

Written Assignment #4

CAS CS 460: Introduction to Database Systems

Due Date and Time: 12/8, 11:59pm on gradescope.

Problem 1. [60 pts]

1. For each of the following schedules, draw the precedence graph and argue if the schedule is conflict serializable. If the schedule is conflict serializable, give one possible equivalent serial schedule. (R_i means transaction *i* reads an item and W_i writes an item.)
 - a) R₁(A); W₁(A); R₂(A); R₂(B); W₃(B); W₂(C); R₄(A); R₄(B); R₄(C); R₂(D); R₃(E); W₁(E);
 - b) R₁(A); R₄(A); W₁(A); W₃(B); R₂(A); R₂(B); R₄(B); R₄(C); R₂(D); R₃(E);
2. For the following two schedules, insert the appropriate locks (shared and exclusive) into the schedule following the Strict 2PL protocol. Also explain what happens as the scheduler executes each schedule. Note that, if a transaction blocks because of an operation, the transaction with the next operation in the schedule will continue. If you have a deadlock, you need to choose a transaction to abort, release its locks, and let the rest of the schedule continue. You need to restart the aborted transaction again at some point after it has been aborted. When a transaction unblocks, it resumes its operations. Write the *actual* executed schedule at the end. (R_i means transaction *i* reads an item and W_i writes an item.)
 - (a) R₁(A); R₂(B); R₃(C); W₁(B); W₂(C); W₃(D);
 - (b) R₁(A); R₂(B); R₃(C); R₁(B); R₂(C); R₃(A); W₁(A); W₂(B); W₃(D);

Problem 2. [40 pts]

Consider the log:

LSN	LOG
00	update: T1 writes P3
10	update: T1 writes P1
20	update: T1 writes P2
30	update: T2 writes P3
40	begin_checkpoint
45	end_checkpoint
50	update: T3 writes P4
60	T1 commit
70	update: T3 writes P2
80	T1 end
90	update: T2 writes P1
100	T2 commit
	CRASH, RESTART

In this log, we store information about 3 transactions. After the log record with LSN 100, the system crashes and then we restart. We use the ARIES recovery algorithm discussed in Chapter 18 in the book. Based on that, answer the following questions:

1. What is done during the Analysis phase?
2. What is done during the Redo phase?
3. What is done during the Undo phase?
4. Show the log when recovery is complete, including all non-null prevLSN and undonextLSN values in log records.

