TRANSACTION THEORY

Student name : Shruthi Shashidhara Shastry

Student ID : 33684669

Applied class : A01 Wednesday 8:00 am G16 room

a) **Write through database**:

From the diagram we can observe the following details :

1) Transactions T3 and T6 were initiated before the checkpoint and successfully committed before the checkpoint occurred. Therefore, no further action is necessary for these transactions.
2) Transactions T1, T4, and T7 were initiated prior to the checkpoint but did not reach the commit. Therefore, these transactions require an undo or rollback process.
3) Transactions T9 and T11 were initiated after the checkpoint and never reached the commit . In such cases, an undo or rollback operation is needed.
4) Transactions T2, T5, and T8 started before the checkpoint and were successfully committed before the power outage or failure. Therefore, a roll-forward or redo procedure is essential for these transactions.
5) Transaction T10 began after the checkpoint and was successfully committed before the power outage or failure. As a result, a roll-forward or redo process is necessary for this transaction.

The Three stages of the recovery process are as follows:

Stage 1: Compiling REDO and UNDO Lists

During this stage, we identify the last checkpoint before the crash in the log file.

Two lists are constructed:

REDO list: Contains the transaction IDs of transactions that were committed.

UNDO list: Contains the transaction IDs of transactions that never committed.

1) Transactions T1, T4, and T7:

These transactions were initiated before the checkpoint but did not reach the commit point. They are included in the **UNDO** list.

2) Transactions T9 and T11:

These transactions were initiated after the checkpoint and never reached the commit point. They are also included in the **UNDO** list.

3) Transactions T2, T5, and T8:

These transactions started before the checkpoint and were successfully committed before the power fail. They are included in the **REDO** list.

4) <u>Transaction T10</u>:

This transaction began after the checkpoint and was successfully committed before the power fail. It is also included in the **REDO** list.

Hence,

REDO List :

T2	T5	T8	T10

UNDO List :

T1	T4	T7	T9	T11

Stage 2: UNDO Operations (Rollback)

During this stage, **UNDO** operations are applied to transactions in the **UNDO** list, starting from the newest transactions.

UNDO List :

T11	T9	T7	T4	T1

Stage 3: REDO Operations (Rollforward)

During this stage, REDO operations to transactions in the REDO list needs to be done , starting from the oldest transactions.

REDO List :

T2	T5	T8	T10

After completing these three stages, the database should be restored to a consistent state based on the checkpoint, with all committed transactions reapplied (REDO) and incomplete or rolled-back transactions undone (UNDO).

b)

TIME	TRANS	ACTION	A	B	C	D	E	F	G	H
0	T1	Read A	S(T1)							
1	T2	Read B		S(T2)						
2	T1	Read C			S(T1)					
3	T4	Read D				S(T4)				
4	T5	Read A	S(T5)							
5	T2	Read E					S(T2)			
6	T2	Update E					X(T2)			
7	T3	Read F						S(T3)		
8	T2	Read F						S(T2)		
9	T5	Update A	T5 wait T1							
10	T1	Commit	X(T5)							
11	T6	Read A	T6 wait T5							
12	T5	Rollback	S(T6)							
13	T6	Read C			S(T6)					
14	T6	Update C			X(T6)					
15	T7	Read G							S(T7)	
16	T8	Read H								S(T8)
17	T9	Read G							S(T9)	
18	T9	Update G							T9 wait T7	
19	T8	Read E					T8 wait T2			
20	T7	Commit							X(T9)	
21	T9	Read H								S(T9)
22	T3	Read G							T3 wait T9	
23	T10	Read A	S(T10)							
24	T9	Update H								T9 wait T8
25	T6	Commit								
26	T11	Read C			S(T11)					
27	T12	Read D				S(T12)				
28	T12	Read C			S(T12)					
29	T2	Update F						T2 wait T3		
30	T11	Update C			T11 wait T12					
31	T12	Read A	S(T12)							
32	T10	Update A	T10 wait T12							
33	T12	Update D				T12 wait T4				
34	T4	Read G							T4 wait T3	

