, S, T, U, V, W) with the following set of functional dependencies:
F = {P $\rightarrow$ QRS, P $\rightarrow$ T, TUV $\rightarrow$ W and U $\rightarrow$ VW}
Which one of the FD in the F is redundant?
(a) P $\rightarrow$ QRS (b) PS $\rightarrow$ T
(c) TUV $\rightarrow$ W (d) U $\rightarrow$ VW

[MCQ]

8. Which are the major and important properties of FD's?
(a) There should be one to one relationship between attributes in FDs.
(b) FDs must be defined in schema.
(c) FDs should be non-trivial.
(d) All of the above

Answer Key

1. **(c)**
2. **(d)**
3. **(d)**
4. **(d)**
5. **(d)**
6. **(c)**
7. **(c)**
8. **(d)**

Hints & Solutions

1. (c)

S_1: True – PQ → R and RT → Q are preserved in PQSTU.

S_2: True – PQRT ∩ PQSTU = PQT and PQT → PQRT which is the candidate key of PQR T relation.

2. (d)

S_1:

	P	Q	R	S	T	U
R_1	α	α				
R_2		α	α			
R_3	α	α	α	α	α	α
R_4					α	α

This is lossless join decomposition

Now checking for dependency preserving

PQ → R, only trivial FD's hold in R, (PQ) and R_2 (Q, R) and FD holds in R_3 (PQST) = {T → U}. Let it be F_1 and FD holds in R_4 (TU) = {T → U}. Let it be F_2.

Now $F+ = (F_1 \cup F_2)^+$

$(PQ)^+$ = PQR but $(F_1 \cup F_2)^+$ will not contain R. So this is not dependency preserving.

S_2:

	P	Q	R	S	T	U
R_1	α	α	α			
R_2	α	α	α	α	α	α
R_3		α	α	α	α	α
R_4	α			α	α	α

This is lossless join decomposition

Now checking for dependency preserving check for FD Q → S

$F^+ = (Q)^+ = \{Q, S\}$ this will no be preserved in any relation as $(F_1 \cup F_2)^+$ will not contain U.

3. (d)

A decomposition is lossy if after joining, relation contains extra tuple, divide the table according to decomposed relation and then perform joining operation again if there is extra tuples then that decomposition is lossy.

STU_{Sub1}		
Name	**Subject**	**Location**
Madhav	OS	Noida
Madhav	DBMS	Noida

STU_{Sub2}		
Name	**Location**	**Marks**
Madhav	Noida	96
Madhav	Noida	100

$STU_{Sub1} \bowtie STU_{Sub1}$			
Name	**Subject**	**Location**	**Marks**
Madhav	OS	Noida	96
Madhav	DBMS	Noida	100
Madhav	OS	Noida	96
Madhav	DBMS	Noida	100

Lossy because we have extra tuples in the relation.

4. (d)

{P → Q, P → R, P → S, PT → W, T → S, T → U}

	P	Q	R	S	T	U	V	W
R_1	α	α	α	α				
R_2				α	α	α	α	α

PT → W is not preserved

Therefore, its neither dependency preserving not lossless

5. (d)

	P	Q	R	S	T	U
R_1	α	α				
R_2		α	α			
R_3	α	α		α	α	
R_4					α	α

Neither lossless nor dependency preserving

∴ (d) is correct option.

6. (c)

S_1 (True): The decomposition R_1, R_2 …. R_n for a relation schema R are said to be lossless if their natural join results the original relation R.

S_2 (True): The decomposition R_1, R_2 …. R_n for a relation schema R are said to be lossy if their natural join results into addition of extraneous tuples with the original relation R.

7. (c)

(a) $P \rightarrow QRS$ $\{P \rightarrow Q, P \rightarrow R, P \rightarrow S\}$

(b) $PS \rightarrow T$, now closure of P has S so S is extraneous attribute. So remove S then resultant FD is $P \rightarrow T$

(c) $\{US\}^+ = VW$, so remaining T and V from FD So resultant FD is $U \rightarrow W$

(d) $U \rightarrow VW = \{U \rightarrow V, U \rightarrow W\}$
So, $U \rightarrow W$ is redundant because it can be derived from FD $U \rightarrow VW$.

8. (d)

(a) There should be one to one relationship between attribute in FD's.

(b) FD's must be defined in schema

(c) FD's should be non-trivial

Hence, option (d) is correct.