Assignment 4: Concurrency and OLAP

Dennis Thinh Tan Nguyen, Nicklas Johansen, Pernille Lous,
Thor Valentin Aakjr Olesen, William Diedrichsen Marstrand

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1 Problem 1: Serializability and 2PL

1.1 Yes/No Questions

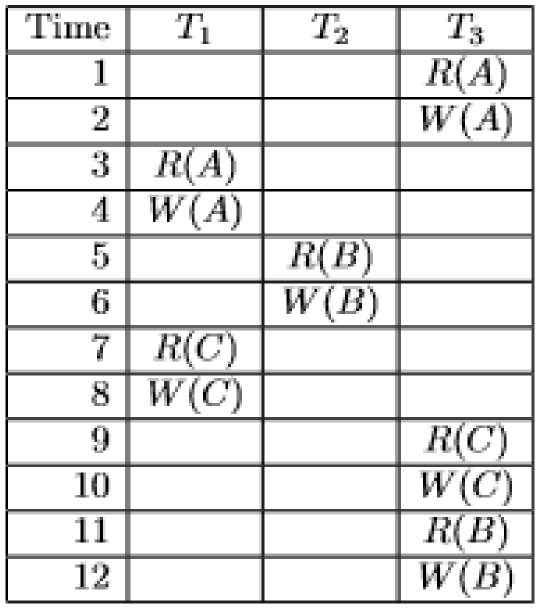
Questions

1. All serial transactions are both conict serializable and view serializable.
2. For any schedule, if it is view serializable, then it must be conict serializable.
3. Under 2PL protocol, there can be schedules that are not serial.
4. Any transaction produced by 2PL must be conict serializable.
5. Strict 2PL guarantees no deadlock.

Answers

1. Yes
2. No
3. Yes
4. No
5. No

1.2 Serializability



Time	T_1	T_2	T_3
1			$R(A)$
2			$W(A)$
3	$R(A)$		
4	$W(A)$		
5		$R(B)$	
6		$W(B)$	
7	$R(C)$		
8	$W(C)$		
9			$R(C)$
10			$W(C)$
11			$R(B)$
12			$W(B)$

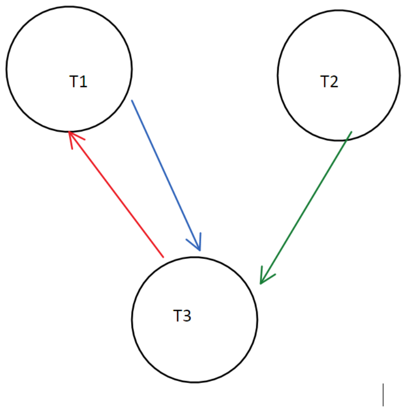
Figur 1: Serializability Schedule, S1

Questions and given schedule

1. Is this schedule serial?
2. Give the dependency graph of this schedule.
3. Is this schedule conict serializable?
4. If you answer yes to the previous question, provide the equivalent serial schedule. If you answer no, briey explain why.
5. Could this schedule have been produced by 2PL?

Answer 1 No, because transactions are strated before running transactions are completed. For instance transaction T_2 starts before T_1 has ended.

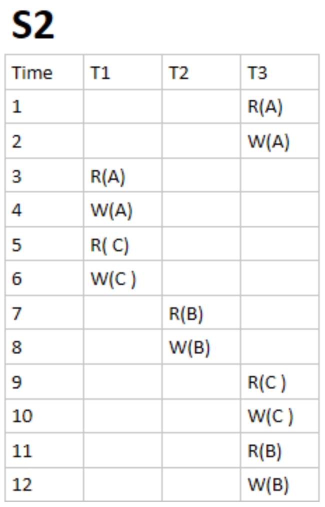
Answer 2



Answer 3 No, because a schedule is conflict serializable if and only if the graph is acyclic. However, the graph contains a cycle between T1 and T3.

Answer 4 Not answered since no was stated in the answer above.

