Branch : CSE & IT Batch:Hinglish

WEEKLY TEST – 02

Subject : DBMS

Topic : Minimal Cover, Properties of Decomposition & Normal Form

Maximum Marks 20

Q.1 to 6 Carry ONE Mark Each

[MSQ]

1. Given a relational schema R(p q r s t) with FD set:

pq → r

s → t

Then choose the correct statement for the given FD set.

(a) R is in 2NF.

(b) R is not in 2NF.

(c) R is in 3NF

(d) R is not in 3NF

[MSQ]

2. Choose the correct statement from the following.

(a) If a relation is in 3NF then it is also in BCNF.

(b) If a relation is in 2NF then it is also in 3NF.

(c) If a relation is in BCNF then it is also in 3NF.

(d) If a relation is in BCNF then it is also in 2NF.

[MCQ]

3. Find the minimal cover for the FD set

F ={X → Y, XY → Z, W → XZ, W → U}

on a relation R (X, Y, Z, W, U)

(a) {X → Y, W → X, W → U}

(b) {X → Z, W → X, W→U}

(c) {X → Y, X → Z, W → X, W → U}

(d) {X → W, W → X, W → U}

[MSQ]

4. Consider the given FD set on relation R(x, y, z, w, v)

FD: {xy → z, z → w, w → y, w → v}

Then choose the correct statement from the following.

(a) R is in 2NF

(b) R is not in 3NF

(c) R is in BCNF

(d) R is not in BCNF

[MCQ]

5. Consider the given relation R(A B C D E F) with FD set as:

{A → CD, B → AC, D → EF, E → FB}

The given relation R satisfies which normal form?

(a) 1NF (b) 2NF

(c) 3NF (d) BCNF

[MCQ]

6. Consider the given set of FD set on relation R(p q r s t u v x)

{p →qr, r → uv, u → pxs, s → t}

The given relation R satisfies which normal form (Highest normal form).

(a) 1NF (b) 2NF

(c) 3NF (d) BCNF

Q.7 to 13 Carry TWO Mark Each

[MCQ]

7. Consider a relational schema R (P Q S T U V X Y Z W) Then what will be the maximum number of candidate keys possible for the above relational schema R?

(a) 10

(b) 20

(c) 252

(d) Not possible to find candidate keys.

[NAT]

8. Find the number of candidate keys for the given relation R (A B C D E F G) with FD set:
{AB → C, D → AB, C → DF, F → EG}

[MCQ]

9. Given a relational schema R(A, B, C, D, E) will set of functional dependencies P and Q as:
P:{A → B, AB → C, D → AC, D → E}
Q: {A → BC, D → AE}
Then choose the correct options from the following.
(a) Q is a subset of P
(b) P is a subset of Q
(c) $P \cong Q$
(d) $P \ncong Q$

[MSQ]

10. Choose the incorrect statements from the following:
(a) There can be atmost one primary key for any relation.
(b) There can be exactly one primary key for any relation
(c) There can exists 0 or more minimal cover for a given FD set for any relation.
(d) There exists only one minimal cover for a given FD set for any relation.

[MCQ]

11. Find the canonical cover for the FD set:
{Y → X, XW → YZ, Z → XYW}
On relation R(X, Y, Z, W)
(a) {Y → X, XW → Z, Z → YW}
(b) {Y → X, XW → Y, Z → YW}
(c) {Y → X, XW → Y, Z → XY}
(d) {Y → X, XW → Z, Z → YX}

[MSQ]

12. Choose the correct statement regarding normal forms from the following.
(a) If there exists only two attributes in a relation then it is in BCNF.
(b) If all the attributes are prime in a relation then the relation is in 3NF but may not be in BCNF.
(c) There exists 0 redundancy in 3NF always.
(d) None of the above.

[NAT]

13. The number of statement that is/are correct?
I: There exist 0% redundancy in third normal form (3NF).
II: There exist 0% redundancy in Boyce codd normal form (BCNF).
III: There should not exist any partial dependency in second normal form (2NF).

Answer Key

1. **(b, d)**
2. **(c, d)**
3. **(c)**
4. **(b, d)**
5. **(d)**
6. **(b)**
7. **(c)**
8. **(3)**
9. **(c)**
10. **(b, d)**
11. **(a)**
12. **(a, b)**
13. **(2)**

Hints and Solutions

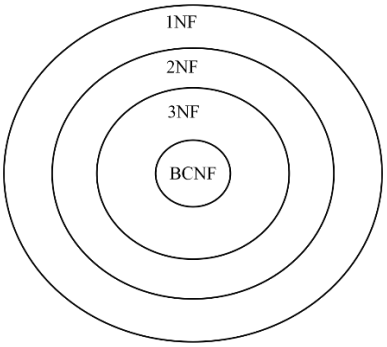
1. (b, d)

Given FD set :{pq →r, s → t}The candidate key for relation R is pqs.

$pqs^+ = \{p\ q\ r\ s\ t\}$

As there exists partial dependency, the relation R is not in 2NF and in turn not in 3 NF.

2. (c, d)



3. (c)

1. $X \rightarrow Y$
2. $XY \rightarrow Z$
3. $W \rightarrow XZ$
4. $W \rightarrow U$

As Y is implied by X, therfore Y is an entraneous attribute in $XY \rightarrow Z$, so updated FD $\Rightarrow X \rightarrow Z$.

