Q1 → R(ABCDEFG) {AB → C, B → D, D → E, A → F, F → G}

Solution :- i) $(AB)^+ = \{ABCDEFG\}$

Hence Candidate Key (C.K) = {AB}

ii) Prime attribute = {A, B}

Nonprime attribute = {C, D, E, F, G}

iii) Find Highest normal form ?

⇒

	AB → C	B → D	D → E	A → F	F → G
INF	✓	✓	✓	✓	✓
2NF	✓	X	✓	X	✓
3NF	—	—	—	—	—
BCNF	—	—	—	—	—

{ Here B → D & A → F Contains partial dependency so it is not in 2NF }

∴ Highest normal form 1NF

(iv) - Decomposition in higher form (i.e BCNF).

R(ABCDEFG)

$A^+ = \{AFG\}$ → R1 [AFG]

A → F

F → G

{CK = A}

$R2\ B^+ = \{BDE\}$ → [BDE]

B → D

D → E

{CK = B}

R3 [ABC]

AB → C

{CK = AB}

R1 & R2 are not in 3NF ∴ Decompose these tables.

R1 [AFG] → R11 [AF] (A → F), R12 [FG] (F → G)

R2 [BDE] → R21 [BD] (B → D), R22 [DE] (D → E)

R3 [ABC]

AB → C

No. of tables 5

Ans: Now R_{11}, R_{12}, R_{21}, R_{22} & R_3 are in BCNF ∴ no further decomposition required

R_1 & R_2 are in 2NF but not in 3NF Due to transitive dependency while R_3 is in BCNF

