CS & IT ENGINEERING

Database Management System

FD's & Normalization

DPP – 08 Discussion Notes

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01 Question

02 Discussion

Q.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? [MCQ]

A. PQRST

B. PQR

C. PQRS

D. None of the above

R(PQRST) [$P \rightarrow Q$, $QR \rightarrow S$, $S \rightarrow T$]

$(PR)^+ = [PRQST]$

Ans (A)

Q.2

Assume a relation R with attributes MNOPQ and F is a set of functional dependencies {M → MNOPQ, N → O} which of the following statement is true?

S_1: R_1 (MOPQ), R_2 (NO) are both in BCNF and preserves lossless join.

S_2: R_1 (MNPQ), R_2 (NO) are both in BCNF and preserves lossless-join.

[MCQ]

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 and S_2 is true

Q.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:

S_1: The only candidate key of R is PQ and PT

S_2: The highest normal form satisfied by R is 2NF

Which of the statement is true? [MCQ]

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 is true

Ans (A)

PA = [P, Q, T]

$(P)^+ = [PRS]$ $(Q)^+ = [QRT]$

R (P Q R S T) $[P \rightarrow RS, Q \rightarrow RT, T \rightarrow Q]$

$(PQ)^+ = [PQRST]$

PQ is CK → 1

$T \rightarrow Q$

$(PT)^+ = [PQRST]$

$(T)^+ = [TQR]$

PT is CK → 2

2CK PQ, PT

S_2 ≡ $P \rightarrow RS$, $Q \rightarrow RT$, $T \rightarrow Q$

Candidate key = [PQ, PT] Non key Attribute = (R & S)

Check 2NF ? $P \rightarrow R$, $P \rightarrow S$, $Q \rightarrow R$

Partial Dependency

Not in 2NF

Q.4

Consider a relation R with attributes P, Q, R, S, T. The following set of functional dependencies hold on R {Q → R, S → P, P → Q}. The highest normal form satisfied by R is.

[MCQ]

A. 1NF
B. 2NF
C. 3NF
D. BCNF

R(PQRST) [Q→R, S→P, P→Q]

Prime Attribute = [S, T]

$(P)^+ = [PQR]$

PT, ST

$(PST)^+ = [PQRST]$

PST is Superkey —①

S→P

$(ST)^+ = [STPQR]$

ST is C.K —①

Ans (A)

Check 2NF ? Check PD ?

S → P

Proper subset of C.K → Non key Attribute [P.D]

Not in 2NF

Q.5

Consider a relation R (P, Q, R, S, T) with the following FD's, {P → Q, QS → P, P → R} if we decompose R into BCNF then which of the following FD cannot be preserved? [MCQ]

PA = [T, S, P, Q]

A. P → Q

B. P → R

C. QS → P

D. All of them are preserved

R(PQRST) [P → Q, QS → P, P → R]

$(P)^+ = [PQR]$

$(PST)^+ = [PQRST]$

$(PT)^+ = [PQRT]$

$(ST)^+ = [ST]$ PST is C.K -①

QS → P

$(QST)^+ = [QSTPR]$

QST is C.K -②

Not in BCNF : X is Not Super key

Ans [C]

BCNF Decomposition

P → Q R(P Q P S T)

P → R R_2(P Q)

QS → P R_3(P R)

R_1(P S T)

R_2(P Q)

R_3(P R)

Q.6 [MCQ]

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?

lossy

A. R_1 (L, M), R_2(M, N), R_3 (N, O) → lossless

B. R_1(L, M), R_2(L, N), R_3 (L, O) → lossless

C. R_1(L, O), R_2(M, O), R_3 (N, O) ⟶ lossy Join (Not lossless)

D. All of the above are lossless

Ans [C]

$R(LMNO)$ $[L \to M,\ M \to N,\ N \to O]$

(a) $R_1(LM)$ $R_2(MN)$ $R_3(NO)$

$R_1(LM) \cap R_2(MN) \Rightarrow M$

$(M)^+ = [MN.O]$ Subset key of R_2

$R_{12}(LMN) \cap R_3(NO) \Rightarrow N$

$(N)^+ = [NO]$ Super key of R_3

$R_{123}(LMNO)$ Lossless

(b) $R_1(LM)$ $R_2(LN)$ $R_3(LO)$

$R_1(LM) \cap R_2(LN) \Rightarrow L$

$(L)^+ = [LMNO] \Rightarrow$ Subset key of R_1 & R_2

$R_{12}(LMN) \cap R_3(LO) \Rightarrow (L)$

$(L)^+ = [LMNO]$ Super key of R_{12} & R_3 $R_{123}(LMNO)$ Lossless

(c) $R_1(LO)$ $R_2(MO)$ $R_3(NO)$

$R_1(LO) \cap R_2(MO) \Rightarrow O$

$(O)^+ = [O]$ Not Subset key of R_1 not R_2

$R_2(MO) \cap R_3(NO) \Rightarrow O$

$(O)^+ = [O]$ Not Subset key of R_2 not R_3

$R_1(LO) \cap R_3(NO) \Rightarrow (O)$

$(O)^+ = [O]$ Not Subset key of R_1 not R_3

Lossy Join

$R \begin{cases} R_1(\ ) \\ R_2(\ ) \end{cases}$

Lossy Join

(1) If Common Attribute of R_1 & R_2

Not a Super key of R_1

(nor)

a Super key of R_2.

