Branch : CSE & IT   Batch : Hinglish

Database Management System
FD's & Normalization   DPP 06

[MCQ]

1. Assume a relation R(P, Q, R, S, T) with the following functional dependencies
{PQ → RST, P → R, Q → S}. which of the following decomposition of R satisfies BCNF?
(a) R_1 (P, R), R_2(Q, S), R_3(P, Q, R, S, T)
(b) R_1(P, R), R_2(Q, S), R_3(P, Q, R, T)
(c) R_1(P, R), R_2(Q, S), R_3(P, Q, S, T)
(c) R_1(P, R), R_2(Q, S), R_3(P, Q, T)

[MCQ]

2. Assume a relation R = (P, Q, R, S) and a set F of functional dependencies:
F = {PR → S, S → P, S → Q, S → R}, Highest normal form satisfied by the relation R is?
(a) 2NF
(b) 3NF
(c) BCNF
(d) 1NF

[MCQ]

3. Assume the relation R(P, Q, R, S, T) with candidate key PQ is in atleast 3NF. which of the following functional dependencies given in option are invalid?

(a) PQ → R
(b) ST → Q
(c) PQ → S
(d) RS → T

[MSQ]

4. State which of the following statements is/are true?
(a) Normal forms are used to eliminate or reduce redundancy in database tables.
(b) A relation is in first normal form if every attribute in that relation is singled valued attribute or No Multivalued Attribute.
(c) A relation is in 2NF if every candidate key is simple candidate key.
(d) A relation R is in BCNF, if R is in 3rd normal form and for every functional dependency, LHS is super key. A relation is in BCNF iff in eveiy non-trivial functional dependency P -> Q, where P is a super key.

[MSQ]

5. Consider the following relation R(P, Q, R, S) and functional dependencies F that hold over the relation
F = {P → QS, RS → Q, R → S, Q → PS}. The relation R is in which of the following normal form?
(a) 1NF
(b) 2NF
(c) 3NF
(d) BCNF

[MCQ]

6. Consider a relation which contains two different true multivalued dependencies then which of the following normal form is violated automatically.
(a) 2NF
(b) 3NF
(c) BCNF
(d) 4 NF

[MCQ]

7. Assume a relation R(P, Q, R, S, T, U) with the following dependencies
1. PQ → RS   2. T → R   3. Q → TU
Given the functional dependencies as shown above which among the options shows the decomposition of relation R is normalized to 3NF?
(a) R_1(P, Q, R, S, T, U) R_2(T, R) R_3(Q, T, U)
(b) R_1(P, Q, R, S) R_2(R, T) R_3(T, U, Q)
(c) R_1(P, Q, R, S) R_2(R, T) R_3(Q, T, U)
(d) R_1(P, Q, S), R_2(T, R) R_3(Q, T, U)

[MCQ]

8. Given the relation 'R' with attributes PQRST with set of functional dependencies {P → P Q R S T, Q → R} which of the following is / are true?
(a) R_1(PRST) R_2(QR) are both in BCNF and preserves lossless join.
(b) R_1(PQST), R_2(QR) are both in BCNF and preserves lossless join
(c) R_1(PST), R_2(QR) are both in BCNF and preserves lossless join.
(d) None of the above.

Answer Key

1. (d)
2. (c)
3. (d)
4. (a, b, c, d)

5. (a, b)
6. (d)
7. (d)
8. (b)

Hints & Solutions

1. **(d)**

If decomposition is lossless and every individual relation satisfy BCNF, then decomposition satisfy BCNF.

(a) The Decomposition $R_1(P, R)$, $R_2(Q, S)$, $R_3(P, Q, R, S, T)$ is lossless, but individual relation R_3 does not satisfy BCNF because of FD $P \to R$ and $Q \to S$.

(b) The Decomposition $R_1(P, R)$, $R_2(Q, S)$, $R_3(P, Q, R, T)$ is lossless, but individual relation R_3 does not satisfy BCNF because of FD $P \to R$.

(c) The Decomposition $R_1(P, R)$, $R_2(Q, S)$, $R_3(P, Q, S, T)$ is lossless, but individual relation R_3 does not satisfy BCNF because of FD $Q \to S$.

(d) The Decomposition $R_1(P, R)$, $R_2(Q, S)$, $R_3(P, Q, T)$ is lossless, and individual relation R_3 also satisfy BCNF. Therefore, this decomposition is in BCNF.

NOTE: If a relation has only two attributes then it is in BCNF. Therefore R_1 and R_2 is in BCNF in all the options given above.

2. **(c)**

PR and S are the super key of the relating. LHS of each FD is super key therefore highest normal form satisfied by R is BCNF.

3. **(d)**

Given, PQ is a composite candidate key. hence prime attributes are P and Q. A relation is said to be in 3NF, if it is in 2NF and if there exists FD $\alpha \to \beta$, then either α is a super key or β is prime attribute. In functional dependency $RS \to T$, neither α is super key nor β is prime attribute. Hence this functional dependency is invalid.

4. **(a, b, c, d)**

a: true: Normal forms are used to eliminate or reduce redundancy in database tables.

b: true: A relation is in first normal form if every attribute in that relation is singled valued attribute.

c: true: A relation is in 2NF if every candidate key is a simple candidate key.

d: true: A relation R is in BCNF, if R is in 3rd normal form and for every functional dependency,

LHS is super key. A relation is in BCNF iff in every non-trivial functional dependency $P \to Q$, where P is a super key.

5. **(a, b)**

The candidate key of relation is R, therefore relation does not contain violation of 2NF.

Hence, highest normal form is satisfied by the relation is 2NF, so it is also satisfies 1NF.

6. **(d)**

If there consist a true / real multivalued dependencies in a relation then that relation automatically violates 4NF.(we need not check MVD's in 1NF, 2NF, 3NF and BCNF)

7. **(d)**

For the given FD set, the minimal cover will be:

$PQ \to R$

$PQ \to S$

$T \to R$

$Q \to T$

$Q \to U$

Minimal cover:

$PQ \to S$

$T \to R$

$Q \to T$

$Q \to U$

Candidate key = {P, Q}

$PQ \to S$ Satisfy 3NF

$T \to R$ does not satisfy 3NF

$Q \to T$ does not satisfy 3NF

$Q \to U$ does not satisfy 3NF

$\therefore$ Those which have same left-hand side will make relation.

$R_1(P, Q, S)$ $R_2(T, R)$, $R_3(Q, T, U)$

8. **(b)**

For BCNF decomposition, the relation is created for those FD which violates BCNF property. So relation is made for QR and remove R from relation and create two relation $R_1(PQST)$, $R_2(QR)$ and this decomposition is lossless.