Answer 5 Yes it could have been produced by 2PL, because it is View Serializable. It is View Serializable because it is View Equivalent to the following schedule *S2*:



S2

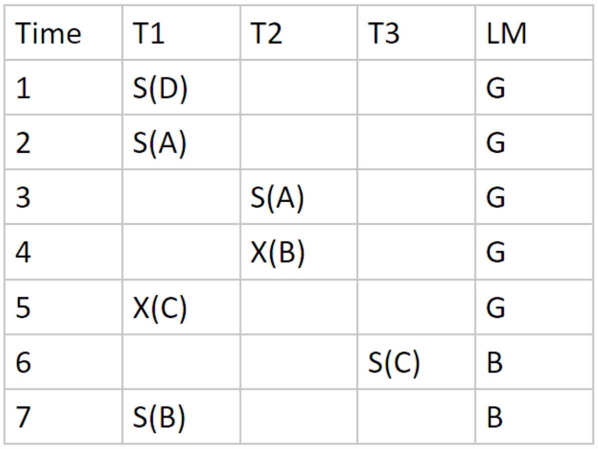
Time	T1	T2	T3
1			R(A)
2			W(A)
3	R(A)		
4	W(A)		
5	R(C)		
6	W(C)		
7		R(B)	
8		W(B)	
9			R(C)
10			W(C)
11			R(B)
12			W(B)

Figur 2: Serializability Schedule, S2

and as such it upholds the 2PL Protocol's guarantee of serializability.

2 Deadlock Detection

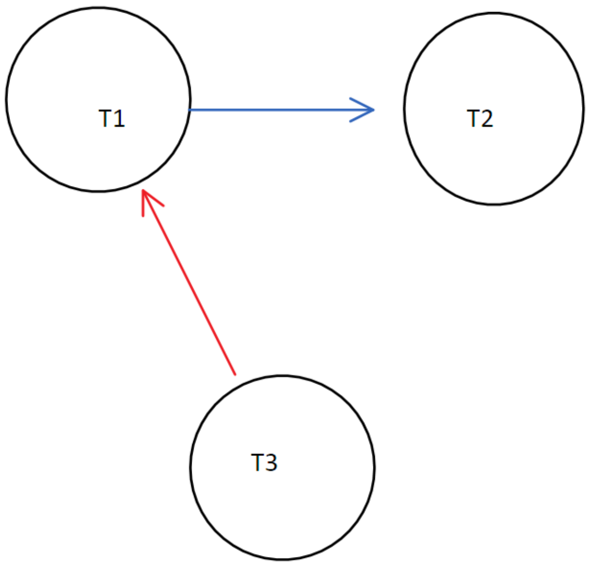
2.1 Determine which lock request will be granted, blocked by the lock manager (LM)



Time	T1	T2	T3	LM
1	S(D)			G
2	S(A)			G
3		S(A)		G
4		X(B)		G
5	X(C)			G
6			S(C)	B
7	S(B)			B

Figur 3: Table showing how LM is handling lock requests.

2.2 wait-for graph for the lock requests in the table in section 2.1 showed in Figur: 3



Figur 4:

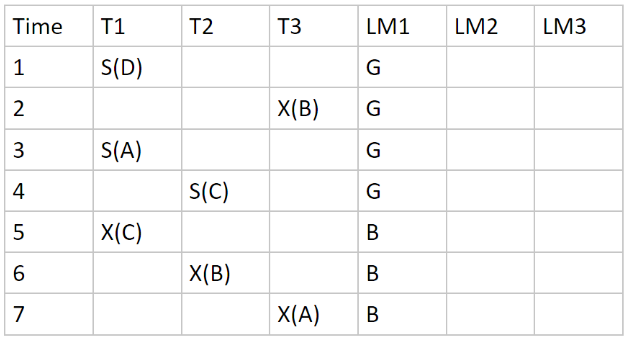
Figur 5: Wait-for graph of LM

2.3 Determine whether there exists a deadlock in the lock requests showed in the table in section 2.1 (Figur 3) and briefly explain why

There are no deadlock since the wait-for graph (Figur 5) is acyclic.

