CS & IT ENGINEERING

Database Management System

FD's & Normalization

DPP – 04 DISCUSSION NOTES

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01 Question

02 Discussion

Q.1

Consider the following two sets of functional dependencies

[MCQ]

$X = \{P \rightarrow Q, Q \rightarrow R, R \rightarrow P, P \rightarrow R, R \rightarrow Q, Q \rightarrow P\}$

$Y = \{P \rightarrow Q, Q \rightarrow R, R \rightarrow P\}$

Which of the following is true?

A. $X \subset Y$

B. $Y \subset X$

C. $X \equiv Y$

D. $X \neq Y$

X covers Y

$P \rightarrow Q$ $(P)^+ = [P\ Q\ R \ldots]$

$Q \rightarrow R$ $(Q)^+ = [Q\ R \ldots]$

$R \rightarrow P$ $(R)^+ = [R\ P \ldots]$

True

Ans [C]

Y covers X

$P \rightarrow Q$ $(P)^+ = [P\ Q\ R]$

$Q \rightarrow R$

$R \rightarrow P$ $(Q)^+ = [Q\ R\ P]$

$P \rightarrow R$

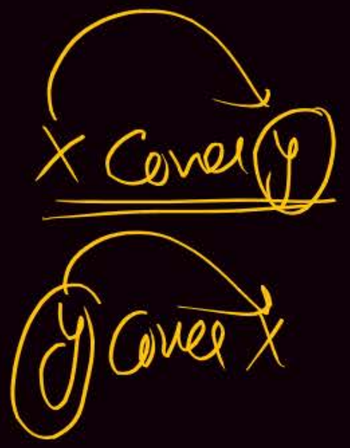
$R \rightarrow Q$ $(R)^+ = [R\ P\ Q]$

$Q \rightarrow P$

True

$F \equiv G$.

X Covers Y :	True	False	True	False
Y Covers X :	False	True	True	False
	$X \supset Y$	$Y \supset X$	$X \equiv Y$	$X \neq Y$



Q.2

Consider a relation with schema R(P, Q, R, S, T) and FD set (PQ → R, R → S, S → P). How many super keys in relation R contains? (7)

[NAT]

P.A = [T, Q, P, S, R]

R(PQRST) [PQ → R, R → S, S → P]

$(PQ)^+ = (PQRS)$

$(PQT)^+ = (PQRST)$

PQT is c.k —(1)

$X_{Attribute} \rightarrow [Prime\ Attribute]$

$S \rightarrow P$

$(SQT)^+ = [SQTPR]$

SQT is c.k —(2)

$R \rightarrow S$

$(RQT)^+ = (PQRST)$

PQT is c.k —(3)

PQT
QST
QTR

R(PQRSI)

PQT ⇒ PQT, PQTR, PQTS, PQTRS

R(PQRSI)

QST ⇒ QST, QSTP, QSTR, PQRST

R(PQRSI)

QTR ⇒ QTR, QTRP, QTRS, PQRST

PQT, QST, QTR, PQTR, PQST, QSRT
PQRST

PQT, QST, QTR

R(PQRST)

PQT RS ⇒ $2^2 = 4$

QST (R) ⇒ $2^1 = 2$

QTR = QTR = 1

7 Ans

Example

R(ABCDE)

C.K A, C, DE

A (ABCDE] ⇒ $2^4 = 16$

C (BDE) ⇒ $2^3 = 8$

DE (DE B) ⇒ $2^1 = 2$

26

Q.3 Consider a relation R(P, Q, R, S, T) with the set of functional dependencies {P → QR, RS → T, Q → S, and T → P}. How many super keys are possible in R? (27). **[NAT]**

PA = [P, T, R, S, Q]

R(PQRST) [P→QR, RS→T, Q→S, T→P]

n: # Attribute

UCK: P, T, RS, RQ

$(P)^+ = [PQRST]$

P is Candidate key — (1)

$T \rightarrow P$

$(T)^+ = [PQRST]$

T is candidate key — (2)

$RS \rightarrow T$

$(RS)^+ = [PQRST]$

$(R)^+ = [R]$

$(S)^+ = [S]$

RS is C.K — (3)

