

Question 1

1) $A^+ = \{A, C, D, E, G, H, I\}$

Hence $A \rightarrow I \in F^+$

2)

Let $X = \{A, B, C, D, E, G, H, J\}$

Try to remove A, $\{B, C, D, E, G, H, J\}^+ = \{A, B, C, D, E, G, H, I, J\}$

Thus $X := \{B, C, D, E, G, H, J\}$

Try to remove C, $\{B, D, E, G, H, J\}^+ = \{A, B, C, D, E, G, H, I, J\}$

Thus $X := \{B, D, E, G, H, J\}$

Try to remove G, $\{B, D, E, H, J\}^+ = \{A, B, C, D, E, G, H, I, J\}$

Thus $X := \{B, D, E, H, J\}$

Try to remove H, $\{B, D, E, J\}^+ = \{A, B, C, D, E, G, H, I, J\}$

Thus $X := \{B, D, E, J\}$

Try to remove D, $\{B, E, J\}^+ = \{A, B, C, D, E, G, H, I, J\}$

Thus $X := \{B, E, J\}$

Try to remove B, E, J

$\{E, J\}^+ = \{A, C, D, E, H, G, I, J\} \neq R$

$\{B, J\}^+ = \{B, G, I, J\} \neq R$

$\{B, E\}^+ = \{A, B, C, D, E, G, H, I\} \neq R$

Thus cannot be removed

So $\{B, E, J\}$ is a candidate key.

3) 1NF.

Check 3NF:

Because $A \rightarrow DE$

So $A \rightarrow E, AC \rightarrow CE$

Because $E \rightarrow CD, CE \rightarrow ADH, H \rightarrow I$

So $AC \rightarrow CE \rightarrow H \rightarrow I$ (transitively dependent)

Thus it is not 3NF.

Check 2NF:

Because $E \rightarrow CD, CE \rightarrow ADH$

So $E \rightarrow D, CE \rightarrow D$

Because $E \subset CE$, so D is partially dependent on CE

Thus it is not 2NF.

Hence, the highest normal form of R is 1NF.

4) Minimal cover for F:

$F_m = \{A \rightarrow E, A \rightarrow I, B \rightarrow G, B \rightarrow I, E \rightarrow C, E \rightarrow D, E \rightarrow A, E \rightarrow H, H \rightarrow G\}$

5) According to 4), $F_m = \{A \rightarrow E, A \rightarrow I, B \rightarrow G, B \rightarrow I, E \rightarrow C, E \rightarrow D, E \rightarrow A, E \rightarrow H, H \rightarrow G\}$

According to 2), $\{B, E, J\}$ is a candidate key.

$R_1 = (A, E, I)$

$R_2 = (B, G, I)$

$R_3 = (E, A, C, D, H)$

$R_4 = (H, G)$

$R_5 = (B, E, J)$

	A	B	C	D	E	G	H	I	J
R1	a	b	b	b	a	b	b	a	b
R2	b	a	b	b	b	a	b	a	b
R3	a	b	a	a	a	b	a	b	b
R4	b	b	b	b	b	a	a	b	b
R5	b	a	b	b	a	b	b	b	a

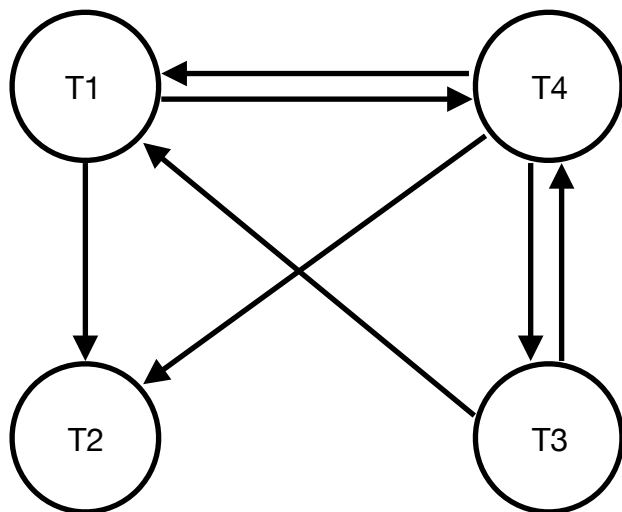
After testing:

	A	B	C	D	E	G	H	I	J
R1	a	b	A	A	a	A	A	a	b
R2	b	a	b	b	b	a	b	a	b
R3	a	b	a	a	a	A	a	A	b
R4	b	b	b	b	b	a	a	b	b
R5	A	a	A	A	a	A	A	A	a

Row R5 is entirely a's, so the decomposition is lossless.

Problem 2

1)



Thus, the transaction schedule is not conflict serialisable.

2)

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12
T1	R(B)	R(A)	W(B)	W(A)								
T2					R(B)	W(B)						
T3							R(A)	W(A)				
T4									R(A)	W(A)	R(B)	W(B)

3)

RL = Read Lock

WL = Write Lock

UL = Unlock

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13
T1	RL(B)					RL(A)	WL(B)	UL(B)			WL(A)	UL(A)	
T2								RL(B)				WL(B)	UL(B)