

Database Management System

FD's and Normalization

DPP 08

[MCQ]

1. Assume a relation R which has 5 attributes PQRST, and the following functional dependencies: $P \rightarrow Q$, $QR \rightarrow S$ and $S \rightarrow T$. Then the closure of PR i.e., $(PR)^+$ is?
- (a) PQRST (b) PQR
(c) PQRS (d) None of the above

[MCQ]

2. Assume a relation R with attributes MNOPQ and F is a set of functional dependencies $\{M \rightarrow MNOPQ, N \rightarrow O\}$ which of the following statement is true?
- S₁:** R₁ (MOPQ), R₂ (NO) are both in BCNF and preserves lossless join.
S₂: R₁ (MNPQ), R₂ (NO) are both in BCNF and preserves lossless-join.
- (a) Only S₁ is true
(b) Only S₂ is true
(c) Both S₁ and S₂ are true
(d) Neither S₁ and S₂ is true

[MCQ]

3. Assume a relation schema R with 5 attributes P, Q, R, S, T and the set of FD'S $P \rightarrow RS$, $Q \rightarrow RT$, $T \rightarrow Q$ consider the statements:
- S₁:** The only candidate key of R is PQ and PT
S₂: The highest normal form satisfied by R is 2NF
- Which of the statement is true?
- (a) Only S₁ is true
(b) Only S₂ is true
(c) Both S₁ and S₂ are true
(d) Neither S₁ nor S₂ is true

[MCQ]

4. Consider a relation R with attributes P, Q, R, S, T. The following set of functional dependencies hold on R $\{Q \rightarrow R, S \rightarrow P, P \rightarrow Q\}$. The highest normal form satisfied by R is.
- (a) 1NF (b) 2NF
(c) 3NF (d) BCNF

[MCQ]

5. Consider a relation R (P, Q, R, S, T) with the following FD's, $\{P \rightarrow Q, QS \rightarrow P, P \rightarrow R\}$ if we decompose R into BCNF then which of the following FD cannot be preserved?
- (a) $P \rightarrow Q$
(b) $P \rightarrow R$
(c) $QS \rightarrow P$
(d) All of them are preserved

[MCQ]

6. Consider a relation R (L, M, N, O) with the functional dependencies:
- $L \rightarrow M$,
 $M \rightarrow N$,
 $N \rightarrow O$
- which one of the following decompositions is not lossless?
- (a) R₁ (L, M), R₂ (M, N), R₃ (N, O)
 (b) R₁ (L, M), R₂ (L, N), R₃ (L, O)
 (c) R₁ (L, O), R₂ (M, O), R₃ (N, O)
 (d) All of the above are lossless

[MSQ]

7. Consider a relation X (P, Q, R, S, T) with the FD's:
- $PQ \rightarrow R$
 $Q \rightarrow S$
 $ST \rightarrow P$
- $Q \rightarrow S$ is a BCNF violation for X. Suppose we decide to decompose X into X₁(Q, S), and X₂(P, Q, R, S, T). Which of the following statements are incorrect?
- (1) $\{PQ \rightarrow R\}$ is a minimal cover for the FD's that hold in X₂.
 (2) $PQ \rightarrow R$ is a BCNF violation for X₂.
 (3) X₂ should be decomposed further into X₃(P, Q, R) and X₄(R, T)
- (a) (1) (b) (2)
(c) (3) (d) (1) and (2) only

[MCQ]

8. Suppose functional dependency $Q \rightarrow R$ holds in relation R (P, Q, R, S) which additional FD will make R be in 3NF, but not BCNF?
- (a) $S \rightarrow PQ$ (b) $PR \rightarrow S$
(c) $RS \rightarrow Q$ (d) $PS \rightarrow Q$



Answer Key

- | | |
|--------|-----------|
| 1. (a) | 5. (c) |
| 2. (b) | 6. (c) |
| 3. (a) | 7. (a, c) |
| 4. (a) | 8. (c) |



Hints & Solutions

1. (a)

Closure of $(PR)^+ = \{P, Q, R, S, T\}$ and also PR is candidate key of the given relation R(PQRST).

2. (b)

For BCNF, we make a relation for those FD which violates BCNF property, relation is made for FD $N \rightarrow O$ and by removing O from relation R and creating two relation R_1 (MNPQ) R_2 (NO) Hence, the decomposition is lossless.

3. (a)

$S_1: P \rightarrow RS, Q \rightarrow RT, T \rightarrow Q$

$\{PQ\}^+ = \{PQRST\}, \{PT\}^+ = \{PQTRS\}$

So, candidate key of R is PQ and PT

Hence, S_1 is true

S_2 : False, we have partial dependency in the relation " $Q \rightarrow R$ ". Hence, the given relation is in 1NF.

4. (a)

$Q \rightarrow R$

$S \rightarrow P$

$P \rightarrow Q$

ST must be a part of candidate key ST is candidate key. If satisfies 1NF.

$S \rightarrow P$ violates 2NF

Become $S \rightarrow P$ is a partial functional dependency.

5. (c)

Starting with $P \rightarrow Q$, we decompose R into PQ and PRST. Now, PRST contains a FD $P \rightarrow R$ that violates BCNF, so we decompose it further into PQR and PST, $P \rightarrow Q$ and $P \rightarrow R$ holds in PQR. And PST doesn't support any nontrivial FD's

Hence, $QS \rightarrow P$ is not preserved.

6. (c)

(a) It is lossless because the relations are decomposed based on the FD's and thus each relation has a

common attribute which is also the primary key in either of them.

(b) It is also lossless as it has common attribute L in three of them and L is also the key in R_1, R_2 , as well as in R_3 .

(c) It is a lossy decomposition because the common attribute is O and O is not the key in either of them.

Hence, the correct option is (c).

7. (a, c)

Since Q and T do not appear on the right side of any FD, they must be a part of every key.

On computing the closure of $\{Q, T\}$. First, apply $Q \rightarrow S$ to get S into the closure. Then, $ST \rightarrow P$ adds P into the closure.

Finally, $PQ \rightarrow R$ adds R into the closure.

The closure of $\{Q, T\}$ covers all attributes of X, so it's a super key of X. But we also know that Q and T must be a part of every key, so $\{Q, T\}$ is the only key.

(a) It is incorrect because $QT \rightarrow PR$ also holds in X_2 (which should be rather obvious because $\{Q, T\}$ is a key).

(b) It is true because PQ does not contain $\{Q, T\}$, the only key of X_2 .

(c) It is incorrect because X_4 should be (P, Q, T) instead of (R, T)

Hence a and c is correct option.

8. (c)

(a) In this, S is the only key, so $Q \rightarrow R$ is both a 3NF and BCNF violation.

(b) Here, PQ is the only key, so both FD's are 3NF and BCNF violations.

(c) Here, we can check that the keys are PRS and PQS. Both FD's violate BCNF, but all the attributes are prime, so there can be no 3NF violation.

(d) PS is the only key, so $Q \rightarrow R$ violates both normal forms.

Hence, the correct option is (c)



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