1.(1)

From F we can get :

$F' = \{A \to B, A \to C, E \to A, E \to D, BD \to E, CE \to D, CE \to H, H \to G, EI \to J\}$

For EI → J

{E} + = {E,A,D}, thus E → J is not inferred by F'

{I} + = {I}, thus I → J is not inferred by F'

Hence , only EI →J is inferred by F'

So ,C → J $\notin F^+$

1.(2)

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

F = $\{A \to BC, E \to AD, BD \to E, CE \to DH, H \to G, EI \to J\}$.

Step 1 Reduce Right Side:

$F' = \{A \to B, A \to C, E \to A, E \to D, BD \to E, CE \to D, CE \to H, H \to G, EI \to J\}$

Step 2 Reduce Left Side:

For BD → E,

{B} + = {B}, thus B → E is not inferred by F'

{D} + = {D}, thus D → E is not inferred by F'

For CE → D,

{C} + = {C}, thus C → D is not inferred by F'

{E} + = {E,A,B,C,D}, Thus E → D is inferred by F' .

Hence, CE → D is replaced by E → D.

For CE → H,

{C} + = {C}, thus C → H is not inferred by F'

{E} + = {E,A,B,C,D,H}, thus E → H is inferred by F'

Hence, CE → H is replaced by E → H.

For EI → J,

{E} + = {E,A,B,C,D}, thus E → J is not inferred by F'

{I} + = {I}, thus I → J is not inferred by F'

Thus:

$F'' = \{A \rightarrow B, A \rightarrow C, E \rightarrow A, E \rightarrow D, BD \rightarrow E, E \rightarrow H, H \rightarrow G, EI \rightarrow J\}$

Step 3 Reduce Redundancy:

$A+|_{F'' - \{A \rightarrow B\}} = \{A,C\}$; thus A→B is not inferred by F'' –{A→B}. That is, A→B is not redundant.

Similarly, we check the rest and find there are all no redundant,

Hence,

$Fm = \{A \rightarrow B, A \rightarrow C, E \rightarrow A, E \rightarrow D, BD \rightarrow E, E \rightarrow H, H \rightarrow G, EI \rightarrow J\}$

1.(3)

For R = (A,B,C,D,E,G,H,I,J,K)

$F = \{A \rightarrow BC, E \rightarrow AD, BD \rightarrow E, CE \rightarrow DH, H \rightarrow G, EI \rightarrow J\}$.

$R1 = \{ABCDE\}$, $R2 = \{EGH\}$, $R3 = \{EIJK\}$

Initially, S is

	A	B	C	D	E	G	H	I	J	K
R1	a1	a2	a3	a4	a5	b16	b17	b18	b19	b110
R2	b21	b22	b23	b24	a5	a6	a7	b28	b29	b210
R3	b31	b32	b33	b34	a5	b36	b37	a8	a9	a10

For each x →y in F, change the table blow:

	A	B	C	D	E	G	H	I	J	K
R1	a1	a2	a3	a4	a5	a6	a7	b18	b19	b110
R2	a1	a2	a3	a4	a5	a6	a7	b28	b29	b210
R3	a1	a2	a3	a4	a5	a6	a7	a8	a9	a10

Now there is row that entirely made up by “a” values.

, So the decomposition is lossless.

1.(4)

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

From F can get:

$F' = \{A \rightarrow B, A \rightarrow C, E \rightarrow A, E \rightarrow D, BD \rightarrow E, CE \rightarrow D, CE \rightarrow H, H \rightarrow G, EI \rightarrow J\}$

From F’

E → A → B & E → D &E → A → C & EI → J & H → G

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

Hence, superkey can be

{E,I,K},{E,C,I,K},{E,I,K,A},{E,I,K,B} ,{E,I,K,D} ,{E,I,K,G }

1.(5)

According minimal cover, we can get 3NF decomposition.

$Fm = \{A \rightarrow B, A \rightarrow C, E \rightarrow A, E \rightarrow D, BD \rightarrow E, E \rightarrow H, H \rightarrow G, EI \rightarrow J\}$

Regarding Fm, I decompose R into a collection of BCNF relations

Which is :

R1 = (ABC)

R2 = (EADH)

R3 = (HG)

