Question 1

1)
No
Because: D+ = {D}
Hence $D \rightarrow A$ not ∈ F+

2)
X = {A, B, C, D, I, J} if the left-hand side of F is a super key.
A can be removed because BCDIJ+ = ABCDEGHIJ = R
B cannot be removed because CDIJ+ = ACDEGHIJ ≠ R
C can be removed because BDIJ+ = ABCDEGHIJ = R
D can be removed because BIJ+ = ABCDEGHIJ = R
I cannot be removed because BJ+ = BDGHJ ≠ R
J cannot be removed because BI+ = BI ≠ R
Because C → IJ
Hence BC+ = ABCDEGHIJ = R
……
AB/BC/BDI/BIJ are the candidate keys for R

3)
64

ABC
ABD
ABI
ABG
ABIJ

4)
Fm = {AB→C, C→I, C→J, J→D, J→H, J→G, DI→A, DI→E}

5)
2NF.
Because non-prime attribute E, G, H is fully functionally determined by prime attribute.

6)
Not dependency-preserving
Because *R1* = $\{ACE\}$, *R2* = $\{BCDE\}$, *R3* = $\{DJGHI\}$, their FD set F1, F2, F3. $(F1 \cup F2 \cup F3)^{+}$ not $= F^{+}$

7)
Not lossless-join

decomposition	A	B	C	D	E	G	H	I	J
$R1 = \{ACE\}$	a		a		a				
$R2 = \{BCDE\}$		a	a	a	a				
$R_3 = \{DJGHI\}$				a		a	a	a	a

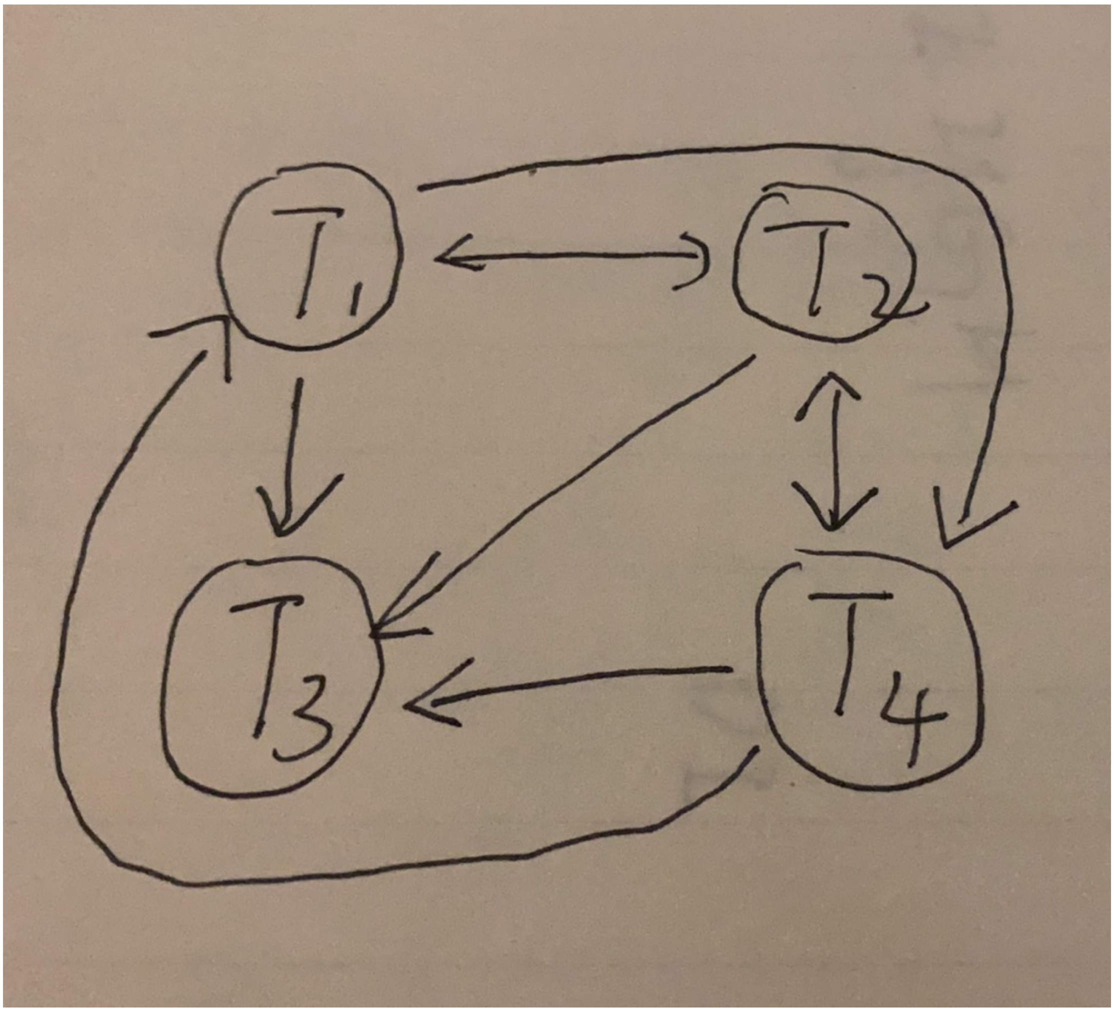
decomposition	A	B	C	D	E	G	H	I	J
$R1 = \{ACE\}$	a		a	b	a	a	a	b	b
$R2 = \{BCDE\}$	a	a	a	a	a	a	a	b	b
$R_3 = \{DJGHI\}$	b			a	b	a	a	a	a

