Serializability Summary

- As transactions execute concurrently, we must guarantee isolation, i.e., we only want to allow “good” schedules.
- “Good” schedules, or rather, schedules that guarantee isolation, means that the resulting schedules are equivalent to some serial schedule.
- Any schedule that is *conflict serializable* is equivalent to some serial schedule.
- Any schedule that is *view serializable* is equivalent to some serial schedule.
- Schedules exist which are neither view nor conflict serializable, but are equivalent to some serial schedule.
- Schedules exist which are view serializable but not conflict serializable.
- Concurrency control schemes/algorithms are required that ensure either conflict or view serializability.

Testing for View Serializability

- Let S be a schedule consisting of transactions $\{T_1, T_2, ..., T_n\}$.
- Construct a *labeled precedence graph* as follows.
- First, add two more "dummy" transactons T_b and T_f.
  - T_b issues **write**(Q) for each Q accessed in S.
  - T_f issues **read**(Q) for each Q accessed in S.
  - T_b is inserted at the beginning of S.
  - T_f is inserted at the end of S.

Testing for View Serializability, Cont.

1. Add an edge $T_i \xrightarrow{0} T_j$ if transaction T_j reads the value of data item Q written by transaction T_i.

2. Remove all the edges incident on useless transactions. A transaction T_i is useless if there exists no path, in the precedence graph, from T_i to transaction T_f.

3. For each data item Q such that T_j reads the value of Q written by T_i, and T_k executes **write**(Q) and $T_k \neq T_b$, do the following:

   a) If $T_i = T_b$ and $T_j \neq T_f$, then insert the edge $T_j \xrightarrow{0} T_k$ in the labeled precedence graph.

   b) If $T_i \neq T_b$ and $T_j = T_f$, then insert the edge $T_k \xrightarrow{0} T_i$ in the labeled precedence graph.

   c) If $T_i \neq T_b$ and $T_j \neq T_f$, then insert the pair of edges $T_k \xrightarrow{p} T_i$ and $T_j \xrightarrow{p} T_k$ in the labeled precedence graph where p is a unique integer larger than 0 that has not been used earlier for labeling edges.

Testing for View Serializability, Cont.

- Meaning of rules 3a-3c:

  - Rule 3a) ensures that if a transaction reads an initial value of Q in schedule S, then it also reads that same value in any view-equivalent schedule.

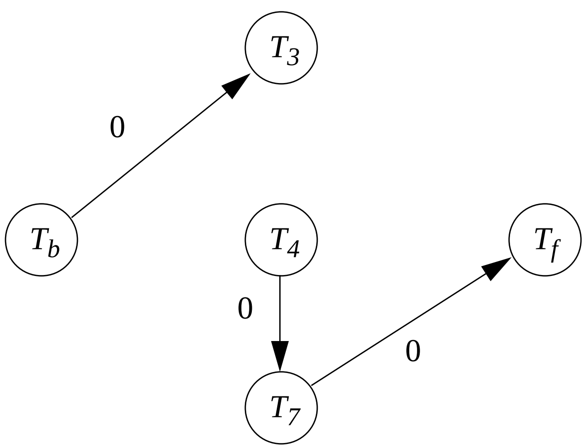
  - Rule 3b) ensures that if a transaction writes the final value of Q in schedule S, then it also writes that same value in any view-equivalent schedule.

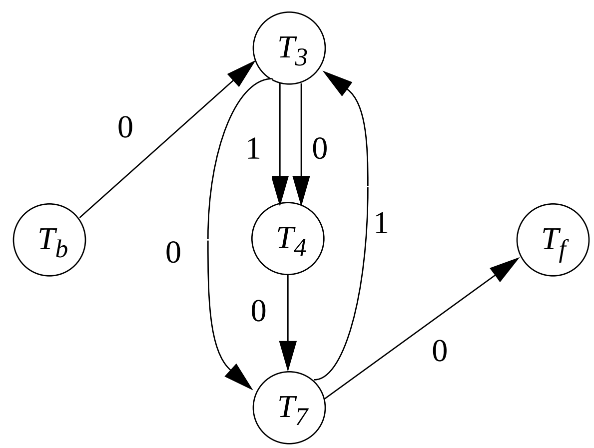
  - Rule 3c) ensures that if a transaction T_i writes a data item that T_j reads, then any transaction T_k that writes the same data item must either come before T_i or after T_j in any view-equivalent schedule.

Testing for View Serializability
Example #1

- Consider the following schedule:

T3	T4	T7
read(Q)		
	write(Q)	
		read(Q)
write(Q)		
		write(Q)





Testing for View Serializability - Example #2

- Consider the following schedule:

T3	T4	T7	T8	T9	T10
read(Q)					
	write(Q)			read(A)	
		read(Q)	write(A)		
write(Q)				write(A)	
		write(Q)			
			write(B)		
					read(A)
					write(A)