R4 = {EIJ}

$R5 = (K)$

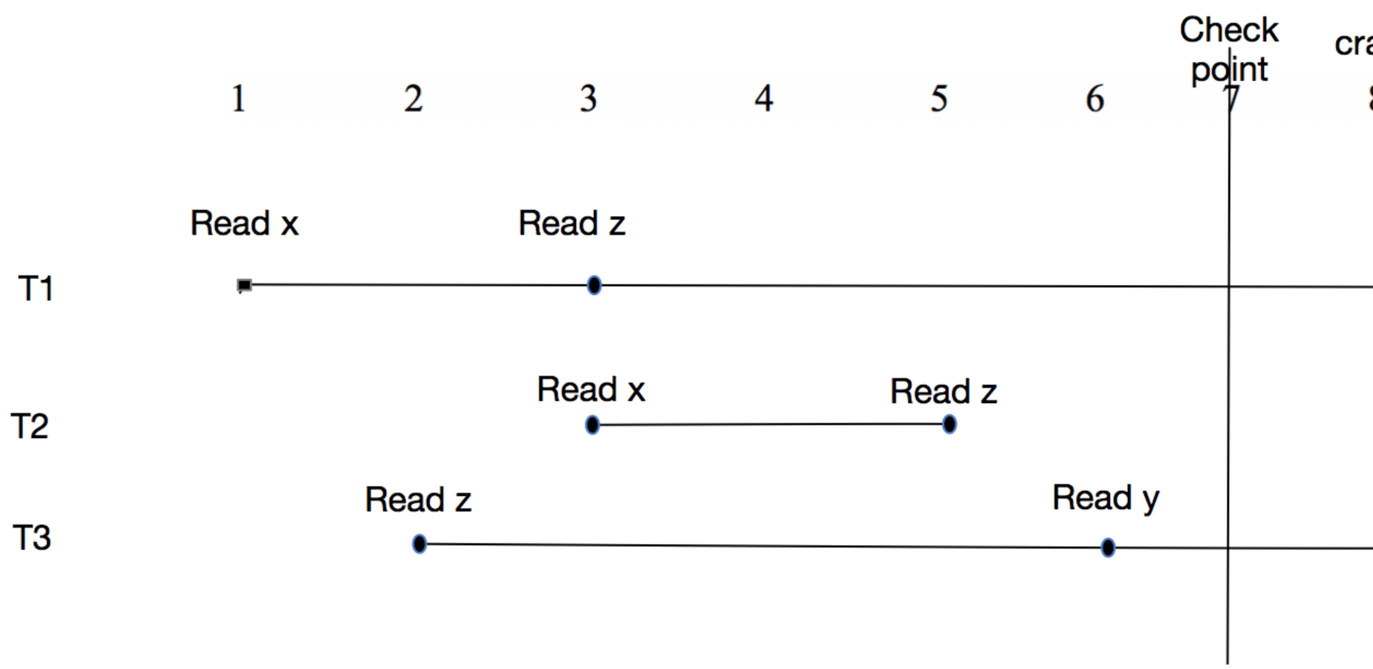
Note: K does not have any relation ship between others, so it can be ignored

	A	B	C	D	E	G	H	I	J
ABC	a	a	a	b	b	b	b	b	b
EADH	a	b	b	a	a	b	a	b	b
HG	b	b	b	b	b	a	a	b	b
EIJ	b	b	b	b	a	b	b	a	a

	A	B	C	D	E	G	H	I	J
ABC	a	a	a	b	b	b	b	a	b
EADH	a	a	a	a	a	a	a	b	b
HG	b	b	b	b	b	a	a	b	b
EIJ	a	a	a	a	a	a	a	a	a

It is lossless join
Functional dependency:
A^+={A,B,C},E^+={A,B,C,D,E,H,G},H^+={H,G},EI^+={A,B,C,D,E,G,H,I,J},K^+={K}
It loss the relation of BD →E, so it's not dependency-preserving
So it's not possible to decompose R into a collection of BCNF relations and ensure the decomposition is dependency-preserving and lossless-join.

2.



(1) T2:redo

T1,T3:undo

(2) T1,T3:undo

(3) T2,do not do anything

3.(1)

Data pages :P1,P2,P3,P4

Queries

Q1:read P1; Q2:read P2; Q3:read P3; Q4:read P4; Q5:read P3;Q6:read P2;

Buffer:

P1	P2	P3

For FIFO, to the Q4,it replace the first buffer(P1),read write and read P4 and in Q5 ,it read P3 directly, in Q6, P2 as well, But for MRU, first ,it replace the third buffer(P3), read write and read P4,and in Q5, it replace the third buffer(P4), read write and read P3,and in Q6,it read P2 directly.so

For FIFO, it only change one time but for MRU it needs to change two times.

3.(2)

Data pages :P1,P2,P3,P4

Queries

Q1:read P1; Q2:read P2; Q3:read P3; Q4:read P2; Q5:read P1;Q6:read P4; Q7:read P3; Q8:read P2;Q9:read P1;

Buffer:

P1	P2	P3

For LRU,to the Q6,it replace buffer(P3), read write and read P4 ,to the Q7, it replace buffer(P2), read write and read P3, ,to the Q8, ,it replace buffer(P1), read write and read P2, ,to the Q9 ,it replace buffer(P4), read write and read P1,it change four times

But for FIFO to the Q6, ,it replace buffer(P1), read write and read P4,to theQ9, it replace buffer(P2),,it replace buffer(P2), read write and read P1,it only change two times.