Q) → R(ABCD) {A → C, B → D}

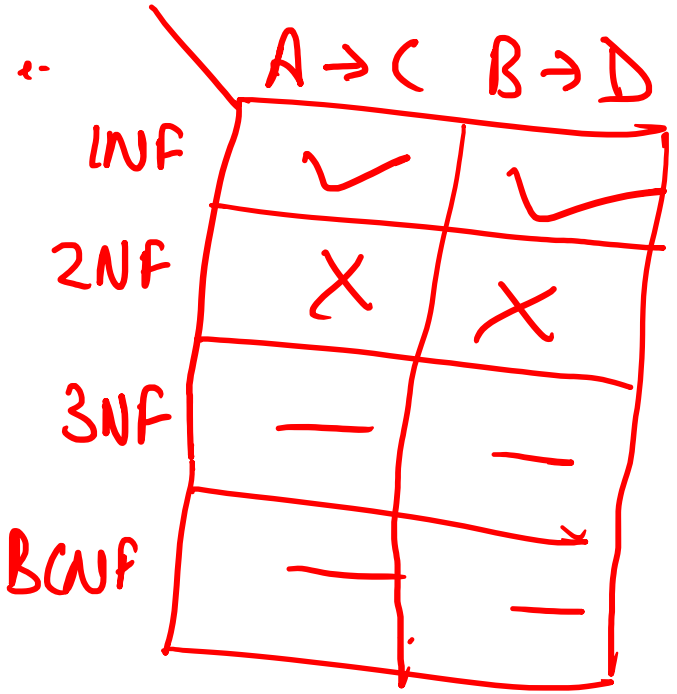
Sol ⇒ i) (AB)+ = {A, B, C, D}

∴ Candidate Key = {AB}

ii) → Prime attribute = {A, B}

Non prime attribute = {C, D}

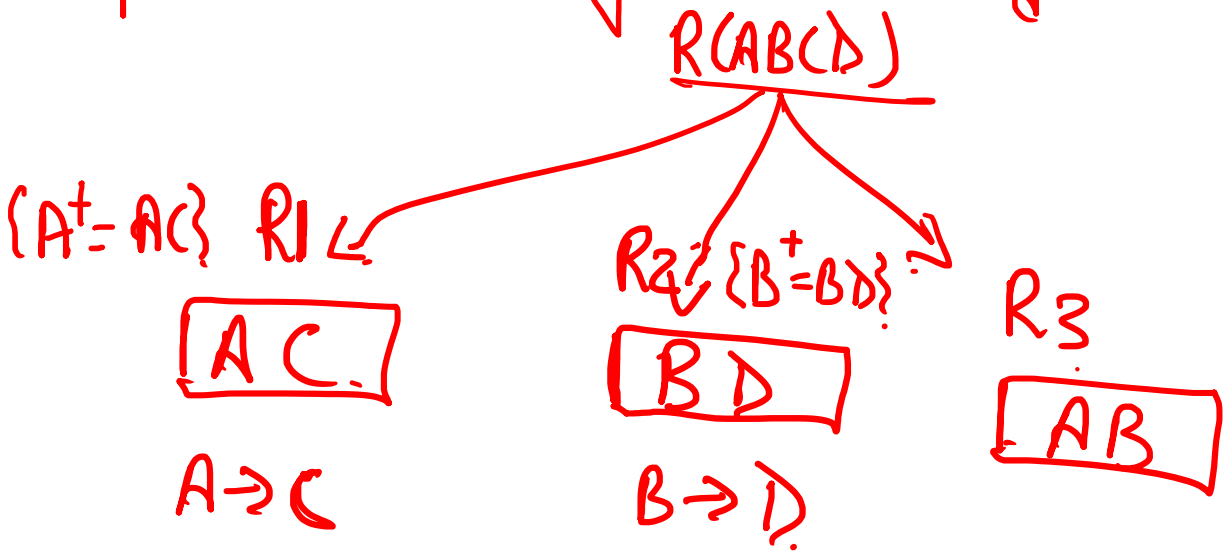
iii) ..



Here A → C & B → D holds partial dependency ∴ it is not in 2NF

∴ Highest normal form is 1NF

Eg). Decomposition into higher normal form:-



Now R1, R2, R3 holds (1NF, 2NF, 3NF & BCNF)

∴ No further decomposition required.

No. of tables = 3 (i.e, R1, R2, R3)

