Q: Give a set of FDs for R(A, B, C & D)

~~wh~~ with primary key AB under which

R is in 1NF but not in 2NF

Sol: $F = \{ \underline{AB} \rightarrow CD,\ B \rightarrow C \}$

prime $\{A, B\}$

proper subset: $\{A\}$, $\{B\}$.

Q: Give set of FDs for R(A, B, C, D) with primary key AB under which R is in 2NF, but not in 3NF.

$F = \{ AB \rightarrow CD,\ C \rightarrow D \}$

prime Att: $\{A, B\}$.

2NF: PA → NPA ×

3NF: NPA → NPA ×

$\beta - \alpha = \{D\} - \{C\} = \{D\} \in$ one of the key.

Q: Closure of CF under

$F = \{ AB \to C,\ C \to D,\ E \to F,\ EG \to B \}$

$(CF)^+ = CFD$

Q: Redundant FDs under $F = \{ AB \to C,\ C \to D,\ E \to F,\ FG \to B,\ [AB \to D] \}$

$AB \to D$

$AB \to CD$

- $C \to D$
- $E \to F$
- $AB \to D$ ✓
- None.

$(AB)^+ =$

Q: Extraneous attributes under

$F = \{ AB \to CD$
$C \to D$
$E \to F$
$EG \to B \}$

A in $AB \to CD$

$\gamma = AB - \{A\} = B$

$\gamma^+ = (B)^+ = B$ under F.

$\gamma \to \beta$ $\quad \alpha \to \beta$

$\gamma = \alpha - \{A\}$

* A in $AB \to CD$ ×
* G in $EG \to B$ × $\to (E)^+ = E$
* B in $AB \to CD$ ×

None.

Q: Extraneous attributes under

$F = \{ AB \to CD,\ C \to D,\ E \to F,\ EG \to BC \}$

* C in $AB \to CD$
* C in $EG \to BC$
* D in $AB \to CD$

C in $AB \to CD$

$F' = \{ AB \to D,\ C \to D,\ E \to F,\ EG \to BC \}$

$AB \to C \in F'^{+}$

$(AB)^{+} = \underline{ABD}$

cannot infer $AB \to C$ in F'

C in $EG \to BC$

$F' = \{ AB \to CD,\ C \to D,\ E \to F,\ EG \to B \}$

$EG \to C$ in F'^{+}

$(EG)^{+} = EGBF$

Q: closure of ABD under

$F = \{ AB \to CD,\ C \to D,\ E \to FG,\ EG \to BC \}$

$(ABD)^+ = ABDC$

Q: Canonical cover of $F = \{ AC \to B$
$AC \to D$
$A \to D$
$A \to B$
$B \to C \}$

$AC \to \underline{BD}$

C extraneous

$(A)^+ = AD\underline{B}C$

$F_c = \{ A \to BD \Rightarrow A \to B$, $A \to D$
$A \to D$
$A \to B$
$B \to C \}$

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

Find candidate keys:

$R = (A, B, C, D, E)$

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

$(AB\cancel{C}\cancel{D}E)^+ = ABCDE$

$(ABE)^+ = ABCDE$ super key.

$(AB)^+ = ABCD$ | $(A)^+ = A$

$(AE)^+ = AE$ | $(B)^+ = BD$

$(BE)^+ = BEACD$ | $(E)^+ = E$

BE - Candidate key.

Now, prime Attributes = $\{B, E\}$.

check prime attributes present rhs of any FD.

$R = (A, B, C, D, E)$

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

$(AB\cancel{C}\cancel{D}\cancel{E})^+ = ABCDE$

$(AB)^+ = ABCDE$

$(B)^+ = BDEAC$

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

$(B)^+ = BDEAC$

$D \to B$
$D \to E$

$(D)^+ = DBEAC$

$(C)^+ = CDBEA$

$\boxed{(AB)^+ = ABCDE}$ super key.