Database Homework 9

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14.3

Because database system might be maintaining important data like transaction records, funds, order history, etc. The break of any properties of `ACID` (Atomicity, Consistency, Isolation or Durability) would cause very serious consequences and great loss for users.

14.6

Yes. Because this graph is acyclic. A possible schedule order is T1, T2, T3, T4, T5.

14.12

- **Atomicity:** Make sure all operations of the transaction are properly reflected in the database, or none. This ensures that crucial transactions are not breakable and maintain the consistency.
- **Consistency:** The data should always be correct and logical. The copy of the same data should always be the same everywhere.
- **Isolation:** Multiple transactions may execute concurrently, but each transaction must be unaware of other transactions and operate properly.
- **Durability:** The change of a successful transaction should be persist, even the system concurred errors and fails. The change of an unsuccessful transaction should be properly rolled back, without causing data inconsistency.

14.13

- **Active:** The initial state, the transaction stays in this state while it is executing.
- **Partially committed:** After the final statement has been executed, but not committed yet.
- **Failed:** After the discovery of errors during the transaction. The execution can no longer proceed.
- **Aborted:** After the transaction has been rolled back and the database restored to its prior state before the first statement of the transaction.
- **Committed:** After the completion of transaction.

14.14

- **Serial schedule:** This indicates a single transaction is being executed at a time. Or we can say all the statements belongs to a single transaction.
- **Serializable schedule:** This indicates a concurrency situation. If a group of concurrency transaction can be turned into a serial schedule, we call this a serializable schedule.

14.15

a.

T_{13} first:

Transaction	Instruction	A	B
T_{13}	read(A)	0	0
T_{13}	read(B)	0	0
T_{13}	if A = 0 then B := B + 1	0	0
T_{13}	write(B)	0	1
T_{14}	read(B)	0	1
T_{14}	read(A)	0	1
T_{14}	if B = 0 then A := A + 1	0	1
T_{14}	write(A)	0	1

T_{14} first:

Transaction	Instruction	A	B
T_{14}	read(B)	0	0
T_{14}	read(A)	0	0
T_{14}	if B = 0 then A := A + 1	0	0
T_{14}	write(A)	1	0
T_{13}	read(A)	1	0
T_{13}	read(B)	1	0
T_{13}	if A = 0 then B := B + 1	1	0
T_{13}	write(B)	1	0

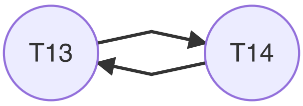
b.

T_{13}	A	B	T_{14}	A	B
read(A)	0				
read(B)	0	0			
if A = 0 then B := B + 1	0	0	read(B)		0
			read(A)	0	0
			if B = 0 then A := A + 1	1	1
write(B)	1	1	write(A)	1	1

Doesn’t satisfies the consistency requirement.

c.

B must be written first before read, A must be written first before B. If we draw a precedence graph of these two transactions, we get:



This is a previous circle, so it’s not possible for them to result in a serializable schedule.