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**CS5600 – 13892**

**Question 1. Transactions**

Let schedule S1 has T1, T2 and T3 are transactions

|  |  |  |
| --- | --- | --- |
| T1 | T2 | T3 |
| Read(Z)  Write(Y)  Read(X)  Commit | Read(X)  Write(X)  Read(Z)  Write(Z)  Commit | Read(X)  Write(X)  Read(Y)  Commit |

Let schedule S2 has T1, T2 and T3 are transactions

|  |  |  |
| --- | --- | --- |
| T1 | T2 | T3 |
| Read(Z)  Write(Y)  Read(X)  Commit | Read(X)  Write(X)  Read(Z)  Write(Z)  Commit | Read(X)  Write(X)  Read(Y)  Commit |

* 1. ) S1 is a conflict equivalent to S2 or not? And why? (3 points)

1.2) S1 is a view equivalent to S2 or not? And why? (3 points)

**Answers:**

Diagram

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**Question 2. Locking Protocol**

2.1 Let schedule S3 contains transaction T1 and T2.

|  |  |
| --- | --- |
| T1 | T2 |
| Lock-X(A)  Read(A)  A=A+100  Write(A)  Unlock(A)  Lock-X(B)  Read(B)  B=B-100  Write(B)  Commit  Unlock(B) | Lock-S(B)  Read(B)  Lock-S(A)  Read(A)  Unlock(B)  Commit  Unlock(A)  Display(A+B) |

2.1.1) The deadlock occurs in schedule S3 or not? And why? (3 points)

2.1.2) How to modify schedule S3 for guarantee about serializability (T1 followed by T2) (4 points)

**Answer**:

Text, letter

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2.2 Let schedule S4 contains transaction T1 and T2.

|  |  |
| --- | --- |
| T1 | T2 |
| Lock-X(A)  Read(A)  A=A+100  Write(A)      Lock-S(B)  Read(B)  Unlock(B)  Commit  Unlock(A) | Lock-S(B)  Read(B)  Lock-S(A)  Read(A)  Unlock(A)  Unlock(B)  Display(A+B)  Commit |

What kind of 2-Phase Locking Protocol in schedule S4? And why? – **Strict 2-phase Locking – holds all Lock-X until the transaction is committed /aborted – Lock-X(A) in T1 is unlocked after commit.**

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2.3 Granularity of locking: The corresponding tree is starting from the top level are

* Database
* Area
* File
* **A picture containing clock, different, various, variety

  Description automatically generated**Record.

Let T1 read Ra1, T2 write Rb1, T3 read Fa and write Ra2, T4 read Fb.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **DB** | **A1** | **Fa** | **Fb** | **Ra1** | **Ra2** | **Rb1** |
| **T1** | **IS** | **IS** | **IS** |  | **S** |  |  |
| **T2** | **IX** | **IX** |  | **IX** |  |  | **X** |
| **T3** | **SIX** | **SIX** | **SIX** |  |  | **X** |  |
| **T4** | **IS** | **IS** |  | **S** |  |  |  |

Complete the following table by filling in the appropriate lock mode. (4 points)

Diagram

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**Question 3. Timestamp-Based Protocol (5 points)**

Let schedule S5 contains transaction T1, T2 and T3 with initial timestamp 5, 8 and 7 respectively. The initial read timestamp(R-TS) for data items A, B and C = 0. The initial write timestamp(W-TS) for data items A, B and C = 0.

|  |  |  |
| --- | --- | --- |
| T1 | T2 | T3 |
| Read(A)  Write(A)    Read(B)  Write(B) | Read(C)  Write(C)  Read(A)  Read(B)  Write(A)  Display(A+B) | Write(C)  Read(A)  Write(A) |

3.1) What are the final R-TS and W-TS of data item A, B, and C? (3 points)

3.2) Which transaction(s) can commit, and which transaction(s) need to rollback or killed? (2 points)

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Text, letter

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