The University of Melbourne
School of Computing and Information Systems
COMP90020 Distributed Algorithms

Tutorial Week 9: Transactions and Concurrency Control

Notes

Exercises

42. A server manages the objects $a_1, a_2, ..., a_n$. The server provides two operations for its clients:

- $read(i)$: returns the v of a_i
- $write(i, v)$: assigns v to a_i

The transactions T and U are defined as follows:

- $T : x = read(j); y = read(i); write(j, 44); write(i, 33);$
- $U : x = read(k); write(i, 55); y = read(j); write(k, 66).$

(a) Give serially equivalent interleavings of T and U that are strict

(b) Give serially equivalent interleavings of T and U that are not strict but **could not produce** cascading aborts

(c) Give serially equivalent interleavings of T and U that **could produce** cascading aborts

43. The transfer transactions of T and U are defined as:

- $T : a.withdraw(4); b.deposit(4);$
- $U : c.withdraw(3); b.deposit(3);$

Suppose that they are structured as a pair of nested transactions

- $T_1 : a.withdraw(4); T_2 : b.deposit(4);$
- $U_1 : c.withdraw(3); U_2 : b.deposit(3);$

(a) Compare the number of serially equivalent interleavings of T_1, T_2, U_1, U_2 with the number of serially equivalent interleavings of T and U.

(b) Explain why the use of these nested transactions generally permits a larger number of serially equivalent interleavings than non-nested ones.

44. Consider the recovery aspects of the nested transactions defined in the exercise above, assume that a withdraw operation will abort if the account will be overdrawn and that in this case the parent will also abort.

(a) Describe serially equivalent interleavings of T_1, T_2, U_1, U_2 that are strict

(b) Describe serially equivalent interleavings of T_1, T_2, U_1, U_2 that are not strict

(c) To what extent does the criterion of strictness reduce the potential concurrency gain of nested transactions?

45. The transactions T and U are defined as follows:

- $T : x = read(i); write(j, 44);$
- $U : write(i, 55); write(j, 66);$

Initial values $a_i = 10, a_j = 20$. Which of the following interleavings are serially equivalent, and which could occur with two-phase locking?

(a)

T	U
x= read (i);	
	write(i, 55);
write(j, 44);	
	write(j, 66);

(b)

T	U
x= read (i);	
write(j, 44);	
	write(i, 55);
	write(j, 66);

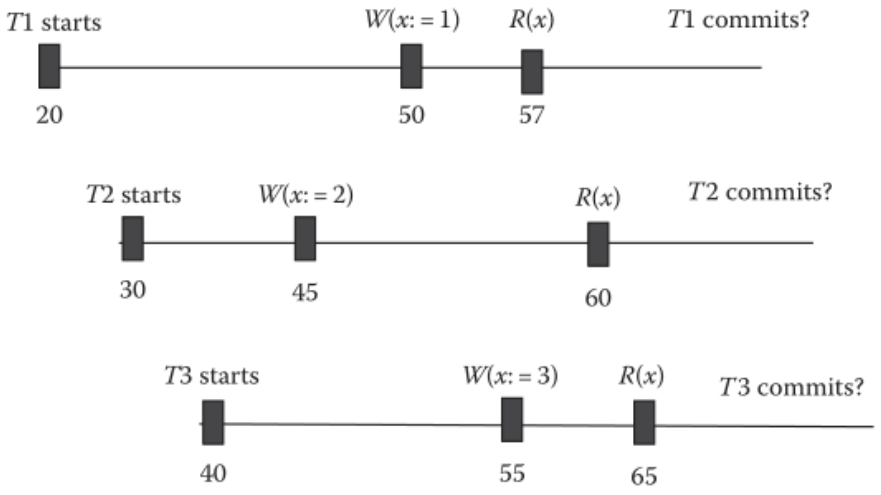
(c)

T	U
	write(i, 55);
	write(j, 66);
x= read (i);	
write(j, 44);	

(d)

T	U
	write(i, 55);
x= read (i);	
	write(j, 66);
write(j, 44);	

46. Consider three concurrent transactions below



Consider concurrency control by timestamp ordering. Which of these three concurrent transactions will commit?