

1a

$AB \rightarrow CD \Rightarrow AB \rightarrow CDE$
 $AB \rightarrow E$
 $AB \rightarrow CDE$

~~4NF~~

~~key~~

Key: AB, 4NF, None, NA

1b

$A \rightarrow BCDE$
 $E \rightarrow ABCD$

$A \rightarrow B$
 $A \rightarrow C$
 $A \rightarrow D$
 $A \rightarrow E$
 $E \rightarrow A$
 ~~$E \rightarrow B$~~
 $E \rightarrow C$
 $E \rightarrow D$

Key: A | E ; NF: 4NF ; None

1c

$R(ABCD)$
 $C \rightarrow D$
 $C \rightarrow A$
 $B \rightarrow C$

Key: B, NF: 2NF
 $C \rightarrow D, C \rightarrow A$

$R_1(CAD), R_2(\underline{BC})$

1d) $R(ABCDEF)$

$A \rightarrow BC$

$AB \rightarrow DE$

$AE \rightarrow F$

$C \rightarrow F$

\Rightarrow

$A \rightarrow B$

$A \rightarrow C$

~~AB~~ $\rightarrow D$

~~AB~~ $\rightarrow E$

$AE \rightarrow F$

$C \rightarrow F$

\Rightarrow

$A \rightarrow B$

$A \rightarrow C$

$A \rightarrow D$

$A \rightarrow E$

~~AE~~ $\rightarrow F$

$C \rightarrow F$

\Rightarrow

$A \rightarrow B$

$A \rightarrow C$

$A \rightarrow D$

$A \rightarrow E$

$C \rightarrow F$

Key : A

NF : 2

FD violates

$C \rightarrow F$

$R1(\underline{C}F), R2(\underline{A}BCDE)$

(1e)

$ABC \rightarrow D$
 $D \rightarrow E$ | 3NF

ABCEG

(2)

$AB \rightarrow C$
 $AC \rightarrow B$
 $AD \rightarrow E$
 $B \rightarrow D$
 $BC \rightarrow A$
 $E \rightarrow G$

$AB \rightarrow C$
 $AC \rightarrow B$
 $BC \rightarrow A$
 $E \rightarrow G$

ABE
ACE
BCE | Keys
NF: 1NF

~~R1(ABCE)~~, R2(EG)

~~R1(ABCE)~~ 1NF ~~BCNF~~

(3)

$ABC \rightarrow D$
 $B \rightarrow EF$
 $D \rightarrow A$ | Key: ABC
NF: 1NF

~~R1(DA)~~ ~~R2~~ R1(BEF), R2(ABCD)

BCNF

R21(DA), R22(BCD)

3NF

R1(ABCD)
R2(BEF)
R3(DA)

Minimal FD Set

TA_ID → {TA_Name, TA_Email, TA_ContactNumber}
StudentID → {Student_Name, StudentEmail, GroupNo}
GroupNo → {ProjectTitle, TL_ID, TL_ContactNo, TA_ID}
{Stage_ID, Parameter_ID} → MaxMarks
{Stage_ID, Parameter_ID, Student_ID} → StudentMarks
{Stage_ID, Parameter_ID, Group_ID} → GroupMarks

Relations

TA(TA_ID, TA_Name, TA_Email, TA_ContactNumber)
Student(StudentID, Student_Name, StudentEmail, GroupNo)
 FK: GroupNo references into Group
Group(GroupNo, ProjectTitle, TL_ID, TL_ContactNo, TA_ID)
 FK: TA_ID references into TA
 FK: {TL_ID, GroupNo } refers into Students ({SID, GRPNO})
StageParam(Stage_ID, Parameter_ID, MaxMarks)
IndividualMarks(Stage_ID, Parameter_ID, Student_ID, Marks)
 FK: {Stage_ID, Parameter_ID} refers into StageParam
 FK: {Student_ID} refers into Student
GroupMarks(Stage_ID, Parameter_ID, Group_ID, Marks)
 FK: {Stage_ID, Parameter_ID} refers into StageParam
 FK: {Group_ID} refers into Group