$Q \rightarrow S$

$(QR)^+ = [PQRST]$

$(Q)^+ = [QS]$

QR is C.K — (4)

Total # Super key = $2^n - 1 \Rightarrow 2^5 - 1$

= 31 Super key

Out 31 Super key

R, S, Q, QS — Not C.K

31 − 4 = 27 Super key

R(PQRST)

P	PQRST	⇒	2^4
T	TQRS	=	2^3
RS	RSQ	=	2^1
RQ	RQ	=	1

P, PQ, PR, PS, PT, PQR, PQS, PQT, PRS, PRT, ... PQRST] 16

16^9

8 ⇒ T, TQ, TR, TS, TQR, TRS, TQS, TQRS] 8

2 → RS, RSQ] ②

1 RQ] — ①

27 Subkey Ans

Q.4

Consider the relation schema R(P, Q, R, S, T, U, V, W, X, Y) and the set of functional dependencies on R are: [MCQ]

F = {PQ → R, Q → TU, PS → VW, V → X, W → Y}. Which of the following can be the candidate key for R?

A. PQT

B. PQS

C. PQSR

D. PQSVW

F : {PQ → R, Q → TU, PS → VW, V → X, W → Y}

$(PQ)^+ = [PQRTU]$

$(PQT)^+ = [PQRTU]$

$(PQS)^+ = [PQRSTUVWXY]$

PQS is C.K ~①

Ans (B)

Q.5

Let a relation R have attributes {P, Q, R, S, T} and "PQR" is the candidate key, then how many super keys are possible ___4___?

[NAT]

$R(PQRST) \Rightarrow R(\underline{PQR}\ ST) \Rightarrow 2^2 = 4$ super key.

PQR, PQRS, PQRT, PQRST

Ans (4)

Q.6

[MCQ]

Consider the following FD sets:

$S_1 = \{P \rightarrow R, PR \rightarrow S, T \rightarrow PS, T \rightarrow U\}$

$S_2 = \{P \rightarrow S, QR \rightarrow PS, R \rightarrow Q, T \rightarrow P, T \rightarrow S, T \rightarrow U\}$

$S_3 = \{P \rightarrow S, R \rightarrow P, R \rightarrow Q, T \rightarrow PU\}$

$S_1 \neq S_2$

Which of the following sets is equivalent?

A. $S_1 \equiv S_2$

B. $S_2 \equiv S_3$

C. $S_1 \equiv S_3$

D. $S_1 \equiv S_2 \equiv S_3$

Ans (B)

S_1 Cover S_2

$P \rightarrow S$ ✓ $(P)^+ = [PRS]$

$QR \rightarrow PS$ ✗ $(QR)^+ = [QR]$

$R \rightarrow Q$

$T \rightarrow P$

$T \rightarrow S$

$T \rightarrow U$

False

$S_1 \neq S_2$

Not Check S_2 Cover S_1

S_1 Cover S_3

$P \rightarrow S$ ✓ $(P)^+ = [PRS]$

$R \rightarrow P$ ✗ $(R)^+ = [R]$

$R \rightarrow Q$

$T \rightarrow PU$

False

$S_1 \neq S_3$

Q.6

[MCQ]

Consider the following FD sets:

$S_1 = \{P \rightarrow R, PR \rightarrow S, T \rightarrow PS, T \rightarrow U\}$

$S_2 = \{P \rightarrow S, QR \rightarrow PS, R \rightarrow Q, T \rightarrow P, T \rightarrow S, T \rightarrow U\}$

$S_3 = \{P \rightarrow S, R \rightarrow P, R \rightarrow Q, T \rightarrow PU\}$

Which of the following sets is equivalent?

A. $S_1 \equiv S_2$

B. $S_2 \equiv S_3$

C. $S_1 \equiv S_3$

D. $S_1 \equiv S_2 \equiv S_3$

S_2 Cover S_3

$P \rightarrow S$ $(P)^+ = (PS)$

$R \rightarrow P$ $(R)^+ = (RQPS)$

$R \rightarrow Q$

$T \rightarrow PU$ $(T)^+ = (TPSU \ldots)$

True

S_3 Cover S_2

$P \rightarrow S$ $(P)^+ = (PS \ldots)$

$QR \rightarrow PS$ $(QR)^+ = (QRPS)$

$R \rightarrow Q$ $(R)^+ = (RPQS)$

$T \rightarrow P$

$T \rightarrow S$ $(T)^+ = (TPUS)$

$T \rightarrow U$

True

$S_2 \equiv S_3$

Q.7

Consider a relation R = {P, Q, R, S, T, U, V, W} with the functional dependency sets S = {PR → V, S → TV, QR → S, RV → QS, PRS → Q, RT → PV}

The minimum numbers of single functional dependency in the minimal cover of F is ___6___?

