CSE 344 Introduction to Data Management

Section 9: Transactions

ACID Revisit

- Atomicity: Either all changes performed by transaction occur or none occurs

- Consistency: A transaction as a whole does not violate integrity constraints

- Isolation: Transactions appear to execute one after the other in sequence

- Durability: If a transaction commits, its changes will survive failures

Serializability

Serial Schedule

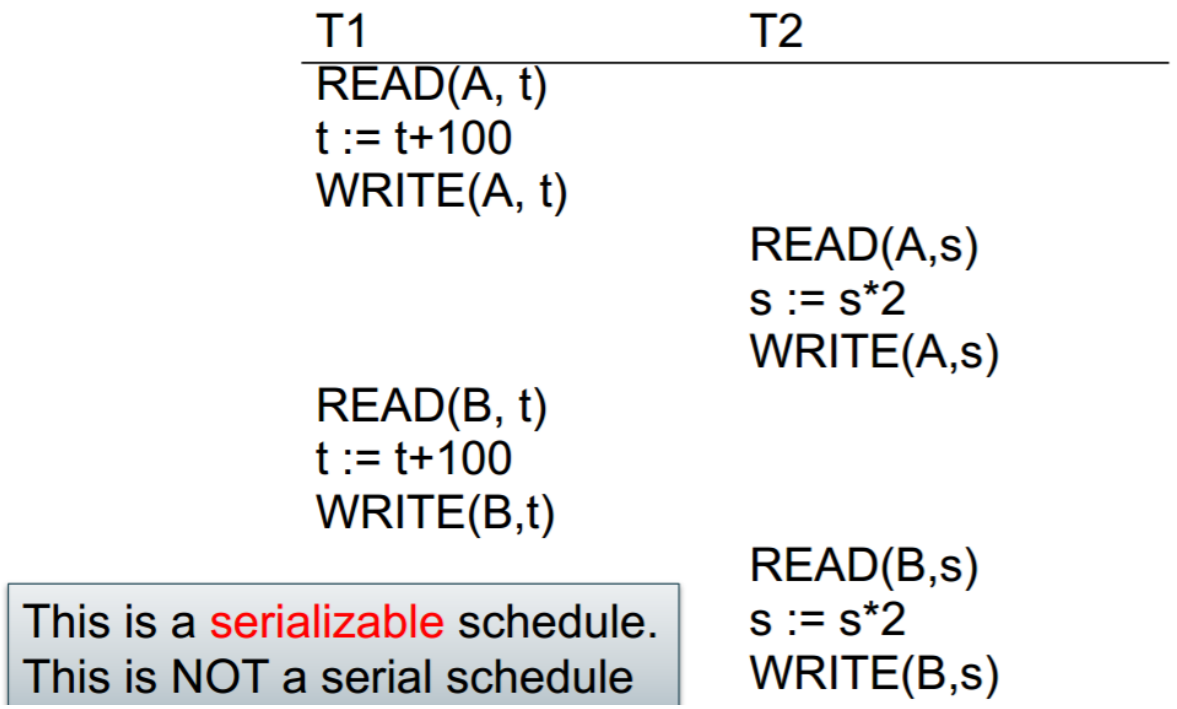
Transactions are executed one after the other, in some sequential order.

- Safe
- But inefficient!

T1	T2
READ(A, t)	
t := t+100	
WRITE(A, t)	
READ(B, t)	
t := t+100	
WRITE(B,t)	
	READ(A,s)
	s := s*2
	WRITE(A,s)
	READ(B,s)
	s := s*2
	WRITE(B,s)

Serializable Schedule

A schedule is serializable if it is equivalent to a serial schedule



Conflicts

Two actions by same transaction T_i: $r_i(X); w_i(Y)$

Two writes by T_i, T_j to same element $w_i(X); w_j(X)$

Read/write by T_i, T_j to same element $w_i(X); r_j(X)$

$r_i(X); w_j(X)$

Conflict-Serializable Schedule

if it has the *same conflicts* as a serial schedule

Testing for conflict-serializability

Precedence graph:

• A node for each transaction Ti ,

• An edge from Ti to Tj whenever an action in Ti conflicts with, and comes before an action in Tj

• The schedule is conflict-serializable iff the precedence graph is *acyclic*

Locking

- Two Phase Locking (2PL): In every transaction, all lock requests must precede all unlock requests

- Strict 2PL: All locks are held until the transaction commits or aborts.

Locking exercise

- L1(A), W1(A), U1(A), Co1
  - Is this schedule possible under 2PL?

L1(A), W1(A), R1(A), Co1, U1(A), L2(A), W2(A), Co2, U2(A)

  - Strict 2PL?

Possible under strict 2PL?

⇒ W1(A), R1(A), Co1, W2(A), Co2

Possible under strict 2PL?

L1(A), W1(A), W2(A), Co1, U1(A)

Possible under strict 2PL?

⇒ W1(A), W2(A), Co1

Possible under strict 2PL?

Worksheet