Tutorial 10: Concurrency Control

CS3402 Database Systems

Question 1

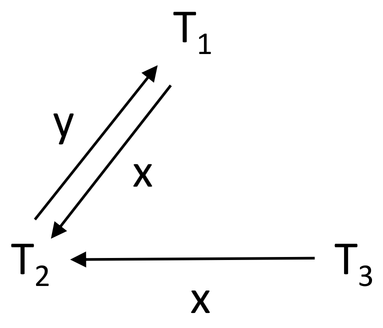
- Consider the following arrival order of operations to the scheduler. (a) If the scheduler adopts a serial execution method for concurrency control, define the serial schedule if the arrival order of operations remains the same as those shown in the table. (b) If the scheduler uses strict two-phase locking to schedule the operations, modify the above table to show the new schedule.

T_1	T_2	T_3
	write(x)	
read(y)		
	read(z)	
		read(x)
	write(y)	
write(x)		
	read(x)	
	commit	
		write(z)
commit		
		commit

Question 1 (Answer)

- (a) If the serial execution method for concurrency control is used, the serial schedule is : T_2, T_1, T_3
- (b) If the strict two-phase locking is used to schedule the operations

T_1	**T_2**	**T_3**
	write_lock(x); write(x)	
read_lock(y); read(y)		
	read_lock(z); read(z)	
		read_lock(x); → blocked
	write_lock(y); → blocked	
write_lock(x); → blocked		



wait-for-graph

- There is a deadlock; (a cycle in the wait-for-graph: $T_2 \to T_1 \to T_2$)

Question 2

- Consider the following schedule at a single server system.

T_1	T_2
read(a)	
	read(a)
write(a)	
	write(a)

a) Add lock and unlock operations to the schedule if Conservative 2PL is adopted.

b) Add lock and unlock operations to the schedule if Strict 2PL is adopted.

c) Which one (S2PL or C2PL) will you choose for scheduling the two transactions?

Question 2(a) (Answer)

a) Add lock and unlock operations to the schedule if Conservative 2PL is adopted.

T_1	T_2
write_lock(a)	
read(a)	
write(a)	
unlock(a)	
	write_lock(a)
	read(a)
	write(a)
	unlock(a)

Question 2(b) (Answer)

b) Add lock and unlock operations to the schedule if Strict 2PL is adopted.

T_1	T_2
read_lock(a)	
read(a)	
	read_lock(a)
	read(a)
write_lock(a) → blocked	
	write_lock(a) → blocked

Question 2(c) (Answer)

c) Which one (S2PL or C2PL) will you choose for scheduling the two transactions?

C2PL since it does not have the deadlock problem and the transactions are short.

Question 3

- The following table shows the schedule for transactions T_1 and T_2 with T_1 having an "older" time-stamp than T_2.

T_1	**T_2**
read(a)	
	read(b)
write(b)	
	write(a)

a) Strict Two-Phase Locking is used for concurrency control. Define the wait-for-graph.

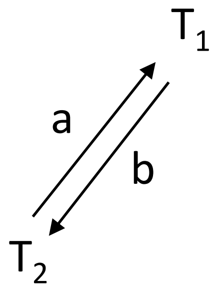
b) Show the new schedule if the wait-die method is used.

c) Show the new schedule if the wound-wait method is used.

Question 3(a) Answer

a) Strict Two-Phase Locking is used for concurrency control. Define the wait-for-graph at each server.

T_1	**T_2**
read_lock(a)	
read(a)	
	read_lock(b)
	read(b)
write_lock(b) → blocked	
	write_lock(a) → blocked



wait-for-graph

Question 3(b) Answer

b) Show the new schedule if the wait-die method is used.

- Wait-die: If $TS(T_i) < TS(T_j)$, T_i waits else T_i dies
- Thus, write(a) from T_2 will make it to abort and release the read lock on data item b.
- Thus, the final schedule will be T_1 and then T_2.

T_1	**T_2**
read_lock(a); read(a);	
	read_lock(b); read(b);
write_lock(b) → blocked	
	write_lock(a) → restarts because it is younger than T_1 and T_2 releases its read lock on b before it restarts
write(b);	
release_lock(T_1);	
	read_lock(b); read(b);
	write_lock(a); write(a);
	release_lock(T_2);

Question 3(c) Answer

c) Show the new schedule if the wound-wait method is used.

- Wound-wait: If $TS(T_i) < TS(T_j)$, T_i wounds else T_i waits
- When the write(b) from T_1 arrives, T_2 is aborted.
- Thus, the final schedule will also be T_1 and then T_2.

T_1	**T_2**
read_lock(a); read(a);	
	read_lock(b); read(b);
write_lock(b); write(b); (TT_2 is restarted by T_1 because T_2 is younger than T_1. The write lock on b is granted to T_1 after T_2 has released its read lock on b)	
release_lock(T_1);	
	read_lock(b); read(b);
	write_lock(a); write(a);
	release_lock(T_2);