Question1.

1.

GJ/GHI

2.

1NF, there are non-prime attribute A and B is functionally determined by G.

3.

F_m ={B -> D, B -> E, CD->E, AHI->C, AHI->J, AJ->E, AJ->H, AJ->I, G->A, G->B}

4.

$\because R_1 = \{ABE\}, R_2 = \{CDH\}, R_3 = \{EGHIJ\}$
$\therefore \ \pi_{R_1}(F_1) = \{\}, \pi_{R_2}(F_2) = \{\}, \pi_{R_3}(F_3) = \{\}$

$F' = F_1 \cup F_2 \cup F_3$

$Since\ F'^{+} \neq F^{+}, hence\ R_1, R_2\ and\ R_3\ are\ not\ dependency\ preserving\ regarding\ F.$

5.

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

Now no row is entirely a's, so the decomposition is not lossless join property.

6.

For F ={B -> DE, CD->E, AHI->CJ, AJ->EHI, G->AB}

Consider AHI->CJ, AHI is not a superkey, split R into R1: {A, C, H, I, J}, R2: {A, B, D, E, G, H, I}

Consider AJ->HI in R1: {A, C, H, I, J} AJ is not a superkey, split R1 into R11: {A, H, I, J}, R12: {A, C, J}

Consider B -> DE, Bis not a superkey, split R2 into R21: {B, D, E}, R22: {A, B, G, H, I}

Consider G->AB, G is not a superkey, split R22 into R3: {A, B, G}, R4: {G, H, I}

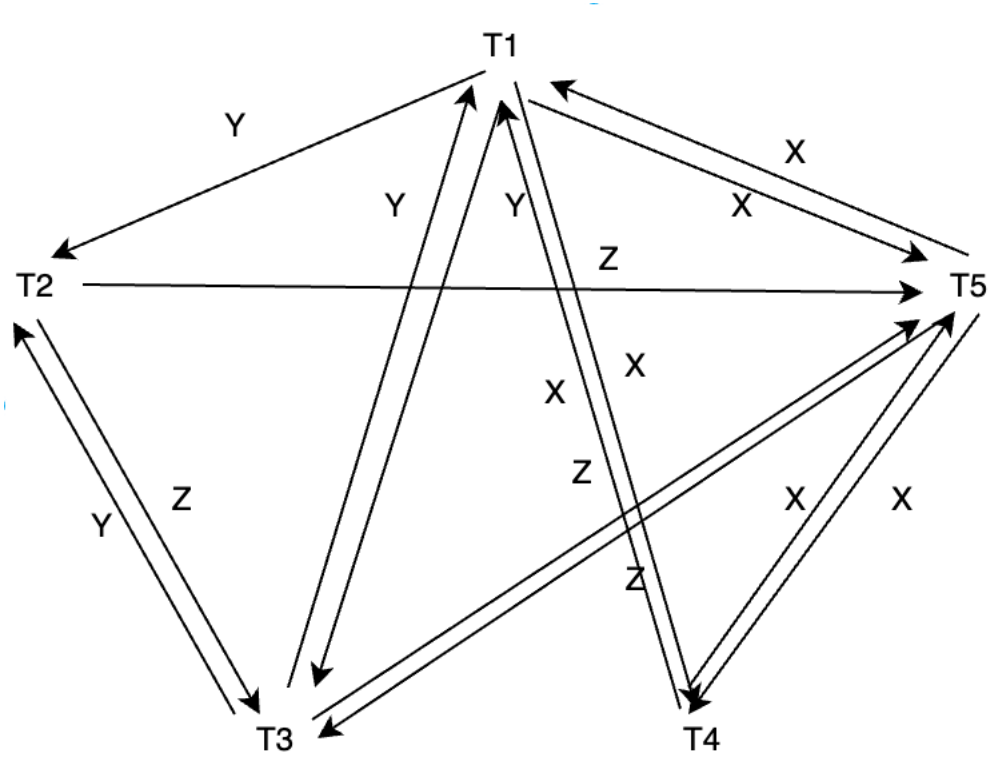
A lossless decomposition of R into BCNF normal form is: R11, R12, R21, R3, R4

Question2.

1.

at checkpoints T1, T2, T3, T4 transactions start, but no transaction commits. At crash point, T3, T4 commit. So we only need to redo T3 and T4, and T1, T2, T5 undo.

2.



The precedence graph is acyclic, so it is not conflict serializable.

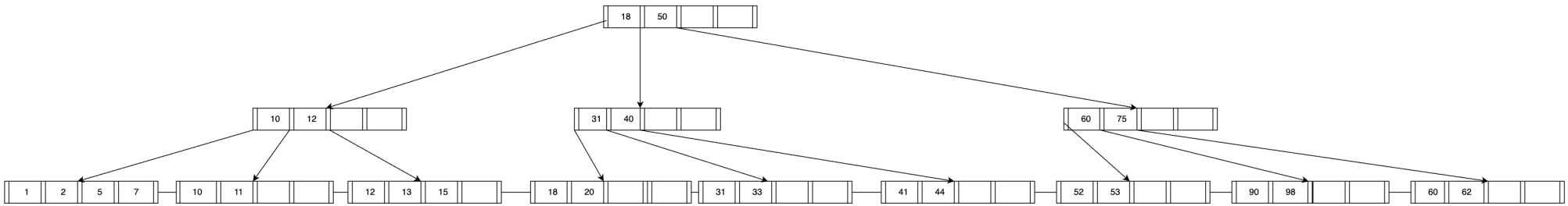
3.

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14	t15	t16	t17	t18
T1	read(X)			read(Y)								write_lock(X)				write_lock(Y)		
T2		write_lock(Z)											read(P)					read(Y)
T3			read(Y)				read(Z)		write_lock(Y)		write_lock(Z)							
T4					read(X)									write_lock(X)				
T5						read(Z)		read(X)		read(P)					write_lock(Z)		write_lock(X)	

	t19	t20	t21
T1	unlock(X)		
T2	unlock(Z)	unlock(X)	
T3	unlock(Y)	unlock(Z)	unlock(X)
T4			unlock(Z)

Question3.

1.



2.