SOLUTION FOR A3 - PART I

QUESTION 1

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

AB -> C
C - > D
E -> F
FH -> I
GC -> A
FI -> H
D - > G

a) **Keys:** ABEH, BCEH, ABEI,BCEI.

b) **Minimal cover:**
step I . Done. All RHSs of the FDs have only one attribute
AB -> C
C - > D
E -> F
FH -> I
GC -> A
FI -> H
D - > G
Step II .
C+= C D G A => replace GC - > I with C -> A
A + = A
B+ = B
F+ = F
I + = I
Step III
All RHSs of the FDs are distinct, son this is the minimal cover:

AB -> C
C - > D
E -> F
FH -> I
C -> A
FI -> H
D - > G

C - > D violates 3NF. D is not a Prime Attribute, C is not a CK

c)
R1(ABC)
R2(C D)
R3 (E F)
R4(FH I)
R5 (C A)
R6(FI H)
R7 (D G)

As this is an abstract DB, we merge R4 and R6 and add a schema with a CK

R1(ABC)
R2(C D)
R3 (E F)
R4(FH I)
R5 (C A)
R6(D G)
R7(ABEH)

because of C ->A and AB ->C, R1 is not in BCNF

d)

Pick D -> G
R1(D G) => BCNF
R11(A B C D E F H I)

AB -> C
C - > D
E -> F
FH -> I
C -> A
FI -> H

Pick C->D
R2(CD) => BCNF
R21(A B C E F H I)

AB -> C
E -> F
FH -> I
C -> A
FI -> H

Pick C - >A

R3(CA) => BCNF
R31(B C E F H I)

E -> F
FH -> I
FI -> H

Pick FH -> I

R4(FHI) => BCNF
R31(B C E F H)
E -> F

Pick E -> F

R5(EF) => BCNF
R6(BCEH) => BCNF

QUESTION 2

a)

R1 intersection R2 = CD
CD+= CDGA
R1 \R2 = AB
R2 \ R1 = EF

R2 intersection R3 = F
F+= F
R2 \R3 = CDE
R3 \ R2 = GHI

R1 intersection R3 = Empty

Non-lossless join decomposition

b) Minimal cover of F:

AB -> C
C - > D
E -> F
FH -> I
C -> A
FI -> H
D - > G

R1(ABCD) F1= {AB->C,C->A,C->D}
R2(CDEF) F2= {C->D, E->F}
R3(FGHI) F3= {FH->I, FI->H}

D-> G is lost (D+ w.r.t. (F1 U F2 U F3) = D

QUESTION 3

A -> BC is never satisfied
D -> E is satisfied by r1, r3
∅-> D is satisfied by r1, r2 (D is a constant)
BD -> D is satisfied by r1, r2, r3

QUESTION 4

I =

a1	b1	c1	d1	e2	f1
a1	b2	c1	d1	e2	f1
a2	b3	c2	d2	e2	f2
a3	b4	c3	d3	e1	f3

u = <a3,b1,c3,d3,e2,f1> **I U {u} does not satisfy A->DE**.