Question 1

1)$E \rightarrow G \in F+$ iff $G \subseteq E^+$ So compute $\{E\}^+$

1st scan of E:

$E^+ := \{E\}$

$E^+ := \{E,B,C,D\}$

2nd scan of E:

$E^+ := \{E,B,C,D,G,H\}$

$E^+ := \{E,B,C,D,G,H,I\}$

3rd scan of E:

no change, therefore the algorithm terminates

$\{E\}^+ := \{B,C,D,E,G,H,I\}$

$G \subseteq E^+$, so $E \rightarrow G \in F+$

2) AEJ/ABJ

3)96 ABHJ/ABCJ/ABDJ/ACEJ/ABIJ

4) $F_m = \{AB \rightarrow E\ C \rightarrow H\ E \rightarrow B\ E \rightarrow D\ D \rightarrow C\ H \rightarrow G\ D \rightarrow I\}$

5) 1NF. In question 4, when finding the minimal cover, $EH \rightarrow I$ can be written into $E \rightarrow I$, so it's partially dependency, not 2NF.

6)not dependency-preserving

$F_1 = \{AB \rightarrow DE\ E \rightarrow BCD\}$ $F_2 = \{C \rightarrow GH\ H \rightarrow G\}$ $F_3 = \emptyset$

$F \neq F_1 \cup F_2 \cup F_3$, thus, not dependency-preserving

7)not lossless-join

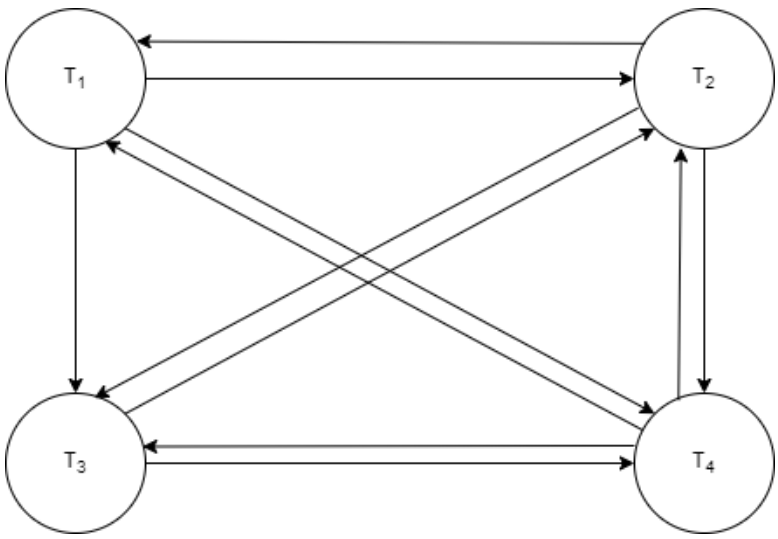
Decomposition	A	B	C	D	E	G	H	I	J
R_1(ABCDE)	a	a	a	a	a	b	b	b	b
R_2(CGH)	b	b	a	b	b	a	a	b	b
R_3(EIJ)	b	b	b	b	a	b	b	a	a

Decomposition	A	B	C	D	E	G	H	I	J
R_1(ABCDE)	a	a	a	a	a	a	a	a	b
R_2(CGH)	b	b	a	b	b	a	a	b	b
R_3(EIJ)	b	a	a	a	a	a	a	a	a

8) F={AB→DE C→GH E→BCD D→CI H→G EH→I}
F_m={AB→E C→H E→B E→D D→C H→G D→I}
Consider AB→E, AB is not a superkey, split R into R_1{A,B,E} and R_2{A,B,C,D,G,H,I,J}
Consider E→B, E is not a superkey, split R_1 into R_{11}{A,E}, R_{12}{B,E}
Consider C→H, C is not a superkey, split R into R_3{C,H}, R_4{A,B,C,D,E,G,I,J}
Consider D→C, D is not a superkey, split R_4 into R_{41}{C,D}, R_{42}{A,B,D,G,I,J}
Consider D→I, split R_{42} into R_5{A,B,D,G,J},R_6{D,I}
Consider AB→D, split R_5 into R_{51}{A,B,D},R_{52}{A,B,G,J}
Consider AB→E, E→D D→C C→H H→G, so AB→G, split R_{52} into R_7{A,B,J},R_8{A,B,G}
One of the possible lossless-join decompositions to BCNF is R_{11}, R_{12}, R_3, R_{41}, R_{51}, R_6,R_7,R_8

Question 2

1)Undo T1, T2,T4
2)Non-serializable
From R(B) W(B), we can find that T_1→T_3, T_1→T_2, T_2→T_4, T_4→T_3, T_2→T_3, T_1→T_4,T_3→T_2,T_3→T_4
From R(A) W(A), we can find that T_4→T_2,T_1→T_2,T_4→T_1
The precedence graph:



This graph is cyclic, so the transaction schedule conflict is non-serializable.

3)

Time	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}
T_1	R(B)	R(A)	W(B)	W(A)											
T_2					R(A)	R(A)	R(B)	W(B)	W(A)						
T_3										R(B)	W(B)				
T_4												R(A)	W(A)	R(B)	W(B)

4)

Time	t_1	t_2	t_3	t_4	t_5	t_6	t_7	t_8	t_9	t_{10}	t_{11}	t_{12}	t_{13}	t_{14}	t_{15}
T_1	L(A)	R(A)	W(A)		L(B)	R(B)	W(B)								
T_2		L(B)	R(B)	W(B)		L(A)	R(A)	W(A)							
T_3									R(A)	W(A)	R(B)	W(B)			
T_4												R(A)	W(A)	R(B)	W(B)

Question 3

1)37

2)