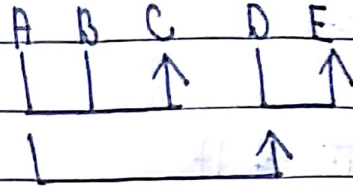


Normalization

1:- $AB \rightarrow C$

$D \rightarrow E$

$A \rightarrow D$



a) $(AB)^+ = ABCDE$

\because we are able to find all the attributes $\therefore AB$ is a only candidate key as they are not having any incoming edges which guarantees them to be a part of key.

b) $AB \rightarrow C$

$D \rightarrow E$

$A \rightarrow D$

$\because A$ is a prime attribute and it is determining a non prime attribute i.e $D \therefore$ it is partially dependent and hence not in 2NF \therefore also not in 3NF.

R_1
(ABC)

$AB \rightarrow C$

C.K

AB

\downarrow

is 2NF

is 3NF

R_2
(ADE)

$A \rightarrow D$

$D \rightarrow E$

C.K

A

\downarrow

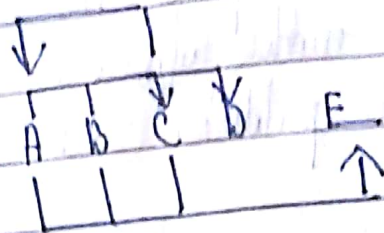
not in 3NF

as D which is p is determining E which is np \therefore transitive dependency

$R_1(ABC)$
 $AB \rightarrow C$
 C.K : AB

$R_2(AD)$
 $A \rightarrow D$
 C.K : A

$R_3(DEF)$
 $D \rightarrow E$
 C.K : D



~~A~~ ~~B~~ / D E

A C D

2. $AB \rightarrow CD$
 $ABC \rightarrow E$ ✓
 $C \rightarrow A$

g clearly B does not have any incoming edge :
 B will form a part of candidate key.

$(AB)^+ = ABCDE$

$\therefore AB$ is a C.K

$(AC)^+ = AC$ $(BC)^+ = BCDEF$

$(AD)^+ = AD$ $\therefore AD$ is a C.K

$(AE)^+$

$(BD)^+ = (BD)$

$(BE)^+ = BE$

$\therefore (AB)^+$ and $(BD)^+$ are C.K

A, B, C

ABC are prime attribute

DE are non prime attribute.

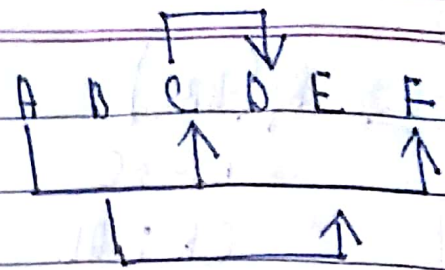
check its in first normal form...

also in 2NF (\because p.d)

also in 3NF (\because no t.d)

not in BCNF because C is which is determining
 A which is also a p.

3:- Book title = A
 author name = B
 book type = C
 list price = D
 author affli = E
 publisher = F



clearly AB does not have any edge \therefore part of C.K.
 $(AB)^+ = ABCFDE$

show p.d.
~~show p.d.~~
 show p.d.

$A \rightarrow CF$
 $C \rightarrow D$
 $B \rightarrow F$

here A and B are P.A
 CDEF are NPA.

$R_1(ACFD) \quad R_2(DE)$
 $A \rightarrow CF$
 $C \rightarrow D$
 C.K A.

$B \rightarrow E$
 C.K B

\downarrow
 $R_1(ACF)$
 $A \rightarrow CF$
 C.K A

$R_2(DE)$
 $B \rightarrow E$
 C.K B

in DCNF

$R_3(CD)$
 $C \rightarrow D$
 C.K C

4:- i) $A \rightarrow B$

$B \rightarrow C$

$C \rightarrow D$

$D \rightarrow A$

$(A^+) = ABCD$

$(B^+) = BCDA$

$(C^+) = CDAB$

$(D^+) = ABCD$

clearly ABCD are prime attributes and they are in 3NF \because there is no partial dependency and transitive dependency. But it is not in BCNF because a prime attribute (in every FD) is determining another prime attribute which is not allowed.

$R_1(AB)$

$R_2(BC)$

$R_3(CD)$

$R_4(AD)$

$A \rightarrow B$

$B \rightarrow C$

$C \rightarrow D$

$D \rightarrow A$

Now all the relations are in BCNF.

ii) $R(ABCD)$

$B \rightarrow C$

$B \rightarrow D$

A B C D

$\begin{matrix} \uparrow & \uparrow \\ \text{ } & \text{ } \end{matrix}$

clearly A and B does not have any incoming edge (i.e. they are essential prime attributes) hence they will form the part of candidate key.

$(AB)^+ = ABCD$

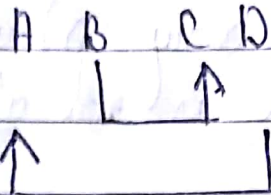
clearly AB is ck and A and B are PA with C & D as NPA.

is not in 2NF because B being P.A determines C and D which are not P.A.

Dec $R_1 (BCD)$ $R_2 (AB)$
 C.K B C.K AB.
 Now in BCNF.

5: (do do)

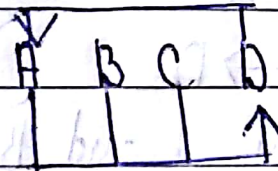
6: a) $B \rightarrow C$
 $D \rightarrow A$



clearly B and D does not have any incoming edge (i.e. essential prime attributes) hence they will form a part of C.K.
 $(BD)^+ = BDCA$
 it is only C.K.

$ABC \rightarrow D$

$D \rightarrow A$



BC does not have any incoming edge.

$\Rightarrow (ABC)^+ = ABCD$ } C.K.A.
 $(BCD)^+ = BCDA$ }

- b) F_1 is in first normal form.
 F_2 is in 3rd normal form.

c) For F_1 :-
 $R_1(BD)$ ✓
 key BD
 $R_2(BC)$ ✓
 key BC
 $R_3(DA)$ ✓
 key D

For F_2 :-
 $R_1(ABCD)$
 key ABC ✓
 $R_2(CAD)$
 key D. ✓
 not possible
 not possible

X — X