CS4432: Database Systems II
Spring D-Term
Homework 4

Release Date: April 24, 2014

Due Date: May 1st, 2014 (11:59PM)

Total Points: 90
**Problem 1 (Precedence Graph) [30 Points]**

For each of the following schedules, answer the following:

Q1: Draw the precedence graph for the schedule.
Q2: Is the schedule conflict-serializable? If yes, write down a possible equivalent serial schedule. If not, explain why not.

**S1:** R1(A), R1(B), R2(A), W3(C), W2(B), W2(C), W1(C)

**S2:** w3(A), w2(C), r1(A), w1(B), r1(C), r2(A), r4(A), w4(D), r2(D)

**S3:**
Problem 2 (Locking Protocol) [20 Points]

Q1 [10 Points]: For each of the following schedules, state whether or not the schedule is legal, and discuss why.

*Remember: A schedule is legal iff:*
- No two transactions have a lock on the same object, and
- No transaction unlocks an object that it does own a lock for

S1 = l1(A) l1(B) r1(A) w1(B) l2(B) u1(A) u1(B) r2(B) w2(B) u2(B) l3(B) r3(B) u3(B)

S2 = l1(A) r1(A) w1(B) u1(A) u1(B) l2(B) r2(B) w2(B) l3(B) r3(B) u3(B)

Q2 [10 Points]: State whether or not Transaction 1 in each of the above schedules is *Well-Formed*. Discuss why?

Problem 3 (2 Phase Locking Protocol) [20 Points]

1. Does the following sequence of actions follow 2PL? (L denotes Lock, U denotes Unlock, R denotes Read, W denotes Write, O denotes Output. So L1(A) denotes that Transaction 1 gets lock for A. We do not show Input here, but instead assume that that will happen along with R or W).

   0. Start T1.
   1. L1(A)
   2. R1(A)
   3. W1(A)
   4. O1(A)
   5. Start T2.
   6. L2(C)
   7. L1(B)
   8. U1(A)
   9. L2(A)
   10. W1(B)
   11. Commit T1
   12. R2(A)
   13. W2(C)
   14. U1(B)
   15. Commit T2
   16. U2(A)
   17. U2(C)

2. Does the above schedule follow strict 2PL?
Problem 4 (Recovery Control) [20 Points]

The following is a sequence of undo-log records written by two transactions $T$ and $U$:

$<$Start $T$$>$;  $<$T, A, 10$>$;  $<$Start $U$$>$;  $<$U, B, 20$>$;  $<$T, C, 30$>$;  $<$U, D, 40$>$;  $<$Commit $U$$>$;
$<$T, E, 50$>$;  $<$Commit $T$$>$

Describe the action of the recovery manager, including the changes to both disk and the log if there is a crash and the last log record to appear on disk is:

(a) $<$ Start $U$$>$
(b) $<$Commit $U$$>$
(c) $<$T, E, 50$>$
(d) $<$Commit $T$$>$

What to Submit
- Include your answers in one file (.doc, .docx, or .pdf). This is the only file to submit.
- Include your name inside the file.

Where to Submit
- In WPI blackboard system

Late Submission Policy
- Follows the policy posted on the course website.