COMP 3311: Database Management Systems

Lecture 20 Exercises
Concurrency Control: Lock-based Protocols

Exercise 1: a) Is the schedule conflict serializable? □ Yes □ No

If yes, give the equivalent serial schedule: ____

b) Rewrite the schedule according to strict 2PL by adding a lock-s() before reading a data item, a lock-x() before writing a data item and an unlock() after all read/write operations have completed. Is the schedule deadlock free? □ Yes □ No →Show where the deadlock occurs.

T_1	T_2	T_3
read(X)		
	read(Y)	
	write(Y)	
		write(Z)
write(X)		
	read(X)	
	write(X)	
		read(Y)
		write(Y)
write(Z)		

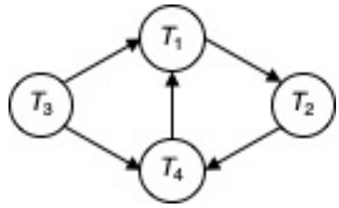
Exercise 2: Which of the following statements is true about the wait-for graph (circle the correct answer)?

a) T_4 is waiting for T_3 to release a data item.

b) The system is in a deadlock state after removing the edge between T_2 and T_4.

c) The system is in a deadlock state after removing the edge between T_3 and T_4.

d) The system is in a deadlock state when T_1 no longer holds a data item needed by T_4.



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Exercise 3: Rewrite the following schedule according to 2PL by adding a lock-s() before reading a data item, a lock-x() before writing a data item and unlock() as necessary.

Is the schedule serializable? □ Yes □ No →Show where the deadlock occurs.

T_1	T_2	T_3
read(X)		
	read(X)	
		read(Y)
read(Z)		
	read(Y)	
	write(X)	
		read(X)
		write(X)
write(Z)		

Exercise 4: In which positions, A to E, can an unlock(X) instruction be inserted if the schedule is according to:

a) strict 2PL (circle the correct answer)

i. {A} {B} {C} {D}

ii. {A} {B} {C} {D} {E}

iii. {A} {C} {D}

iv. {B} {E}

v. {A} {C} {D} {E}

b) rigorous 2PL (circle the correct answer)

i. {A} {B} {C} {D}

ii. {A} {B} {C} {D} {E}

iii. {A} {C} {D}

iv. {B} {E}

v. {A} {C} {D} {E}

T_1	T_2
lock-s(X)	
read(X)	
	lock-s(X)
lock-x(Y)	
{A}	
read(Y)	
write(Y)	
	read(X)
	{C}
commit	
unlock(Y)	
{B}	
	{D}
	commit
	{E}

You must upload this completed exercise sheet to Canvas by **11 p.m. today.**

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Exercise 5: Consider the schedule shown below.

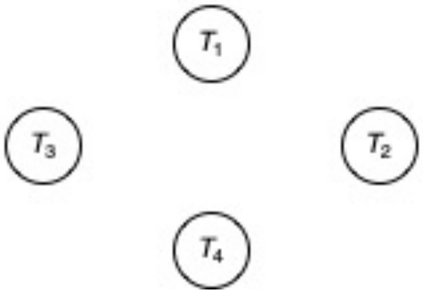
a) Is the schedule conflict serializable? □ Yes □ No

If yes, give the equivalent serial schedule __________________

b) If T_3 aborts after write(Y), which other transactions will be rolled back? ________________

c) If T_1 aborts after write(X), which other transactions will be rolled back? ________________

d) Construct the wait-for graph that results from this schedule if all locks are only exclusive-locks (lock-x), no locks are released, and the execution process runs to the point of lock-x(Y) in T_1.



Wait-for Graph

e) Add lock-s(), lock-x() and unlock() instructions to the schedule according to strict 2PL.

T_1	T_2	T_3	T_4
read(X)			
write(X)			
	read(X)		
		read(Y)	
		write(Y)	
	write(X)		
			read(Y)
write(Y)			

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