Universität Freiburg
Institut für Informatik
Dr.-Ing. Thomas Hornung

Georges-Köhler Allee, Geb. 51
D-79110 Freiburg
hornungt@informatik.uni-freiburg.de

Exercises
Distributed Systemes: Part 2
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1. Exercise sheet: Refresh Concurrency Control and Recovery

Exercise 1
Consider the following schedules.

S_1: $R_3X\ R_2Y\ W_2Y\ R_1Y\ W_1Y\ R_2X\ W_2X\ R_1X\ W_1X\ W_3Z$.
S_2: $R_3X\ R_2Y\ W_2Y\ R_1Y\ W_1Y\ R_2X\ W_2X\ R_1X\ W_1X\ W_3Y$.
S_3: $R_1Y\ W_1Y\ R_2Y\ W_2Y\ R_2X\ W_2X\ R_3Z\ W_3X\ R_1X\ W_1X$.

For each schedule give its conflict graph. Which schedules are serializable, which are not?

Exercise 2
Assume on a database three transactions are being executed.

a) The transactions are of the form:
T_1 : RA WA
T_2 : RA WA
T_3 : RA WA

(i) How many serial schedules do exist for T_1, T_2, T_3? Give the reasons!

(ii) How many serializable schedules do exist for T_1, T_2, T_3, which are not serial ones? Give the reasons!

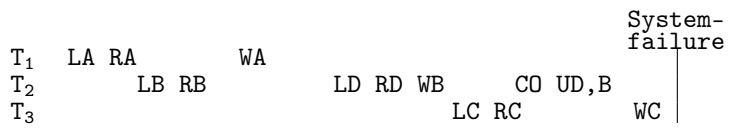
b) The transactions are of the form:
T_1 : RA WC
T_2 : RB WA
T_3 : RC WD

(i) How many schedules do exist for T_1, T_2, T_3, which are not serializable? Give the reasons!

(ii) Applying 2-phase-locking, is it possible that all serializable schedules of T_1, T_2, T_3 may occur? Give the reasons!

Exercise 3
(a) Give an example of three transactions, which obey 2PL and have the following properties: (i) When being executed a deadlock may occur. (ii) For each pair of the three transactions and for any execution of such a pair, no deadlock can occur.
(b) Make suggestions for deadlock-free variants of the 2PL-protocol.

Exercise 4
Consider the following schedule.



Assume that actions W_1A, W_2B are not materialized in the database, however action W_3C is.

(a) Give the state of the database, the systembuffer and the log file when the system failure occurs.

(b) Describe the operations done when executing the restart algorithm and give the resulting state of the database.