3 Deadlock prevention

3.1 Determine which lock request will be granted, blocked or aborted by the lock manager 1 (LM1)

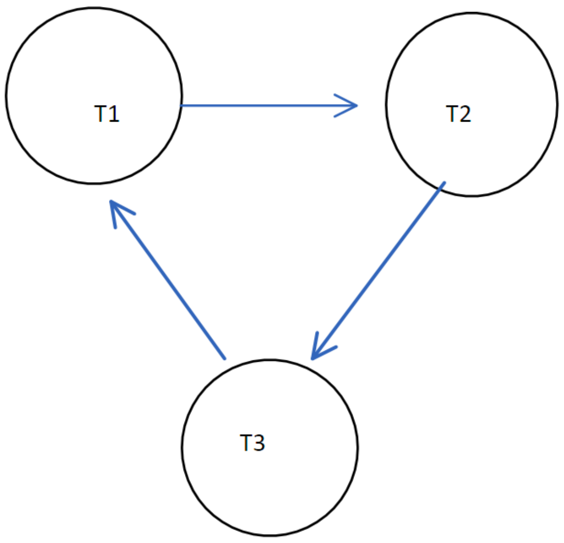


Time	T1	T2	T3	LM1	LM2	LM3
1	S(D)			G		
2			X(B)	G		
3	S(A)			G		
4		S(C)		G		
5	X(C)			B		
6		X(B)		B		
7			X(A)	B		

Figur 6: Table showing how LM1 is handling lock requests.

3.2 Give the wait-for graph for the lock request in the table (Figur 6). Give one reason why LM1 Results in a deadlock

Since the graph (Figur 8) contains a cycle in such a way that T1, T2, T3 is waiting for each other, this results in a deadlock



Figur 7:

Figur 8:

3.3 Deadlock prevention with LM2

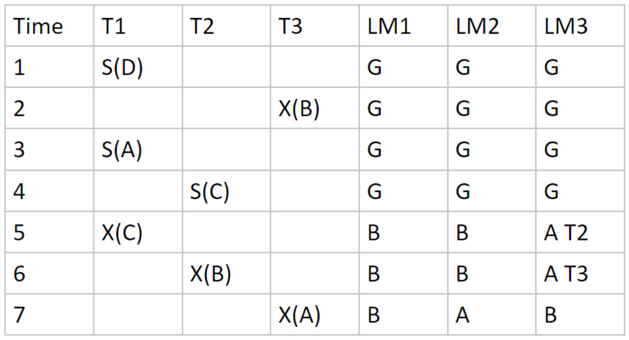
Please note that we have created a table (Figur 9) that illustrates the task of section 3.3 and section 3.4.

- **LM2 with Wait-Die policy.**
- S(D) on T1 is granted.
- X(B) on T3 is granted
- S(A) on T1 is granted
- S(C) on T2 is granted
- X(C) on T1 is blocked
- X(B) on T2 is blocked
- X(A) on T3 is aborted

3.4 Deadlock prevention with LM3

- **LM2 with Wound-wait policy.**
- S(D) on T1 is granted.
- X(B) on T3 is granted
- S(A) on T1 is granted
- S(C) on T2 is granted
- Abort S(C) on T2
- Abort X(B) on T3
- X(A) on T3 is blocked

Table depicting lock requst handling of LM1, LM2 and LM3 The table (Figur: 9) presentates how LM1, LM2 and LM3 handle locks differently. This table is created from the information based on section 3.1, section 3.3 and section 3.4.



Time	T1	T2	T3	LM1	LM2	LM3
1	S(D)			G	G	G
2			X(B)	G	G	G
3	S(A)			G	G	G
4		S(C)		G	G	G
5	X(C)			B	B	A T2
6		X(B)		B	B	A T3
7			X(A)	B	A	B

Figur 9: This is table is a visualization on LM1, LM2 and LM3.