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

$A \to B$ OL

$BC \to E$ OL 3NF

$ED \to A$ OL

$A^+ = AB$

$BC^+ = BCE$

$ED^+ = EDAB$

CK: $\to$ 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 $R(A\ B\ C\ D\ E)$

$AB \to C$ PD

$D \to E$ PD

$AB^+ = ABC$ CK is ABD

$D^+ = DF$

$ABD^+ \Rightarrow ABDCE$

$R \rightarrow R_1\ (ABC)$ it include closure of the left side which is causing problem

$R \rightarrow R_2\ (DE)$

$R \rightarrow R_3\ (ABD)$

$R_1(ABC)$

$(AB \rightarrow C)$

FD

$AB^+ \Rightarrow ABC$

$R2(DE)$

$D \rightarrow E$ FD

$D^+ \Rightarrow DE$

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

Ex $R(ABCDE)$ into 2NF

$A \rightarrow B$

$B \rightarrow E$

$C \rightarrow D$

$A^+ = ABE$

$B^+ = BE$

$C^+ = CD$

$AC^+ = ACBDE$

AC is CK

R1 (A B C)

A → B
ck

B → E
np np

$A^+ = ABE$

$B^+ = BE$

no PD

R2 (C D)

C → D no PD

$C^+ = CD$

R3 (A C)

CK.

no PD so it is in 2NF

Decomposition into 3NF —

remove all TD from the R

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

AB → C	FD	$AB^+ = ABCDFGHIJ$
A → DE	PD	$A^+ = ADEIJ$
B → F	PD	$B^+ = BFGH$
F → GH	PD	$F^+ = FGH$
D → IJ	PD	$D^+ \Rightarrow DIJ$

CK

AB

$R_1(A\ D\ E\ I\ J)$ $\quad$ $R_2(B\ F\ G\ H)$ $\quad$ $R_3(A\ B\ C)$

$A \rightarrow DE$ FD $\quad$ $B \rightarrow F$ FD $\quad$ $AB \rightarrow C$

$D \rightarrow IJ$ TD $\quad$ $F \rightarrow GH$ TD $\quad$ CK.

$A^+ = ADEIJ$ $\quad$ $B^+ = BFGH$

$D^+ = DIJ$ $\quad$ $F^+ = FGH$

remove all TD for 3NF

$R_{11}(D\ I\ J)$ $\quad$ $R_{12}(ADE)$ $\quad$ $R_{21}(FGH)$ $\quad$ $R_{22}(BF)$

$D \rightarrow IJ$ $\quad$ $A \rightarrow DE$ $\quad$ $F \rightarrow GH$ $\quad$ $B \rightarrow F$

$R_3(ABC)$

$AB \rightarrow C$

Lossy Decomposition —

① $R \rightarrow R_1,\ R_2$

$R_1 \bowtie R_2 \supset R$

② lossless

$R_1 \bowtie R_2 = R$

using FD

(a) $R_1 \cup R_2 = R$

(b) $R_1 \cap R_2 \neq \phi$

(c) common attribute must be the key of either R_1 or R_2

Ex $R(A\ B\ C\ D)$

$R_1(A\ B\ C)$ $\quad$ $R_2(A\ D)$

FD –
$A \to BC$

(a) $R_1 \cup R_2 = R$ ✓

(b) $R_1 \cap R_2 = A$ — not $= \phi$

(c) A is PK of R_1 & R_2

So it is lossless