Q) Convert to 3NF

~~R(ABCDE)~~

R(ABCDEFGH)

{A → BD, B → C, E → FG, AE → H}

I) C.K = AE

∴ Prime attributes : A, E

Non prime attribute = B, C, D, F, G, H

∴ A → BD is a P.D (Partial dependency)

E → FG is a P.D

II) Now Find the P.d's take the left hand side of P.D find its closure to form new tables

And A^+ = ABDC

∴ forms a table R_1(ABCD)

also E → FG ∴ E^+ = EFG

∴ forms a table R_2(EFG)

III) Now remove the right hand side of the P.D's from the whole attribute set to get the remaining relation

∴ A ~~B~~ C ~~D~~ E ~~F~~ ~~G~~ H

∴ R_3(ACEH)

∴ we get 3 tables

∴ R_1(ABCD) R_2(EFG) R_3(ACEH)

A^+ = ABCD : A → BCD

B^+ = BC : B → C

C^+ = C

D^+ = D

★ Next Find the FD's in each case

$AB^+ = ABCD$: $AB \to CD$ α because already we know
$A \to CD$ from
$A \to BCD$

$AC^+ = ABCD$ $AC \to BD$ α Same logic
$AD^+ = ABCD$ $AD \to BC$ α

$ABC^+ = ABCD$ $ABC \to D$ α Not required
$ABD^+ = ABCD$ $ABD \to C$ α
$BCD^+ = \cancel{ABCD}\ BCD$ α
$ACD^+ = ABCD$ $ACD \to B$ α

$\therefore$ $\boxed{\text{only FDs are } A \to BCD \text{ and } B \to C}$

$\therefore R_2(EFG)$

FD: $E^+ = EFG$: $E \to FG$
$F^+ = F$ α
$G^+ = G$ α
$EF^+ = EFG$ $EF \to G$ α Not required because of
$FG^+ = FG$ α
$EG^+ = EFG$ $EG \to F$ α Not required

$\therefore$ $\boxed{E \to FG \text{ is only FD}}$

$R_3(AECH)$
$A^+ = ABCD$ $A \to C$
$C^+ = C$ α
$E^+ = EFG$ α
$H^+ = H$ α
$AC^+ = AC$ α
$AE^+ = AEH\cancel{BD}C\cancel{FG}$ $AE \to CH$
$AH^+ = A\cancel{BD}H\cancel{C}$ α A
$EC^+ = \cancel{EFG}C$ α
$EH^+ = E\cancel{FG}H$ α
$CH^+ =$
$ACE^+ = ACEH$ $ACE \to H$ α redundant
$ACH^+ = ACH$ α
$AEH^+ = \cancel{AEHBD}C\cancel{FG}$ $AEH \to C$ α redundant

FD for R_3

$\boxed{\begin{array}{l} A \to C \\ AE \to CH \end{array}}$

$R_1(\underline{A}BCD)$

$A \to BCD$

$B \to C$

in 2NF form

(No P.D)

$R_2(\underline{E}FG)$

$E \to FG$

In 2NF form

(No P.D)

$R_3(\underline{AE}CH)$

$A \to C \to PD$

$AE \to CH$

Not in 2NF form

$\therefore$

repeat the Same step II

left hand Side P.D find its closure

$A^+ = \underline{A}C$

$R_4(\underline{A}C)$

in 2NF form

remaining 2

$AE\cancel{C}H$

$R_5(\underline{AE}H)$

$AE \to H$

$\therefore$ in 2NF form

Now we have in 2NF form. To check for 3NF find any T.D are there

$\therefore R_1(\underline{A}BCD)$ $R_2(\underline{E}FG)$ $R_4(\underline{A}C)$ $R_5(\underline{AE}H)$

~~in 2NF form~~

R_1: FD are $A \to BCD$, $B \to C$ → $B \to C$ is a Transitive dependency → $\therefore$ Not in 3NF form

R_2: FD are $E \to FG$ → No Transitive dependency → $\therefore$ in 3NF form

R_4: FD are $A \to C$ → No Transitive dependency → $\therefore$ in 3NF form

R_5: FD are. $AE \to H$ → No transitive dependency → $\therefore$ in 3NF form

↳ In this Case we have to split the table to Subtables to remove T.D. Here we have one T.D, So we Construct a table using the Closure of left hand Side of T.D

∴ Split $R_1(ABCD)$ ~~to~~ further to remove transitive dependency

∴ $B \to C$ is the transitive dependency

∴ find B^+ - BC will give you $R_6(BC)$ and then remaining excluding right hand side of T.D we get $AB\cancel{C}D$

$R_6(\underline{B}C)$ and $R_7(\underline{A}BD)$

↓

No Transitive dependency

∴ in 3NF

FD: $A \to BD$

$A^+ = ABD$ ∴ $A \to BD$

$B^+ = B$ ✗

$D^+ = D$ ✗

$AB^+ = ABD = AB \to D$ ✗ (redundant)

$BD^+ = B\cancel{D}\cancel{C} = BD \to B$ ✗ (trivial)

$AD^+ = \cancel{A}B\cancel{C}\cancel{D} = AD \to B$ ✗ (redundant)

∴ only one FD

$\underline{A} \to BD$

∴ No Transitive dependency

∴ in 3NF

∴ Final Answer in 3NF is

$$\boxed{R_6(\underline{B},C) \quad R_7(\underline{A}BD) \quad R_2(\underline{E}FG) \quad R_4(\underline{A}C) \quad R_5(\underline{AE}H)}$$