



Northeastern University
CS5200 – DBMS
Spring 2025
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Mar 27, 2025

Homework 6 Solution

Problem 1. *Consider the following schedule...*

$r_1(A), r_2(B), w_1(A), w_1(B), r_2(C), w_1(A), c_1, r_3(B), w_3(B), c_3, w_2(C), c_2$

Assume that all writes to A , B , and C prior to the operations above have already committed. Provide an answer, **with justification**, for each of the following questions.

- Is this schedule serial?
- Is this schedule conflict serializable?
- Is this schedule recoverable?
- Is this schedule cascadeless?

Problem 1. Solution

$T_1 : r_1(A), w_1(A), w_1(B), w_1(A), c_1$

$T_2 : r_2(B), r_2(C), w_2(C), c_2$

$T_3 : r_3(B), w_3(B), c_3$

- No.
 - Operations from T_1 , T_2 , and T_3 are interleaved, for example, T_2 read B after T_1 starts.
- Yes.
 - $r_2(B)$ read B before $w_1(B)$, $T_2 \rightarrow T_1$
 - $r_2(B)$ read B before $w_3(B)$, $T_2 \rightarrow T_3$
 - $w_1(B)$ before $r_3(B)$ and $w_3(B)$, $T_1 \rightarrow T_3$
 - $T_2 \rightarrow T_1 \rightarrow T_3$
- Yes.
 - T_2 reads B which was written by T_1
 - T_2 commits after T_1 , so it's correct
 - T_3 also reads from T_1 and commits after T_1
- No.
 - T_2 reads B written by T_1 before commits, so it's a dirty read

Problem 2. Consider the following transactions...

$$T_1 : r(B), r(A), w(A)$$

$$T_2 : r(B), w(B), r(A)$$

List **all** schedules that are conflict equivalent to serial schedule (T_2, T_1) .

Problem 2. Solution

$$r_2(B), w_2(B), r_2(A), r_1(B), r_1(A), w_1(A)$$

- The following schedules are conflict equivalent to the serial schedule (T_2, T_1) :
- $r_2(B), w_2(B), r_2(A), r_1(B), r_1(A), w_1(A)$
- $r_2(B), w_2(B), r_1(B), r_2(A), r_1(A), w_1(A)$
- These maintain the necessary conflict orderings:
- $w_2(B)$ before $r_1(B)$
- $r_2(A)$ before $w_1(A)$

Problem 3. Consider the following schedule...

$$r_3(C), r_1(A), w_3(C), r_2(A), r_1(C), r_2(B), w_2(B), r_1(B), w_1(A)$$

Answer each of the following questions.

- Construct a precedence graph for this schedule.
- Is this schedule conflict serializable? If so, list all conflict-equivalent serial schedule(s). If not, provide justification.

Problem 3. Solution

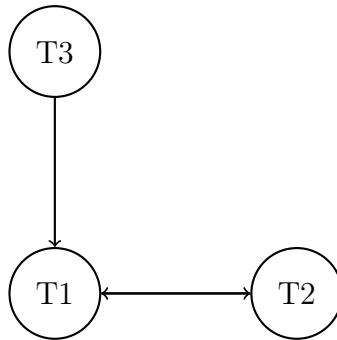
$$T_1 : r_1(A), r_1(C), r_1(B), w_1(A)$$

$$T_2 : r_2(A), r_2(B), w_2(B)$$

$$T_3 : r_3(C), w_3(C)$$

(a) Precedence Graph

- $T_3 \rightarrow T_1$: $w_3(C)$ occurs before $r_1(C)$ (write-read conflict on C)
- $T_2 \rightarrow T_1$: $r_2(A)$ before $w_1(A)$ (read-write conflict on A)
- $T_1 \rightarrow T_2$: $r_1(B)$ before $w_2(B)$ (read-write conflict on B)



(b) Is the schedule conflict serializable?

No, the schedule is not conflict serializable because the precedence graph contains a cycle:

$$T_2 \rightarrow T_1 \rightarrow T_2$$

This cycle implies that there is no equivalent serial schedule.