Q → R(ABCDEF) {A → BC, D → E, E → F}

Sol → ① $(AD)^+ = \{ABCDEF\}$

Candidate Key (C.K) = {AD}

② ⇒ Prime Attribute = {A, D}

Non prime attribute = {B, C, E, F}

③

	A → BC	D → E	E → F
1NF	✓	✓	✓
2NF	X	X	✓
3NF	—	—	—
BCNF	—	—	—

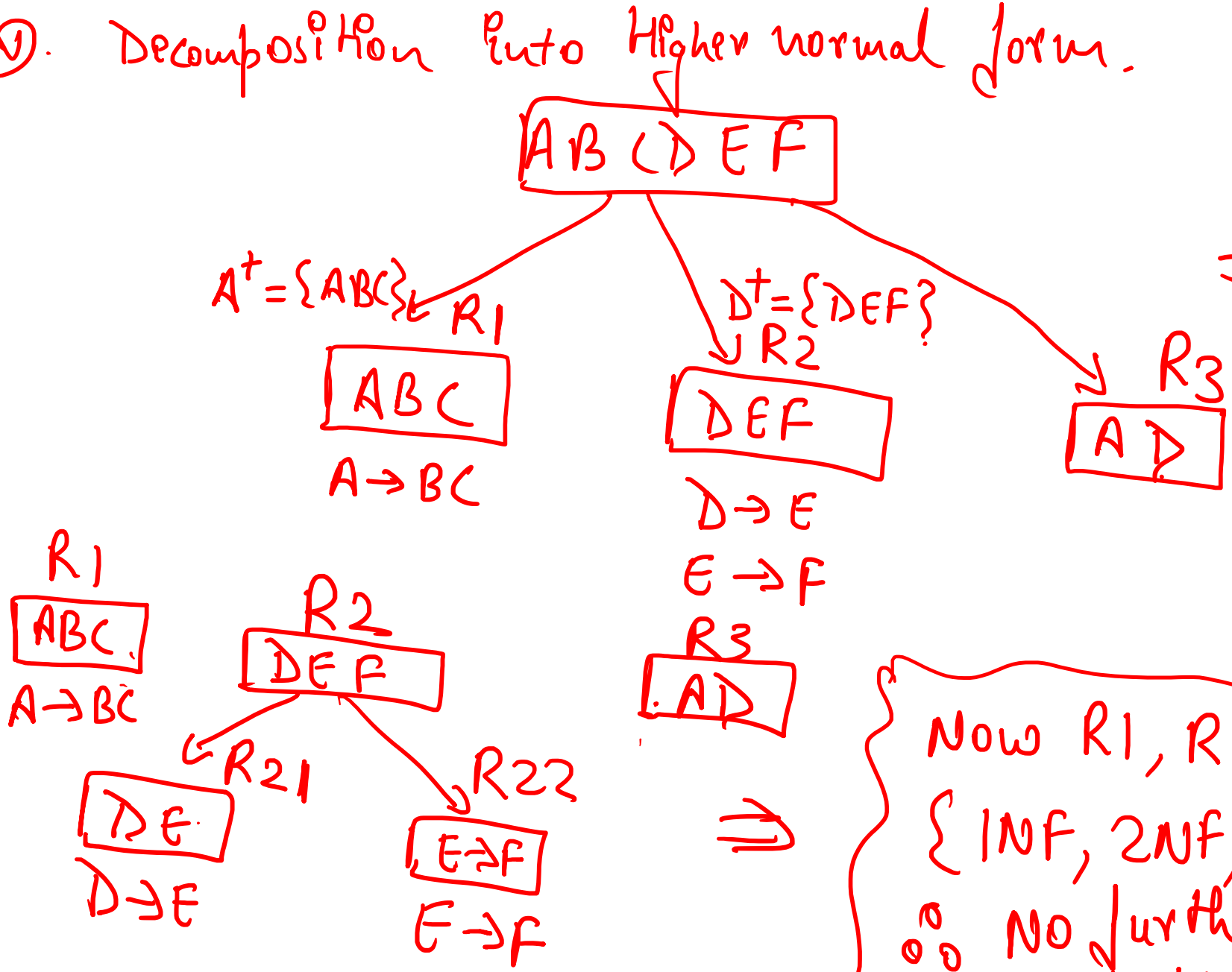
Here A → BC & D → E Hold Partial dependency

It is not in 2NF

∴ Highest normal form

1NF

(N). Decomposition into Higher normal form.



⇒ Here R1 & R3 are in BCNF But R2 is not in 3NF. ∴ Decompose R2

⇒ Now R1, R21, R22, & R3 are in {1NF, 2NF, 3NF & BCNF}
∴ No further decomposition required
No. of tables = 4 {R1, R21, R22, R3}