(2) R(ABCD)

R1(AB) R2(CD) } Lossy BC2 No Common Attribute

(3) R(ABCDE)

R1(ABC) R2(BCD) } Lossy BC2 Attribute 'E' missing

Q.7 [MSQ]

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 X_1(Q, S), and X_2 (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 X_2.

(2) $PQ \rightarrow R$ is a BCNF violation for X_2.

(3) X_2 should be decomposed further into X_3(P, Q, R) and X_4 (R, T)

A. (1)

B. (2)

C. (3)

D. (1) and (2) only

$X(PQRST)$ $[PQ \to R,\ Q \to S,\ ST \to P]$

Candidate keys = [PQT, QST]

$X_1(QS)$ $X_2(PQRST)$

$(P)^+ = [P]$ $(Q)^+ = [QS]$

$(T)^+ = [T]$

$(PQ)^+ = [PQS]$ $(QS)^+ = [QS]$

$(ST)^+ = [ST]$

(i) $PQ \to R$ is Minimal Cover ⟶ Incorrect

(ii) $PQ \to R$ is BCNF Violation in X_2 ⟶ Correct

PQ → Not subset key → Not in BCNF

(iii) $X_2(PQRST)$ → $X_3(PQR)$, $X_4(RT)$

$PQ \to R$

$Q \to S$

$R_1(PQST)$

$R_2(PQR)$

$R_3(QS)$

Q.8

Suppose functional dependency Q → R holds in relation R (P, Q, R, S) which additional FD will make R be in 3NF, but not BCNF?

[MCQ]

A. S → PQ

B. PR → S

C. RS → Q

D. PS → Q

Ans [C].

(a) R(PQRS) [S → PQ, Q → R]

$(S)^+ = [SPQR]$

S is Candidate key

Check 3NF

S → PQ 3NF ✓

Q → R ✗ Not in 3NF

Q is Not Super key

(∵)

R is Non Prime.

(a) Not in 3NF

(b) R(PQRS) [PR → S, Q → R]

$(PR)^+ = [PRS$

$(PQ)^+ = [PQRS]$ Non Prime = [R, S]

PQ is C.K Prime/key Attribute = [P, Q]

Check 3NF

PR → S; PR Not Super key? S is Not Prime Attribute } Not in 3NF

Q → R ⇒ Partial Dep Not in 2NF

Not in 2NF & Not in 3NF.

Q.8

Suppose functional dependency Q → R holds in relation R (P, Q, R, S) which additional FD will make R be in 3NF, but not BCNF?

[MCQ]

A. $S \rightarrow PQ$

B. $PR \rightarrow S$

C. $RS \rightarrow Q$

D. $PS \rightarrow Q$

(C) $R(PQRS)$ $\{RS \rightarrow Q, Q \rightarrow R\}$

Prime Attr = [P, R, S, Q]

$(RS)^+ = [RSQ]$

$(PRS)^+ = [PQRS]$

PRS is C.K

$Q \rightarrow R$

$(PQS)^+ = [PQRS]$

PQS is C.K -②

Check 3NF ?

$X \rightarrow y$ $RS \rightarrow Q$; Q is Prime Attribute

$Q \rightarrow R$; R is Prime Attribute

R is in 3NF But Not in BCNF X is Not Subset key

(D) $R(PQRS)$ $\{PS \rightarrow Q, Q \rightarrow R\}$

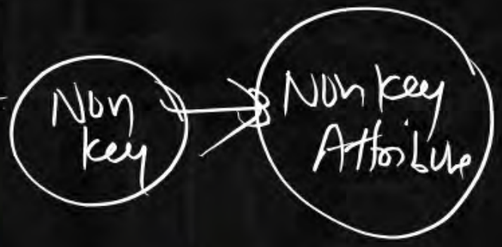
$(PS)^+ = [PSQR]$

PS is Candidate key

Check 3NF

$PS \rightarrow Q$; ✓ 3NF ✓

$Q \rightarrow R$ Not in 3NF



Q is Not Subset key (OR)

& R is Non Prime so Not in 3NF


THANK YOU GW
SOLDIERS !