

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

$A \rightarrow B$ OL

$BC \rightarrow E$ OL 3NF

$ED \rightarrow A$ OL

$A^+ = AB$

$BC^+ = BCE$

$ED^+ = EDAB$

CK: $\rightarrow CDE, BCD, ACD$

$\Rightarrow BCDE = CDE = CD(BC)$
 CDP
 $= ACD$

Decomposition — of relation

Let R is in 1NF

So make it 2NF; we break R in
such a way that PD is removed

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

$AB \rightarrow C$ PD

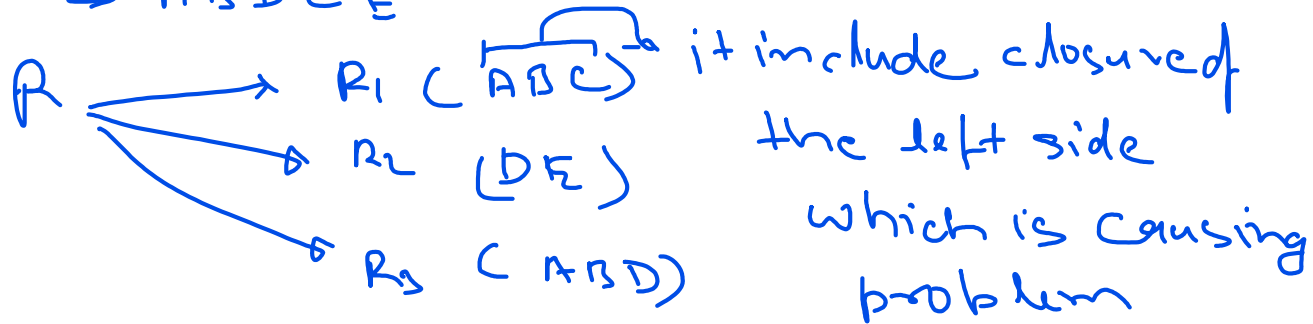
$D \rightarrow E$ PD

$$AB^+ = ABC$$

CK is ABD

$$D^+ = DE$$

$$ABD^+ \Rightarrow ABDC E$$



$$R_1(ABC)$$

$$(AB \rightarrow C)$$

FD

$$AB^+ \Rightarrow ABC$$

$$R_2(DE)$$

$$D \rightarrow E$$

FD

$$D^+ \Rightarrow DE$$

in these relation there no PD so it is in 2NF

Ex R(ABCDE) into 2NF

$$A \rightarrow B$$

$$D \rightarrow E$$

$$C \rightarrow D$$

$$A^+ = AB E$$

$$B^+ = BE$$

$$C^+ = CD$$

$$AC^+ = ACDE$$

AC is CK

$R_1(A B C)$

$A \rightarrow B$

PK

$B \rightarrow E$

PK PK

$A^+ = AB E$

$B^+ = BE$

no PD

$R_2(C D)$

$C \rightarrow D$ no PD

$C^+ = CD$

$R_3(AC)$

CK.

no PD $\Rightarrow$ it is in 2NF

Decomposition into 3NF -

remove all $\rightarrow D$ from the R

$R(A B C D E F G H I J)$

$AB \rightarrow C$ FD

$A \rightarrow DE$ PD

$B \rightarrow F$ PD

$F \rightarrow GH$ PD

$D \rightarrow IJ$ PD

$AB^+ = ABCDEFGHIJ$ CK
AD

$A^+ = ADEIJ$

$B^+ = BFGH$

$F^+ = FGH$

$D^+ = DIJ$

$R_1(ADEIS)$

$A \rightarrow DE \quad FD$

$D \rightarrow IS \quad TD$

$A^+ = ADEIS$

$D^+ = DIS$

$R_2(BFGH)$

$B \rightarrow F \quad FD$

$F \rightarrow GH \quad TD$

$B^+ = BFGH$

$F^+ = FGH$

$R_3(ABC)$

$AB \rightarrow C$

CK.

remove all TD for 3NF

$R_{11}(DIS)$

$D \rightarrow IS$

$R_{12}(ADE)$

$A \rightarrow DE$

$R_{21}(FGH)$

$F \rightarrow GH$

$R_{22}(BF)$

$B \rightarrow F$

$R_3(ABC)$

$AB \rightarrow C$

Lossy Decomposition —

① $R \xrightarrow{\quad} R_1$
 $R \xrightarrow{\quad} R_2$

$R_1 \bowtie R_2 \supset R$

② lossy loss

$R_1 \bowtie R_2 = R$

using FD

$$\left\{ \begin{array}{l} \textcircled{a} R_1 \cup R_2 = R \\ \textcircled{b} R_1 \cap R_2 \neq \emptyset \end{array} \right.$$

③ common attribute
must be the key of
either R_1 or R_2

Ex $R(A B C D)$



① $R_1 \cup R_2 = R$ ✓

② $R_1 \cap R_2 = A$ — not = $\emptyset$

③ A is PK of R_1 & R_2 —

So it is lossless