[NAT]

Step 1: PR → V, S → T, S → V, QR → S, RV → Q, RV → S, ~~PRS → Q~~, RT → P, RT → V

Step 2: L.H.S Extraq

✓PR → V $(P)^+ = [P]$ $(R)^+ = [R]$

✓QR → S $(Q)^+ = [Q]$ $(R)^+ = [R]$

✓RT → Q $(R)^+ = [R]$ $(V)^+ = [V]$

~~PRS → Q~~

$[PR]^+ = [PRVQS]$ S is extraneous

PR → Q

✓RT → P $(R)^+ = [R]$ $(T)^+ = [T]$

S is extraq

PR → Q

PRS → Q

Q.7

Consider a relation R = {P, Q, R, S, T, U, V, W} with the functional dependency sets S = {PR → V, S → TV, QR → S, RV → QS, PRS → Q, RT → PV}

The minimum numbers of single functional dependency in the minimal cover of F is _____.

[NAT]

Redundant FD

Steps :

① PR → V Extra

② S → T, ③ S → V. ④ QR → S. ⑤ RV → Q, ⑥ RV → S. ⑦ PR → Q ⑧ RT → P, ⑨ RT → V Extra

① $(PR)^+ = [PRQSVT]$

② $(S)^+ = [SV]$

③ $(S)^+ = [ST]$

④ $(QR)^+ = [QR]$

⑤ $(RV)^+ = [RVSTPQ]$

⑥ $(RV)^+ = [RV]$

⑦ $(PR)^+ = [PR]$

⑧ $(RT)^+ = [RTVS]$

⑨ $(RT)^+ = [RTPQSV]$

Ans (6)

Minimal Cover

Step1 : Split the FD such that R.H.S contain Single Attribute

Step2 : We find Redundant (Extra) Attribute on L.H.S

$AB \rightarrow C$

A is extra if $(B)^f = (\ldots A)$

B is extra if $(A)^f = (\ldots B)$

Step3 : Find Redundant FD (Extra FD)

$F: \{A \rightarrow B,\ B \rightarrow C,\ A \rightarrow C\}$

$A \rightarrow C$ is R.F.D

$\{A \rightarrow B,\ B \rightarrow C\}$

$(A)^f = \{ABC\}$

Q.8

Consider a relation R(P, Q, R, S, T) with the following functional dependencies: PQR → ST and S → PQ, then the number of super keys in R is (10) ?

PA: {R, P, Q, [NAT]

R(PQRST) {PQR → ST, S → PQ}

Sol:

$(PQR)^+ = \{PQRST\}$

PQ, QR, PR ✗

PQR is Candidate key — (1)

$S \rightarrow PQ$

$(SR)^+ = \{SRPQT\}$

SR is C.K — (2)

Total # Super key

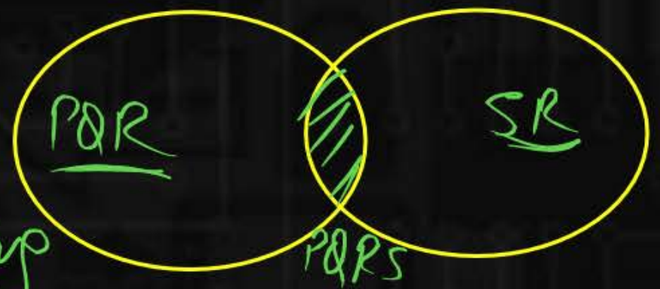
Ans (10)

2 CK PQR, SR

$2^{5-3} + 2^{5-2} - 2^{5-4}$

$2^2 + 2^3 - 2^1$

$4 + 8 - 2 =$ 10 Ans




THANK YOU GW
SOLDIERS !