Assignment Second

Ques 1 :

Ans 1.1 :

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

Functional Dependencies are as follows :

A -> DE
B -> GI
E -> CD
CE -> ADH
H -> G
AH -> I

A) Scanning Functional Dependencies
A^+ = {A,D,E,C,H,G,I}
{A^+} := {A,D,E,C,H,G,I}

Thus, $A \rightarrow I \in F^+$

Ans 1.2 :

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

In order to find the candidate key for the relation we intend to find the closure of the attributes present in the relation. If we are able to get all of the attributes from this closure then that attribute is part of the candidate key

Now given that the number of possibilities will be huge. Thus as a rule of thumb, we start the lookout for the keys from the Right Hand side of the functional dependencies.

1. From , the set of functional dependencies, taking the identifying attributes in the set X as :
   X = { A, B, E,C,H,J }
   Note :: There was no attribute identifying the attribute J, hence the same was added to the set for perusal.

   A) Removing the attribute i.e. A and taking the closure i.e.
   X' : = { B, E,C,H,J }

   X' $^+$:= { B,E,C,H,J,G,I,D,A} $\in$ R, Thus attribute A can be removed from the possible set as its redundant

   B) Removing another attribute i.e. B and taking the closure i.e.
   X'' : = { E,C,H,J }
   X''$^+$: = {C,E,H,A,D,G,I,J } $\notin$ R
   Thus, we cannot remove attribute B from the set.

   C) Removing another attribute i.e. C and taking the closure i.e.
   X'' : = { B, E,H,J }
   X''$^+$:= {B,E,H,J,G,I,D,C,A } $\in$ R,

   Thus, attribute C is redundant and can be removed from the candidate set.

D) Removing another attribute i.e. E and taking the closure i.e.
X'' : = { B,H,J }
X''^{+} := {B,H,J,G,I} $\notin$ R

Thus, we cannot remove attribute E from the candidate set

E) Removing another attribute i.e. H and taking its closure i.e.
X'' : = { B, E,J }
X''^{+} := {B,E,J,G,I,C,D,A,H} $\in$ R

Thus, attribute H is redundant and can be removed from the candidate set.

Thus, the candidate key is {B,E,J}, as $\{B,E,J\}^{+}$:= {B,E,J,G,I,C,D,A,H} $\in$ R

Ans 1.3 :

Checking the definition of the 2NF:

A relation scheme is in second normal form (2NF) if all non-prime attributes are fully functionally dependent on the candidate keys.

Now checking the Relation with respect to the definition of the 2NF, we observed the following :

> The attributes G and I are partially determined by B.
> The attributes C & D are partially determined by E.

Since the relation R is having attribute values that are atomic and follows the relational model. Thus, the relation R is in 1NF.

Ans 1.4:

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

Functional Dependencies are as follows :

A -> DE
B -> GI
E -> CD
CE -> ADH
H -> G
AH -> I

Step 1 : Following the algorithm, reducing the RHS.

A -> D
A -> E
B -> G
B -> I
E -> C
E -> D
CE -> A
CE -> D
CE -> H
H -> G
AH -> I

Step 2 : Reducing the LHS.

1) CE -> A
C^+ = [C]
Thus we cannot infer C->A from C^+

We take E^+
E^+ = [E,C,D,A]

Since we can infer E->A thus we can reduce it to E-> A

2) CE -> D
C^+ = [C]
Thus we cannot infer C->A from C^+

We take E^+
E^+ = [E,C,D,A]

Since we can infer E->D thus we can reduce it to E-> D

3) CE -> H
C^+ = [C]
Thus we cannot infer C->H from C^+

We take E^+
E^+ = [E,C,D,A,H]

Since we can infer E->H thus we can reduce it to E-> H

4) AH -> I
A^+ := [A,D,E,C,H,G,I]

Since we can infer A->I thus we can reduce it to A-> I

Step 3 : Now checking the set for redundant attributes i.e.
For each FD X → {A} ∈ F, remove it from F if: A ∈ X+ with respect to F − {X →{A}}.

F'' is as follows :
A -> D
A -> E
B -> G
B -> I
E -> C
E -> D
E -> A
E -> H
H -> G
A -> I

Now checking redundancies by taking closure of the attributes i.e.
We have A->D
Taking $A^+|_{F'' - \{A->D\}}$ = [A, E,C,D] , Hence it is redundant

We have A -> E
Taking $A^+|_{F'' - \{A->E\}}$: = [A,I]

Hence it is not redundant

We have B->G
Taking $B^+|_{F'' - \{B->G\}}$:= [B,I]
Hence, not redundant

We have B-> I
Taking $B^+|_{F'' - \{B->I\}}$:= [B,G]
Hence not redundant

We have E->C
Taking $E^+|_{F'' - \{E->C\}}$:= [E,D,A,H,G,I]
Hence not redundant

We have E -> D
Taking $E^+|_{F'' - \{E->D\}}$:[E,C,A,H,G,I]
Hence not redundant

We have E->A
Taking $E^+|_{F'' - \{E->A\}}$: [E,C,D,H,G]
Hence not redundant

We have E-> H
Taking $E^+|_{F'' - \{E->H\}}$: [E,C,D,I,A]
Hence not redundant

We have H->G
Taking $H^+|_{F'' - \{H->G\}}$: [H]
Hence not redundant

We have A-> I
Taking $A^+|_{F'' - \{A->I\}}$: [A,E,C,D,H,G]
Hence not redundant

Thus the computed F_{min} is as follows :
{
A ->E, B ->G , B -> I, E ->C , E-> A, E-> H, H-> G, A-> I, E-> D
}

Ans 1.5
Using the F_{min} computed in the question 4 we can convert into 3NF.

R1 = (A, E, I)
R2 = (B,G,I)
R3 = (E,C,D,A,H)
R4 = (H,G)

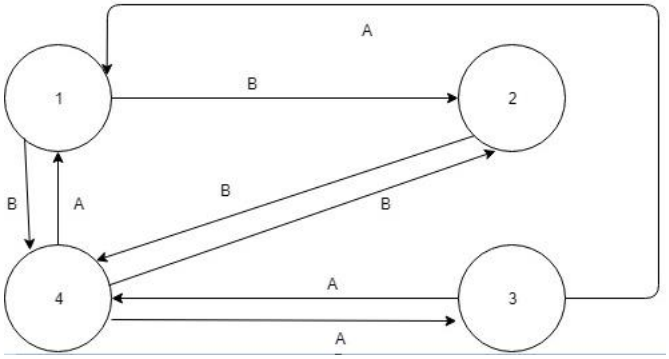
Now since neither of the Relations (R1 to R4) include the candidate key, hence it is included in the relation R5 as follows :
R5 = (B, E, J)

Ques 2

Ans 2.1

The schedule is not conflict-serializable. Since there exists a cycle in the precedence graph.

The precedence graph is as follows :



Ans 2.2:
The schedule is as follows :

time	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)

Ans 2.3:
The schedule is as follows :

T1	T2
Write_lock(B)	
Read(B)	
Write_lock(A)	
Read(A)	
Write(B)	
Unlock(B)	
	Write_lock(B)
	Read(B)
Write(A)	
Unlock(A)	
	Write(B)
	Unlock(B)