$R(ABCD)$

FD: $\{A \to B,\ B \to C,\ C \to D\}$ — is 2nd NF.

$A \to C \quad AB \to D$

$ABCD^+ = \{ABCD\}$

$A^+ = \{ABCD\}$ Candidate key.

prim attribute $= \{A\}$ → proper subset of prim Attribute → No partial dependency

Non-prime $= \{B\ C\ D\}$

2NF

Dependency Preserving decomposition

$R(ABCDE)$

$F = \{A \to B,\ B \to C,\ C \to D,\ D \to A\}$

$R_1(ABC) \quad R_2(CDE)$

Soln

$A^+ = \{A\ B\ C\ \cancel{D}\}$ Not in R_1 — $A \to BC$

$B^+ = \{B\ C\ \cancel{D}\ A\}$ — $B \to AC$

$C^+ = \{C\ \cancel{D}\ AB\}$ — $C \to AB$

$AB^+ = \{ABC\cancel{D}\}$ — $AB \to C$ ✗

$BC^+ = \{BC\cancel{D}A\}$ — $BC \to A$ ✗

$AC = \{AC\cancel{D}B\}$ — $AC \to B$ ✗ union

$C^+ = \{CD\cancel{AB}\} = D$ — $C \to D$

$D^+ = \{D\cancel{A}\cancel{B}C\} = D \to C$

$E^+ = \{E\}$

$CD = \{CD\cancel{AB}\}$

$DE = \{DE\cancel{ABC}\}$ — $DE \to C$ ✗

$CE = \{CD E\cancel{AB}\}$ — $CE \to D$ ✗ duplicate

$F_1 \to A \to BC,\ B \to AC,\ C \to AB \ \cup\ F_2 \to (C \to D\quad D \to C)$.

$F_1 \cup F_2 \equiv F$ — G cover F, $G \supseteq F$, F cover G

Dependency Preserving Yes.

R (A B C D E)

F — {A → BCD, B → AE, BC → AED, D → E, C → DE}

R1 {A, B}

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

$\boxed{A \to B}$

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

$\boxed{B \to A}$

R2 {B, C}

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

$\boxed{B \to C}$

$C^+ = \{\cancel{C}, \cancel{D}, \cancel{E}\}$

$= \phi$

R3 (C, D, E)

$C = \phi(\cancel{C}DE)$ $\boxed{C \to DE}$

$D = \{\cancel{D}, E\}$ $\boxed{D \to E}$

$E = \{\cancel{E}\} = \phi$

$CD = \{\cancel{C}\cancel{D}E\}$ CD → E

$CE = \{\cancel{C}D\cancel{E}\}$ $\boxed{CE \to D}$

$DE = \{\cancel{D}\cancel{E}\} - \phi$

Lossless decomposition

R1(A D)

A	D
1	1
2	1
3	2

R2(D C)

D	C
1	1
1	2
2	1

R1 X R2 ← cartesian product

A	D	B	C
1	1	1	1
1	1	1	2
1	1	2	1
2	1	1	1
2	1	1	2
2	1	2	1
3	2	1	1
3	2	1	2
3	2	2	1

Cartesian product

Trans

Natural join B:

Common hai B

$R_1(A,B)$., $R_2(B,C)$

$R_1 B = R_2 B$.

A	B	B	C
1	1	1	1
1	1	1	2
2	1	1	1
2	1	1	2
3	2	2	1

Natural join

jab common hoga b dono mai tab hi Natural join hoga

A	B	C
1	1	1
1	1	2
2	1	1
2	1	2
3	2	1

Q $R(ABCDEF)$

$F = \{AB \to C, C \to D, D \to EF, F \to A, D \to B\}$

$D = \{ABC, CDE, EF\}$ → like union karna hota chaiye

$R_1(ABC)$ $R_2(CDE)$ $R_3(EF)$

Now $C \to AB$

$R_1 \bowtie R_2$

$C \to DE$

Now

$C^+ = \{CDEFAB\}$

∴ C is candidate key for both.

Now it is lossless.

$R_{12}(ABCDE)$ $R_3(EF)$

$R_1 \bowtie R_2$

$E^+ = \{E\}$

∴ It is not the candidate key for both R_{12} and R_3

∴ It is a Lossy Relation

Q1 $R = \{ABCDE\}$ $FD = \{A \to C, B \to C, C \to D, DE \to C, CE \to A\}$
$A \to D, B \to D\}$

$R_1(AD)$ $R_2(AB)$ $R_3 = (BE)$, $R_4\{CDE\}$, $R_5 = \{AE\}$

$A^+ = \{ACD$

E^+

Tables have the candidate key for both.

Q2 $R(XYZWQ)$ $FD = \{X \to Z, Y \to Z, Z \to W, WQ \to Z$
$ZQ \to X, X \to W, Y \to W\}$

$R_1(XW)$ $R_2(XY)$ $R_3(YQ)$ $R_4(ZWQ)$ $R_5(XQ)$

$X^+\{XZW$

Problems with Concurrent Execution

(i) W-W (Lost update problem)

(ii) W-R (Dirty Read Problem)

(Uncommitted data problem)

(iii) R-W

(iv) R-R (Non-Repeatable Read).

Lock based Protocol

(i) Shared lock.

↳ Read only lock

↳ data item can only read

- Multiple transaction can hold a shared lock on the same data item at the same time

(ii) Exclusive lock.

↳ Read and write

↳ only one transaction can hold an exclusive lock on a data item at any time

Simplistic lock

↳ basic method

↳ It allow