1. $X \rightarrow Y$
2. $X \rightarrow Z$
3. $W \rightarrow X$
4. $W \rightarrow Z$
5. $W \rightarrow U$

In 4, $W \rightarrow Z$, is a redundant FD

So, Finally: $X \rightarrow Y$

$X \rightarrow Z$

$W \rightarrow X$

$W \rightarrow U$

$$\text{Minimal cover} = \begin{Bmatrix} X \rightarrow Y,\ W \rightarrow X \\ X \rightarrow Z,\ W \rightarrow U \end{Bmatrix}$$

4. (b, d)

The candidate key for relation R

$xy^+ = \{x, y, z, w, v\}$

$xz^+ = \{x, z, w, y, v\}$

$xw^+ = \{x, w, y, v, z\}$

$xv^+ = \{x, v\}$

	$xy \rightarrow z$	$z \rightarrow w$	$w \rightarrow y$	$w \rightarrow v$
2NF	✓	✓	✓	×
3NF	✓	✓	✓	×
BCNF	✓	×	×	×

Candidate keys: {xy, xz, xw}

Prime attributes: {x, y, z, w}

The given relation is in 1NF.

5. (d)

$\{A \rightarrow CD, B \rightarrow AC, D \rightarrow EF, E \rightarrow FB\}$

Candidate keys for relation R are:

$A^+ = \{A, C, D, E, F, B\}$

$B^+ = \{B, A, C, D, E, F\}$

$C^+ = \{C\}$

$D^+ = \{D, E, F, B, A, C\}$

$E^+ = \{E, F, B, A, C, D\}$

$F^+ = \{F\}$

$CF^+ = \{C, F\}$

Candidate keys are: {A, B, D, E}

	$A \rightarrow CD$	$B \rightarrow AC$	$D \rightarrow EF$	$E \rightarrow FB$
2NF	✓	✓	✓	✓
3NF	✓	✓	✓	✓
BCNF	✓	✓	✓	✓

6. (b)

Given FD set:

$\{p \rightarrow qr\ \ r \rightarrow uv\ u \rightarrow pxs\ \ s \rightarrow t\}$

Candidate keys:

$p^+ = \{p, q, r, u, v, x, s, t\}$

$r^+ = \{r, u, v, p, x, s, t, q\}$

$u^+ = \{u, p, x, s, t, q, r, v\}$

$s^+ = \{s, t\}$.

prime attributes = {p, r, u}

	p → qr	r → uv	u → pxs	s → t
2NF	✓	✓	✓	✓
3NF	✓	✓	✓	×
BCNF	✓	✓	✓	×

Hence, the highest normal form is 2NF.

7. (252)

For any relational instance with "n" attributes we get the maximum number of candidate keys if we group 2 attributes together.

Therefore selecting 2 attributes set from n attributes

$${}^{n}C_{\left\lfloor \frac{n}{2} \right\rfloor} \Rightarrow {}^{10}C_{\left\lfloor \frac{10}{2} \right\rfloor} \Rightarrow {}^{10}C_5$$

$$\Rightarrow \frac{^{2}\cancel{10} \times 9 \times \overset{2}{\cancel{8}} \times 7 \times \cancel{6} \times \cancel{5!}}{\cancel{5!} \times \cancel{5} \times \cancel{4} \times \cancel{3} \times \cancel{2} \times 1}$$

$\Rightarrow 4 \times 9 \times 7$

$\Rightarrow 36 \times 7 = 252$

8. (3)

$A^+ = \{A\}$

$B^+ = \{B\}$

$C^+ = \{C, D, F, A, B, E, G\}$

$D^+ = \{D, A, B, C, F, E, G\}$

$E^+ = \{E\}$

$F^+ = \{F, E, G\}$

$AB^+ = \{A, B, C, D, E, F, G\}$

Only 3 candidate keys possible for R i.e {C, D, AB}

9. (c)

Let's first find attribute closure of L.H. S of FD set Q in FD set P

$A^+ = \{A, \underline{B}, \underline{C}\}$ ✓ [A → BC] in Q.

$D^+ = \{D, \underline{E}, \underline{A}, C, B\}$ ✓ [D → AE] in Q.

So, $Q \subseteq P$

Now checking the attribute closure of L.H.S of FD set P in FD set Q.

$A^+ = \{A, B, C\}$ ✓ [A → B] in P

$AB^+ = \{A, B, C\}$ ✓ [A → BC] in P

$D^+ = \{\underline{D}, \underline{A}, E, B, \underline{C}\}$ ✓ [D → AC] in P

[D → E] in P

So, $P \subseteq Q$

We can conclude that $P \cong Q$. So option (c) is correct.

10. (b, d)

There exists at most one primary key for any relation.

There can be 0 or more minimal cover for any given FD set for a relation.

11. (a)

(1) Y → X

XW → YZ

Z → XYW No extraneous attribute

(2) Y → X

XW → Y, Redundant FD

XW → Z Removing redundant FD's.

Z → X, Redundant FD

Z → Y

Z → W

(3) Y → X

XW → Z Applying merging rule on RHS.

Z → Y

Z → W

Resultant FD: {Y → X, XW → Z, Z → YW}

12. (a, b)

If there exists only two attributes in a relation then it is always in BCNF.

If all the attributes are prime in a relation, then the relation is in 3NF always because for satisfying 3NF.

For FD X → Y:

Either X should be a super key or Y should be a prime attribute.

13. (2)

There may be redundancy in 3NF while there exists no redundancy in BCNF. The second normal form does not allow any partial dependency.

So statement II and III are correct.