CS & IT ENGINEERING

Database Management System

FD's & Normalization

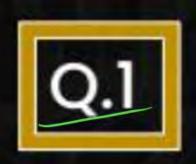**DPP – 06**   Discussion Notes

By- Vijay Agarwal sir

Q.1 Assume a relation $R(P, Q, R, S, T)$ with the following functional dependencies

$\{PQ \rightarrow RST, P \rightarrow R, Q \rightarrow S\}$. which of the following decomposition of $\underline{R}$ satisfies BCNF?

2nd Method

[MCQ]

A. $R_1(P, R), R_2(Q, S), R_3(P, Q, R, S, T)$
(a) $R_3(PQRST)$ $P \rightarrow R, Q \rightarrow S$ $P \& Q$ Not Super key Not in BCNF

B. $R_1(P, R), R_2(Q, S), R_3(P, Q, R, T)$
(b) $P \rightarrow R$; P is Not Super key $\therefore$ Not in BCNF

C. $R_1(P, R), R_2(Q, S), R_3(P, Q, S, T)$
(c) $Q \rightarrow S$; Q is Not Super key $\therefore$ Not in BCNF

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

Ans (D)

BCNF

$X \rightarrow y$ is in BCNF

iff X : super key.

BCNF Decomposition

$R(PQRST)$

$P \rightarrow R$

$Q \rightarrow S$

R_2 | P R |

$R_1(PQT)$

R_3 | Q S |

$R_1(PQT)$
$R_2(PR)$ Ans
$R_3(QS)$

BCNF

Not in BCNF

$R(PQRST) \quad (PQ \rightarrow RST, \ P \rightarrow R, \ Q \rightarrow S)$

$(PQ)^+ = [PQRST]$

$(P)^+ = [PR]$

$(Q)^+ = (QS)$

| PQ is Candidate key | — ①

Check BCNF ? $PQ \rightarrow RST$ ✓ BCNF

P Not super key $\underline{P} \rightarrow R$: Not in BCNF

Q Not super key $\underline{Q} \rightarrow S$: Not in BCNF

every $\dfrac{X \rightarrow y}{X: \text{Not super key}}$

BCNF

$$X \to y$$

X: Super key

Q.2 Assume a relation R = (P, Q, R, S) and a set F of functional dependencies:

$PA = (P, R, S)$
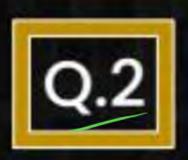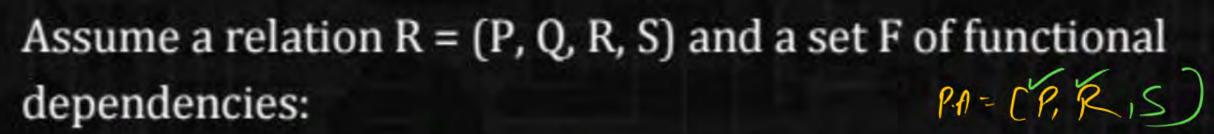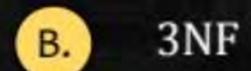
F = {PR → S, S → P, S → Q, S → R}, Highest normal form satisfied by the relation R is?

R(PQRS)

F: [PR→S, S→P, S→Q, S→R]

[MCQ]

A. 2NF

$(PR)^+ = [PRSQ]$
$(P)^+ = [P]$
$(R)^+ = [R]$

B. 3NF

$S→P$
$(SR)^+ = [PQRS]$ $R = (R)^+ = [R]$ S

C. BCNF

PR is Candidate key —①

$(S)^+ = [SPQR]$
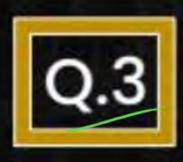
S is Candidate key —②
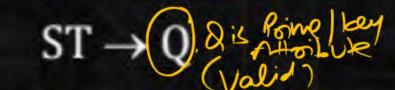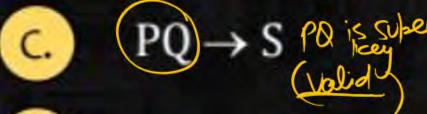
D. 1NF

Ans [C].