Q4) → R(ABCDE) { A→BC, CD→E, B→D, E→A }

Sol → ① $A^+ = ABCDE$

$E^+ = ABCDE$

$(CD)^+ = ABCDE$

$(BC)^+ = ABCDE$

∴ Candidate keys = { A, E, CD, BC }

② Prime attribute = { A, B, C, D, E }

Non prime attribute = { ∅ }

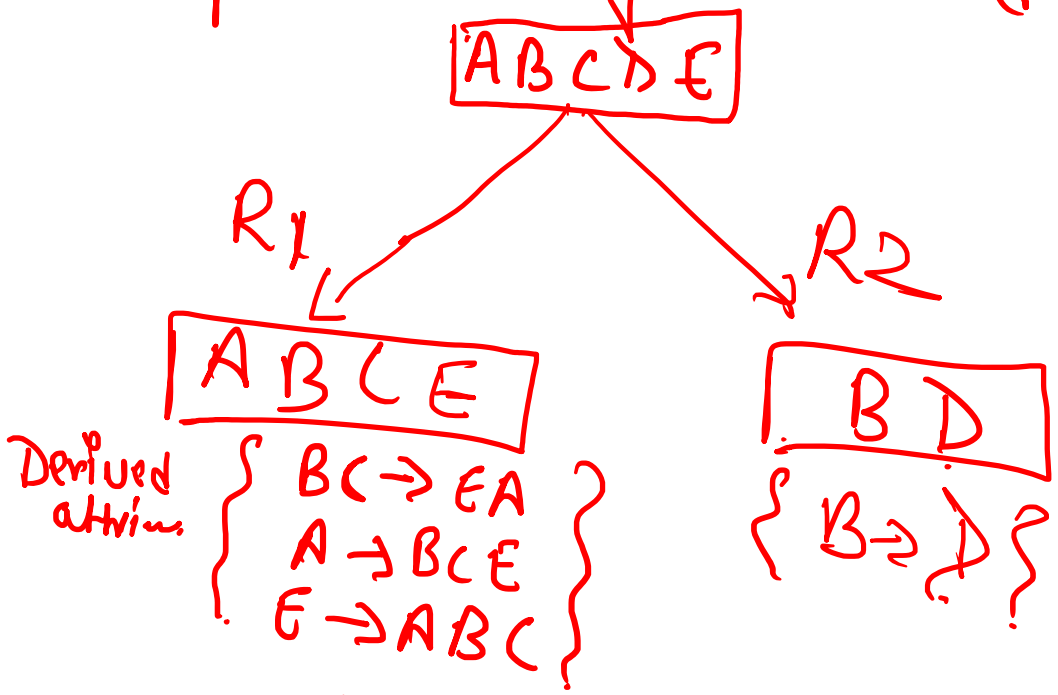
(5) →

	A→BC	CD→E	B→D	E→A
INF	✓	✓	✓	✓
2NF	✓	✓	✓	✓
3NF	✓	✓	✓	✓
BCNF	✓	✓	X	✓

⇒ In B→D B is not a CK or super key ∴ It is not in BCNF

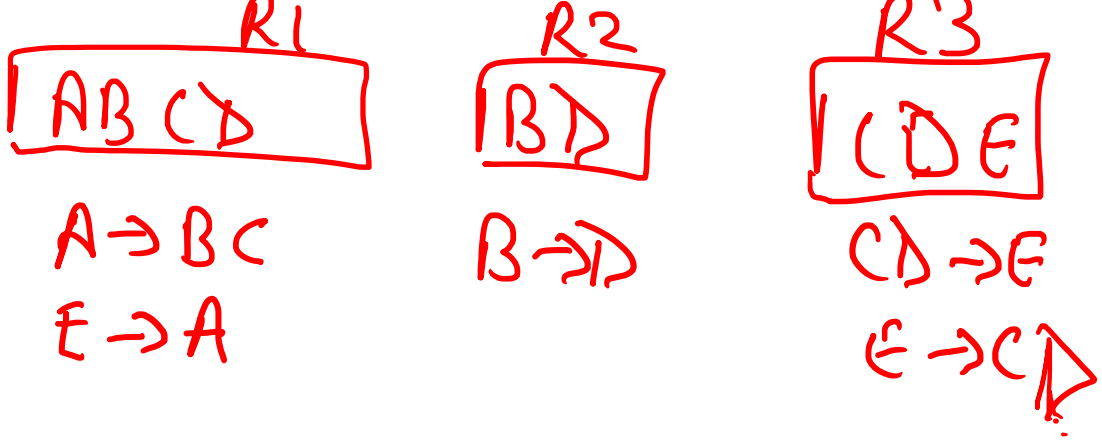
Highest normal form = 3NF

④ Decomposition into highest normal form :



Here R1 & R2 are in BCNF But not Dependency preserving (D.P)
∴ CD → E is missing in both R1 & R2 table ✓

⇒ To make dependency preserving we need to add one more relation with attribute CDE ✓



R1, R2 & R3 are in BCNF & hold lossless & D.P
∴ No. of tables = 3