8)
Step 1:
Fm = {AB→C, C→I, C→J, J→D, J→H, J→G, DI→A, DI→E}
Step 2:
because AB/BC/BDI/BIJ is candidate key, hence AB→C can be subset {ABC}
then because the left-hand of J→D, J→H, J→G, DI→A, DI→E, C→I, C→J contains no A/B/C, hence they can be subset {JD}, {JH}, {JG}, {DIA}, {DIE}
So the BCNF relations is {ABC}, {JD}, {JH}, {JG}, {DIA}, {DIE}, {CI}, {CJ}

Question 2

1)
T1 undo T2 redo
T3, T4 do nothing

2)



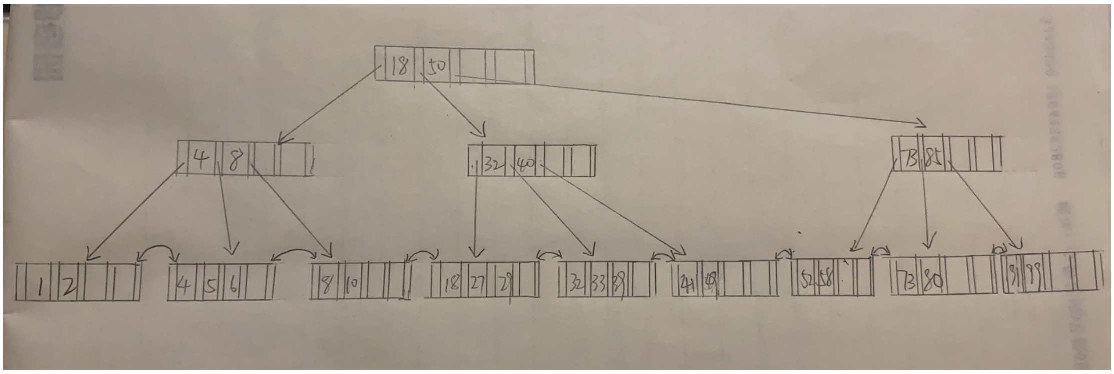
3)

time	T1	T2	T3	T4
1	R(B)			
2	R(A)			
3	W(B)			
4	W(A)			
5		R(B)		
6		R(A)		
7		W(B)		
8		R(A)		
9		W(A)		
10				R(A)
11				W(A)
12				R(B)
13				W(B)
14		R(B)		
15		W(B)		

4)
There is no way to construct a schedule whose wait-for graph contains cycles.
We have T1 and T2 read and write on B, we have potential to make T2 wait-for T1. We have T1 and T2 read and write on A, we have potential to make T1 wait-for T2. we cannot make both T2 wait-for T1 and T1 wait-for T2.

Question 3

1)
80
Because (5 * 5 * 4) – 20 = 80

2)


3)