2CK ① PR
② S

Q.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?)
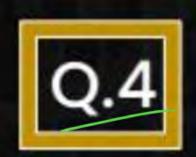
[MCQ]

R(PQRST)   Candidate key = PQ

Prime/key Attribute = (P, Q)

Non Prime/Non key Attribute = (R, S, T)

A. $PQ \to R$ PQ superkey (valid)

B. $ST \to Q$ Q is Prime/key Attribute (valid?)

C. $PQ \to S$ PQ is super key (valid)

D. $RS \to T$

3NF : every $X \to Y$ Non Trivial FD Satisfy

X : super key
(or)
Y : key/Prime Attribute

$RS \to T$

neither
RS : super key   RS : Not Super key
(nor)
T : Prime/key Attribute   T : Not Prime/Not key Attribute

Ans (D)

Q.4 State which of the following statements is/are true?

A. Normal forms are used to eliminate or reduce redundancy in database tables.
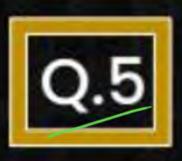
B. A relation is in first normal form if every attribute in that relation is singled valued attribute.

C. A relation is in 2NF if it has no partial dependency.

$$BCNF$$
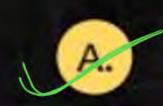$$\bigotimes \to y$$
$$x: \text{super key}$$

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 every non-trivial functional dependency $P \to Q$, where P is a super key.

A, B, C & D.

Q.5

Consider the following relation R(P, Q, R, S) and functional dependencies F that hold over the relation   Candidate key = R

$F = \{P \to QS, RS \to Q, R \to S, Q \to PS\}$. The relation R is in which of the following normal form?

[MSQ]

$F : (P \to QS, RS \to Q, R \to S, Q \to PS)$
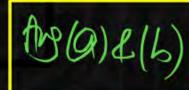
A. 1NF

$(P)^+ = (PQS)$

B. 2NF

$(R)^+ = (RSQP)$ Only ⊥ C.k

C. 3NF

R is Candidate key

Proper subset of S.k → Non key Attribute

D. BCNF

Check 2NF ? : No Partial Dep.

Ans (a) & (b)

R is in 2NF

Check 3NF ? (x→y)

$P \to QS$ X: Not Subset

$Q \to PS$ or

Y: Not key Attribute
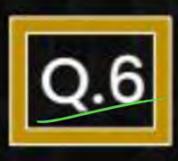
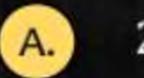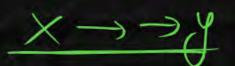**Q.6** Consider a relation which contains two different true multivalued dependencies then which of the following normal form is violated automatically.
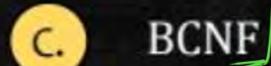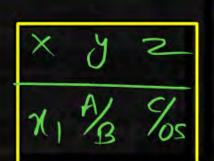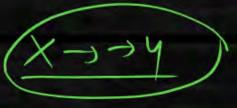
[MCQ]

$X \rightarrow\rightarrow Y$

A. 2NF

B. 3NF $\quad X \rightarrow Y$

C. BCNF

D. 4NF

$X \rightarrow\rightarrow Y$

$X \rightarrow Y$ exist

If $t_1.x = t_2.x$ then $t_1.y = t_2.y$ must be same

X	y	z
x_1	A/B	C/OS

Ans (D)
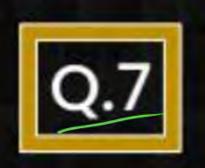
$t_1.x = t_2.x = t_3.x = t_4.x$

and

$t_1.y = t_2.y$ && $t_3.y = t_4.y$

and

$t_1.z = t_3.z$ && $t_2.z = t_4.z$

X	y	z
x_1	A	C
x_1	A	OS
x_1	B	C
x_1	B	OS

Q.7
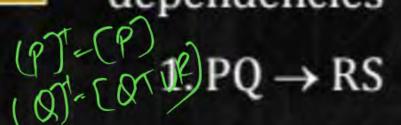
Assume a relation R(P, Q, R, S, T, U) with the following dependencies

