Question 1:

1. Since D->CJ, by augmentation and reflexivity, BD->BC;
   Since BD->BC and BC->DEG, by transitivity and reflexivity, BD->G.

2. T = Ø
   Find a super key X.
   Let X := {A,B,C,H,J}
   Try to remove A, {B,C,H,J}+={A,B,C,D,E,G,H,I,J}
   Thus, X := {BCHJ}
   Try to remove B, {C,H,J}+={C,H,J}
   Thus, B cannot be removed.
   Try to remove C, {B,H,J}+={B,H,J}
   Thus, C cannot be removed.
   Try to remove H, {B,C,J}+={B,C,D,E,G,J}
   Thus, H cannot be removed.
   Try to remove J, {B,C,H}+={A,B,C,D,E,G,H,I,J}
   So {B,C,H} is a candidate key and add to T.

   Find another super key X.
   Let X := {A,D,H}
   Try to remove A, {D,H}+={A,B,C,D,E,G,H,I,J}
   Thus, X:= {D,H}
   Try to remove D, {H}+={H}.
   Thus, D cannot be removed.
   Try to remove H, {D}+={C,D,J}
   Thus, H cannot be removed.
   So {D,H} is a candidate key and add to T.

   Cannot find other super keys that does not contain any candidate key in T.
   So candidate keys are {B,C,H}, {D,H}.

3. 1NF since it only contains atomic attribute values.
   Not in 2NF since D->J violates 2NF, the non-prime attribute J is partially dependent on key {D,H}.

4. Reduce right side.
   F'={A->E, A->I, BC->D, BC->E, BC->G, CEH->G,CEH->J, D->C, D->J, DHJ->A, DHJ->B}
   Reduce left side.
   BC->D,
   B+={B}, thus B->D is not inferred by F'.
   Hence, BC->D cannot be replaced by B->D.
   C+={C}, thus C->D is not inferred by F'.
   Hence, BC->D cannot be replaced by C->D.
   Similar for BC->E and BC->G.
   CEH->G,
   CE+={CE}, thus, CE->G is not inferred by F'.
   Hence, CEH->G cannot be replaced by CE->G.

CH+={CH}, thus, CH->G is not inferred by F'.
Hence, CEH->G cannot be replaced by CH->G.
EH+={EH}, thus, EH->G is not inferred by F'.
Hence, CEH->G cannot be replaced by EH->G.
Similar for CEH->J
DHJ->A,
DH+={ABCDEGHIJ}, DH->A can be inferred by F'
Hence, DHJ->A can be replaced by DH->A.
Similar for DH->B.
F''={A->E, A->I, BC->D, BC->E, BC->G, CEH->G,CEH->J, D->C, D->J, DH->A, DH->B}
no FD can be removed anymore.
Thus, Fmin={A->EI, BC->DEG, CEH->GJ, D->CJ, DH->AB}

5. Not lossless since there's no row contains a entirely.

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

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

6. A->EI violates BCNF, decompose R into R1(A,E,I), R2(A,B,C,D,G,H,J).
D->CJ violates BCNF, decompose R2 into R21(D,C,J), R22(A,B,D,G,H).
BD->G violates BCNF, decompose R22 into R221(B,D,G), R222(A,B,D,H).

R can be decomposed into R1(A,E,I), R21(D,C,J), R221(B,D,G) and R222(A,B,D,H).

Question 2:

1.

Attempts	Frame1	Frame2	Frame3	Frame4	Hits
1	1				0
2	1	2			0
3	1	2	3		0
4	1	2	3	4	0
5	1	2	3	4	1
6	1	2	3	4	2
7	5	2	3	4	2
8	5	2	3	4	3
9	5	2	3	4	4
10	5	6	3	4	4
11	5	6	7	4	4
12	5	6	7	4	5
13	5	6	7	2	5
14	1	6	7	2	5

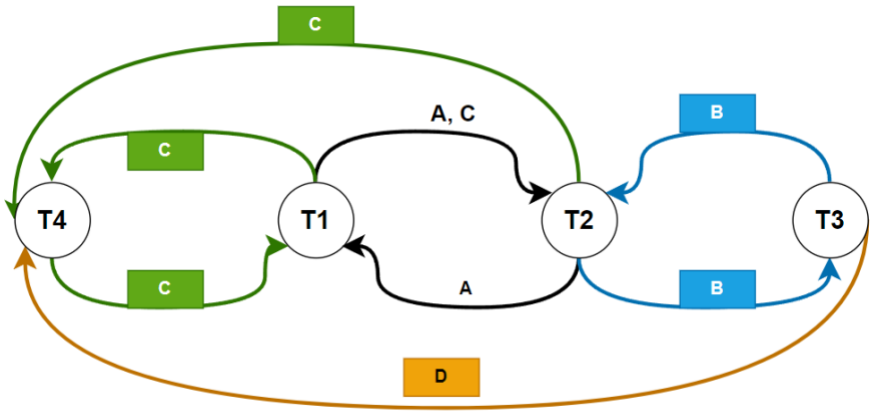
2.

Attempts	Frame1	Frame2	Frame3	Frame4	Hits
1	1				0
2	1	2			0
3	1	2	3		0
4	1	2	3	4	0
5	1	2	3	4	1
6	1	2	3	4	2
7	1	5	3	4	2
8	1	5	3	2	2
9	1	5	3	2	3
10	6	5	3	2	3
12	6	7	3	2	3
12	6	7	3	5	3
13	6	7	2	5	3
14	1	7	2	5	3

3. FIFO is better since it has less page fault.

Question3:

1. T2 redo. T1, T3, T4 undo.
2. Not conflict serializable



3. Deadlock on A and C between T1 and T2.

	t1	t2	t3	t4	t5	t6	t7	t8	t9	t10	t11	t12	t13	t14	t15	t16	t17	t18	t19
T1			WL(A)	R(A)					WL(C)	W(C)	R(A)	W(A)	UL(A)	UL(C)					
T2	WL(B)	R(B)			RL(C)	R(C)	WL(A)	W(A)							UL(C)	UL(A)	UL(B)		
T3																		...	
T4																			...