**Problem Set 5**

Problem 1

Consider the three schedules below. For each one, answer the following questions and provide detailed explanation or proof for your answer:

**Note**: “is this possible under a strict 2PL protocol” means does there exist a way to lock the items as needed, so that each transactions goes through a growing and a shrinking phase.

1. Is this schedule conflict-serializable?
2. Is this schedule recoverable if the transactions complete in the order specified?
3. Is this schedule cascadeless?
4. Is this schedule possible under a (non-strict) 2PL protocol?
5. Is this schedule possible under a strict 2PL protocol?
6. Is this schedule possible under a rigorous 2PL protocol

|  |  |  |
| --- | --- | --- |
| **T1** | **T2** | **T3** |
| R(A) |  |  |
|  | R(B) |  |
| W(C) |  |  |
|  |  | R(C) |
|  | W(B) |  |
| W(A) |  |  |
|  |  | R(B) |
| R(B) |  |  |
| commit |  | W(C) |
|  |  | commit |
|  | abort |  |

Table 1: Schedule 1

|  |  |
| --- | --- |
| **T1** | **T2** |
|  | R(A) |
| R(B) |  |
| R(A) |  |
| W(A) |  |
|  | R(C) |
| W(B) |  |
| commit | W(C) |
|  | commit |

Table 2 : Schedule 2

|  |  |  |
| --- | --- | --- |
| **T1** | **T2** | **T3** |
|  | R(A) |  |
| R(B) |  |  |
|  |  | R(C) |
| R(A) |  |  |
|  |  | R(B) |
| W(A) |  |  |
|  | R(C) |  |
|  |  | W(C) |
| W(B) |  |  |
| commit |  |  |
|  | W(C) |  |
|  | commit |  |
|  |  | R(A) |
|  |  | commit |

Table 3: Schedule 3

Problem 2

Consider the following schedule on five transactions, where lock-X() and lock-S() denote requests for exclusive and shared locks, respectively, Is the schedule deadlocked? Prove your answer. If it is deadlocked discuss one method to recover. If it is not deadlocked, how would you avoid a deadlock?

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| T1 | T2 | T3 | T4 | T5 |
| lock-S(A) |  |  |  |  |
|  |  | lock-S(C) |  |  |
|  | lock-X(B) |  |  |  |
|  |  |  | lock-X(D) |  |
|  |  |  |  | lock-S(E) |
| lock-S(E) |  |  |  |  |
|  |  | lock-S(G) |  |  |
|  | lock-S(A) |  |  |  |
|  |  |  |  | lock-X(C) |
|  |  |  | lock-S(C) |  |
|  | lock-X(G) |  |  |  |
| lock-S(D) |  |  |  |  |
|  |  |  |  | lock-S(B) |
|  |  |  | lock-X(B) |  |
|  |  | lock-S(A) |  |  |