$(PQ)^+ : (PQRSTU)$ — PQ is Candidate key

$(P)^+ = (P)$
$(Q)^+ = (QTU)$
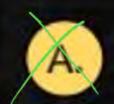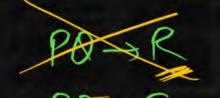
1. $PQ \to RS$ 2. $T \to R$ 3. $Q \to TU$

Given the functional dependencies as shown above which among the options shows the decomposition of relation R is normalized to 3NF?

[MCQ]

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

$PQ \to R$
$PQ \to S$
$T \to R$
$Q \to T$
$Q \to U$

$(PQ)^+ = (PQSTRU)$
$(PQ)^+ = (PQTUR)$
$(T)^+ = (T)$
$(Q)^+ = (QU)$
$(Q)^+ = (QTR)$

Ans (D).

$PQ \rightarrow S, \quad T \rightarrow R \quad Q \rightarrow T, \quad Q \rightarrow U$
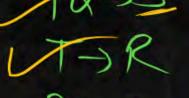
$\boxed{PQ \rightarrow S, \ T \rightarrow R, \ Q \rightarrow TU}$

$\boxed{PQ \text{ is Candidate key}}$

Check 3NF?

$PQ \rightarrow S \ \checkmark \ 3NF$

$\left. \begin{array}{l} T \rightarrow R \ \times \\ Q \rightarrow TU \ \times \end{array} \right\} \xrightarrow{\ X \rightarrow Y \ }$

X : Not Super key
(or)
Y : Not Prime Attribute

3NF Decomposition

$T \rightarrow R$
$Q \rightarrow TU$

$R(PQRSTU)$

$\boxed{T \quad R}$

$\boxed{Q \ T \ U}$

$\boxed{\begin{array}{l} R_1(PQS) \rightarrow PQ \rightarrow S \\ R_2(TR) \rightarrow T \rightarrow R \\ R_3(QTU) \rightarrow Q \rightarrow TU \end{array}}$

3NF
+ Dep. Preserved
+ Lossless

$R_1(PQS) \ R_2(TR) \ R_3(QTU)$

$(T)^+ = (QTU)$
Super key of R_3

$R_1(PQS) \cap R_{23}(QTUR)$
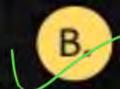$(Q)^+ = (QTUR) \ S \cdot k \cdot \text{of} \ R_{23}$

$R_{123}(PQRSTU)$
Lossless
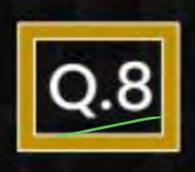
Q.8 Given the relation 'R' with attributes PQRST with set of functional dependencies $\{P \rightarrow P\,Q\,R\,S\,T, Q \rightarrow R\}$ which of the following is / are true?

$(P)^+ = (PQRST)$ P is Candidate key   **[MCQ]**

A. $R_1(\underline{PRST})\ R_2(QR)$ are both in BCNF and preserves lossless join.

B. $R_1(PQST), R_2(\underline{QR})$ are both in BCNF and preserves lossless join

C. $R_1(\underline{PST}), R_2(QR)$ are both in BCNF and preserves lossless join.

D. None of the above.

check BCNF ? $Q \rightarrow R$ fails BCNF : Q is Not Super key.

BCNF Decomposition

Ans (B).

$Q \rightarrow R$

$R(PQRST)$

$\boxed{Q\ R}$

$\boxed{\begin{array}{l} R_1(PQST) \\ R_2(QR) \end{array}}$

$R_1(PQST) \cap R_2(QR)$

$(Q)^+ = (QR)$

super key of R_2

Lossless

BCNF

THANK YOU GW SOLDIERS !