CS 186 Spring 2024 | Introduction to Database Systems Lakshya Jain | DIS 8

1 Conflict Serializability

T1		R(A)	W(A)	R(B)					
T2					W(B)	R(C)	W(C)	W(A)	
T3	R(C)								W(D)

(a) Draw the dependency graph (precedence graph) for the schedule. Assume all transactions commit at the end of the schedule.

(b) Is this schedule conflict serializable? If so, what are all the conflict equivalent serial schedules? If not, why not?

T1	R(A)		R(B)				W(A)	
T2		R(A)		R(B)				W(B)
T3					R(A)			
T4						R(B)		

(c) Draw the dependency graph (precedence graph) for the schedule.

(d) Is this schedule conflict serializable? If so, what are all the conflict equivalent serial schedules? If not, why not?

2 Deadlocks

T1	S(A)	S(D)		S(B)					
T2			X(B)				X(C)		
T3					S(D)	S(C)			X(A)
T4								X(B)	

(a) Draw a "waits-for" graph at the end of the schedule and state whether or not there is a deadlock. Assume all transactions attempt to commit at the end of the schedule.

(b) If we try to avoid deadlock by using wait-die deadlock avoidance policy, would any transactions be aborted? Assume T1 priority > T2 > T3 > T4.

3 Locking

T1	T2
Lock_X(B)	
Read(B)	
B := B * 10	
Write(B)	
Lock_X(F)	
Unlock(B)	
	Lock_S(F)
F := B * 100	
Write(F)	
Commit	
Unlock(F)	
	Read(F)
	Unlock(F)
	Lock_S(B)
	Read(B)
	Print(F + B)
	Commit
	Unlock(B)

(a) What is printed, assuming we initially have B = 3 and F = 300?

(b) Does the execution use 2PL or strict 2PL?

(c) Would moving Unlock(F) in the second transaction to any point after Lock_S(B) change this (or keep it) in 2PL?

(d) Would moving Unlock(F) in the first transaction and Unlock(F) in the second transaction to the end of their respective transactions change this (or keep it) in strict 2PL?

(e) Would moving Unlock(B) in the first transaction and Unlock(F) in the second transaction to the end of their respective transactions change this (or keep it) in strict 2PL?

4 Multigranularity Locking

(a) Suppose a transaction T1 wants to scan a table R and update a few of its tuples. What kinds of locks should T1 have on R, the pages of R, and the updated tuples?

(b) Is an S lock compatible with an IX lock?

(c) Consider a table which contains two pages with three tuples each, with Page 1 containing Tuples 1, 2, and 3, and Page 2 containing Tuples 4, 5, and 6.

i. Given that a transaction T1 has an IX lock on the table, an IX lock on Page 1, and an X lock on Tuple 1, which locks could be granted to a second transaction T2 for Tuple 2?

ii. Given that a transaction T1 has an IS lock on the table and an S lock on Page 1, what locks could be granted to a second transaction T2 for Page 1?