Administrivia

HW4 Wednesday
Project 2 due next Monday
Midterm 2 next Monday in class
Format
- cumulative
- question booklet + answer sheet
- 1 page cheat sheet

Conflict Serializability

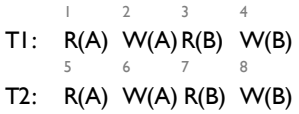
def: possible to swap non-conflicting operations to derive a serial schedule.

∀ conflicting operations O1 of T1, O2 of T2
- O1 always before O2 in the schedule or
- O2 always before O1 in the schedule

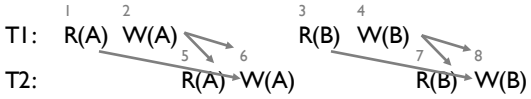
Logical

Conflicts
16, 25, 26, 38, 47, 48

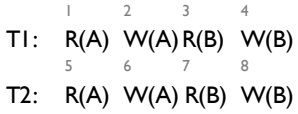
Logical



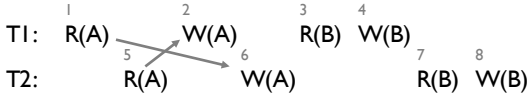
Serializable



Logical



Not Serializable



Conflict Serializability

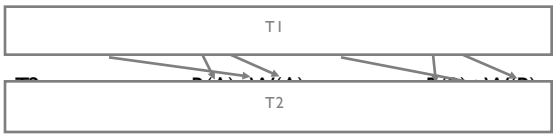
Transaction Precedence Graph
Edge Ti → Tj if:
1. Ti read/write A before Tj writes A or
2. Ti writes some A before Tj reads A

If graph is acyclic (does not contain cycles) then conflict serializable!

Logical

	1	2	3	4
T1:	R(A)	W(A)	R(B)	W(B)
	5	6	7	8
T2:	R(A)	W(A)	R(B)	W(B)

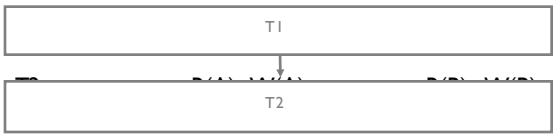
Serializable



Logical

	1	2	3	4
T1:	R(A)	W(A)	R(B)	W(B)
	5	6	7	8
T2:	R(A)	W(A)	R(B)	W(B)

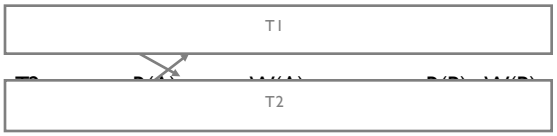
Serializable



Logical

	1	2	3	4
T1:	R(A)	W(A)	R(B)	W(B)
	5	6	7	8
T2:	R(A)	W(A)	R(B)	W(B)

Not Serializable



Fine, but what about COMMITing?

T1 R(A) W(A) R(B) ABORT
T2 R(A) COMMIT

Not recoverable

Promised T2 everything is OK. ITWAS A LIE.

T1 R(A) W(B) W(A) ABORT
T2 R(A) W(A)

Cascading Rollback.

T2 read uncommitted data → T1's abort undos T1's ops &T2's

How are these two anomalies different?

Lock-based Concurrency Control

Acquire shared(read) or exclusive(write) lock BEFORE operation
If other xact has lock, can get if lock table says so

YES

		T1	
	Allowed?	S	X
T2	S	Y	N
	X	N	N

Can this schedule happen?

T1 R(A) W(A) R(B) ABORT
T2 R(A) COMMIT

Lock-based Concurrency Control

Two-phase locking (2PL)
- Growing phase: acquire locks
- Shrinking phase: release locks

shrink here

T1 R(A) W(B) W(A) ABORT
T2 R(A) W(A)

Uh Oh, same problem

Lock-based Concurrency Control

Strict two-phase locking (Strict 2PL)

- Growing phase: acquire locks
- Shrinking phase: release locks
- Hold onto locks until commit/abort

Why? Which problem does it prevent?

T1	R(A)	W(B)	W(A)	ABORT
T2			R(A) W(A)	

Guarantees serializable schedules! Avoids cascading rollbacks!

Review

Issues

- TR: dirty reads
- RW: unrepeatable reads
- WW: lost writes

Schedules

- Equivalence
- Serial
- Serializable

Serializability

- Conflict serializability
- how to detect

Conflict Serializable Issues

- Not recoverable
- Cascading Rollback

Strict 2 phase locking