



Exercises
Distributed Systemes: Part 2
Summerterm 2012
29.6.2012

5. Exercise sheet: Distributed Concurrency Control and Recovery

Exercise 1

Assume a given set of transactions and let SR be the set of all serializable schedules on a centralized database. Let $2PL$ (TS) be the set of all schedules when applying a 2-phase locking (time stamp protocol). Which of the following statements are correct? Give proofs or counterexamples.

- $SR = TS$
- $SR = 2PL$
- $SR = 2PL \cup TS$
- $2PL = TS$
- $2PL \subseteq TS$
- $TS \subseteq 2PL$
- $TS \cap 2PL = \emptyset$

Exercise 2

Prove that distributed 2PL guarantees serializability.

Exercise 3

Consider the following local schedules:

- $S_1 : R_1A \ W_1A \ R_2A \ W_2A$
 $S_2 : R_2B \ W_2B \ R_1B \ W_1B$
- $S_1 : R_1A \ W_2A$
 $S_2 : R_3B \ W_1B \ R_2C \ W_3C$
- $S_1 : R_1A \ R_3A \ R_3B \ W_3A \ W_3B \ R_2B$
 $S_2 : R_4D \ W_4D \ R_1D \ R_2C \ R_4C \ W_4C$
- $S_1 : W_1A \ c_1 \ R_3A \ R_3B \ c_3 \ W_2B \ c_2$
 $S_2 : W_2C \ c_2 \ R_4C \ R_4D \ c_4 \ W_1D \ c_1$

- (1) Verify whether or not the schedules are serializable.
- (2) Demonstrate that by applying Distributed 2PL (Timestamp Protocol) the not serializable schedules could not have occurred.
- (3) Check whether or not the schedules are rigorous and commit-deferred.
- (4) Demonstrate that by applying a Ticket-based concurrency control the not serializable schedules could not have occurred.

Exercise 4

- (1) Give the communication topology of centralized, decentralized and linear 2PC.
- (2) Give the state diagrams of decentralized and linear 2PC, in analogy to the state diagram of centralized 2PC.

Exercise 5

Characterize centralized 2PC and linear 2PC with respect to

- (1) message and time complexity,
- (2) possibilities of processes to become uncertain.