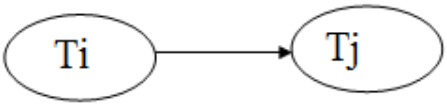
Testing of Serializability

Serialization Graph is used to test the Serializability of a schedule.

Assume a schedule S. For S, we construct a graph known as precedence graph. This graph has a pair G = (V, E), where V consists a set of vertices, and E consists a set of edges. The set of vertices is used to contain all the transactions participating in the schedule. The set of edges is used to contain all edges Ti ->Tj for which one of the three conditions holds:

1. Create a node Ti → Tj if Ti executes write (Q) before Tj executes read (Q).
2. Create a node Ti → Tj if Ti executes read (Q) before Tj executes write (Q).
3. Create a node Ti → Tj if Ti executes write (Q) before Tj executes write (Q).

Precedence graph for Schedule S



- If a precedence graph contains a single edge Ti → Tj, then all the instructions of Ti are executed before the first instruction of Tj is executed.
- If a precedence graph for schedule S contains a cycle, then S is non-serializable. If the precedence graph has no cycle, then S is known as serializable.

For example:

Time

T1	T2	T3
Read(A)		
	Read(B)	
$A := f_1(A)$		
		Read(C)
	$B := f_2(B)$	
	Write(B)	
		$C := f_3(C)$
		Write(C)
Write(A)		
		Read(B)
	Read(A)	
	$A := f_4(A)$	
Read(C)		
	Write(A)	
$C := f_5(C)$		
Write(C)		
		$B := f_6(B)$
		Write(B)

Schedule S1

Explanation:

Read(A): In T1, no subsequent writes to A, so no new edges

Read(B): In T2, no subsequent writes to B, so no new edges

Read(C): In T3, no subsequent writes to C, so no new edges

Write(B): B is subsequently read by T3, so add edge T2 → T3

Write(C): C is subsequently read by T1, so add edge T3 → T1

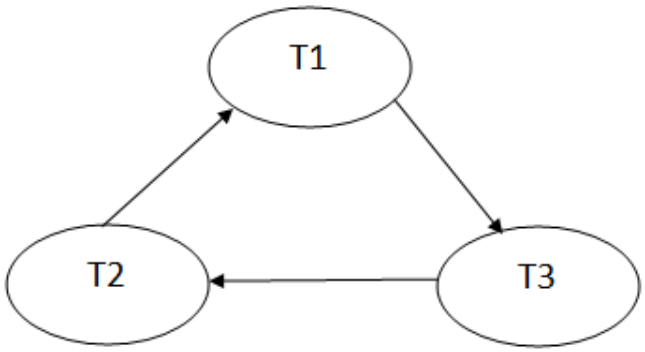
Write(A): A is subsequently read by T2, so add edge T1 → T2

Write(A): In T2, no subsequent reads to A, so no new edges

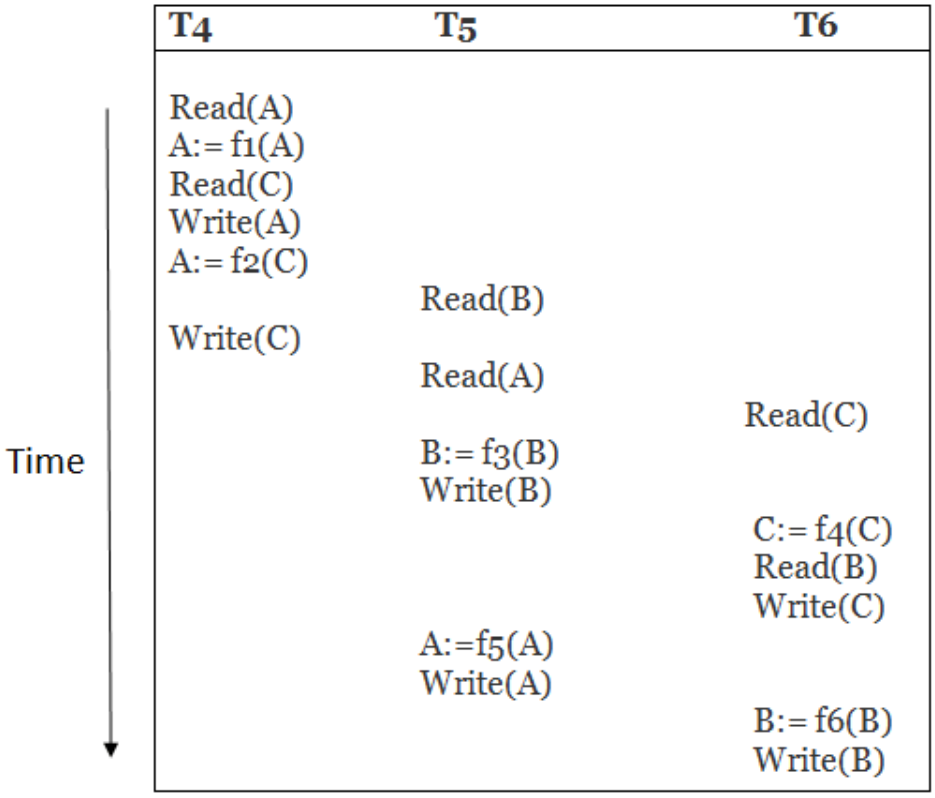
Write(C): In T1, no subsequent reads to C, so no new edges

Write(B): In T3, no subsequent reads to B, so no new edges

Precedence graph for schedule S1:



The precedence graph for schedule S1 contains a cycle that's why Schedule S1 is non-serializable.



Schedule S2

Explanation:

Read(A): In T4,no subsequent writes to A, so no new edges

Read(C): In T4, no subsequent writes to C, so no new edges

Write(A): A is subsequently read by T5, so add edge T4 → T5

Read(B): In T5,no subsequent writes to B, so no new edges

Write(C): C is subsequently read by T6, so add edge T4 → T6

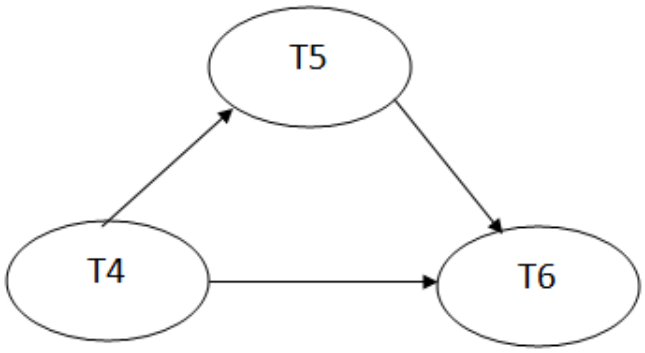
Write(B): A is subsequently read by T6, so add edge T5 → T6

Write(C): In T6, no subsequent reads to C, so no new edges

Write(A): In T5, no subsequent reads to A, so no new edges

Write(B): In T6, no subsequent reads to B, so no new edges

Precedence graph for schedule S2:



The precedence graph for schedule S2 contains no cycle that's why ScheduleS2 is serializable.

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