i)   **Item A :** T10 wait T12   **Item F :** T2 wait T3

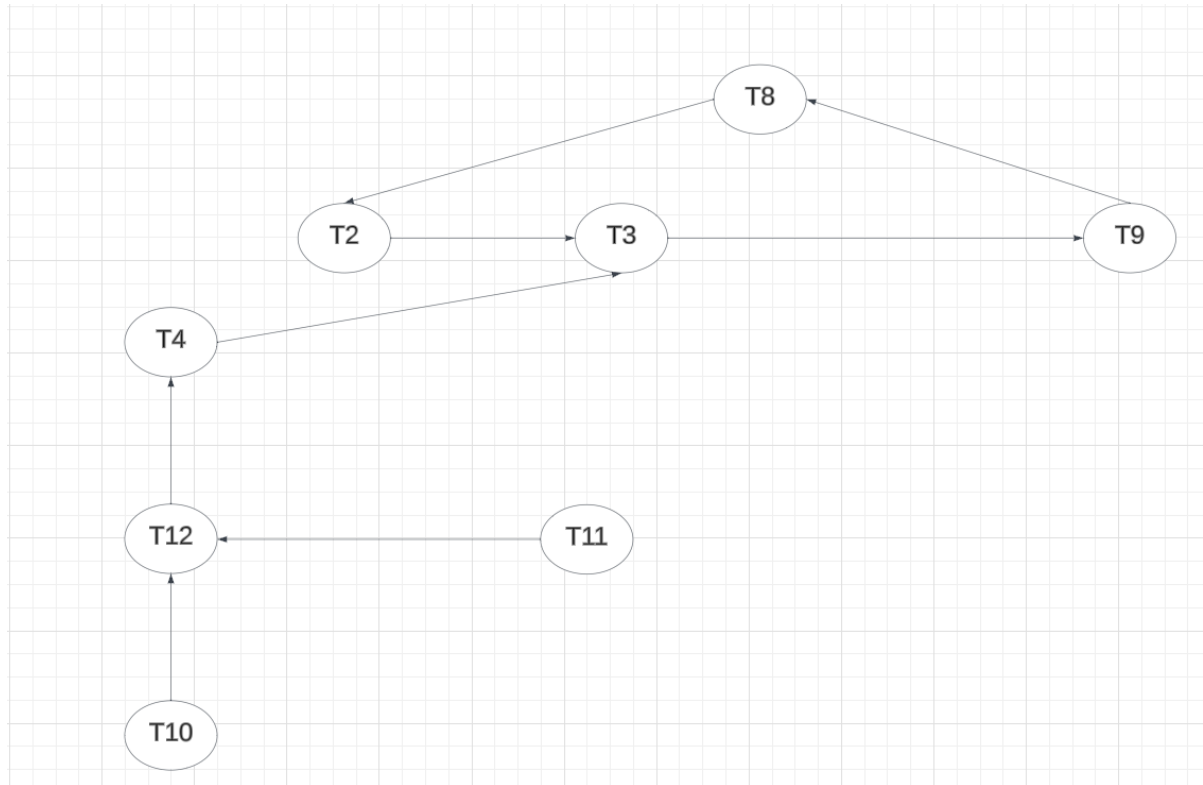**Item C :** T11 wait T12   **Item G :** T3 wait T9

Item D: T12 wait T4   **Item G :** T4 wait T3

Item E : T8 wait T2   **Item H** : T9 wait T8

ii)   **Wait for graph** indicating the state of waiting locks at time 34 is as follows:

iii)   Deadlock exists as T2 waits for T3 ,T3 wait for T9, T9 waits for T8 and T8 wait for T2 which results in a deadlock.
The transactions involved in Deadlock are **T9 , T8 , T3 and T2**.