Which of the following statements about the Two Phase Locking (2PL) protocol is/are TRUE?

A 2PL permits only serializable schedules

B With 2PL, a transaction always locks the data item being read or written just before every operation and always releases the lock just after the operation

C With 2PL, once a lock is released on any data item inside a transaction, no more locks on any data item can be obtained inside that transaction

D A deadlock is possible with 2PL

Once the DBMS informs the user that a transaction has been successfully completed, its effect should persist even if the system crashes before all its changes are reflected on disk. This property is called

A durability

B atomicity

C consistency

D isolation

Consider the following read-write schedule S over three transactions T_1, T_2, and T_3, where the subscripts in the schedule indicate transaction IDs:

$S : r_1(z); w_1(z); r_2(x); r_3(y); w_3(y); r_2(y); w_2(x); w_2(y);$

Which of the following transaction schedules is/are conflict equivalent to S ?

A $T_1T_2T_3$

B $T_1T_3T_2$

C $T_3T_2T_1$

D $T_3T_1T_2$

Let $R_i(z)$ and $W_i(z)$ denote read and write operations on a data element z by a transaction T_i, respectively. Consider the schedule S with four transactions.

S: $R_4(x)R_2(x)R_3(x)R_1(y)W_1(y)W_2(x)W_3(y)R_4(y)$

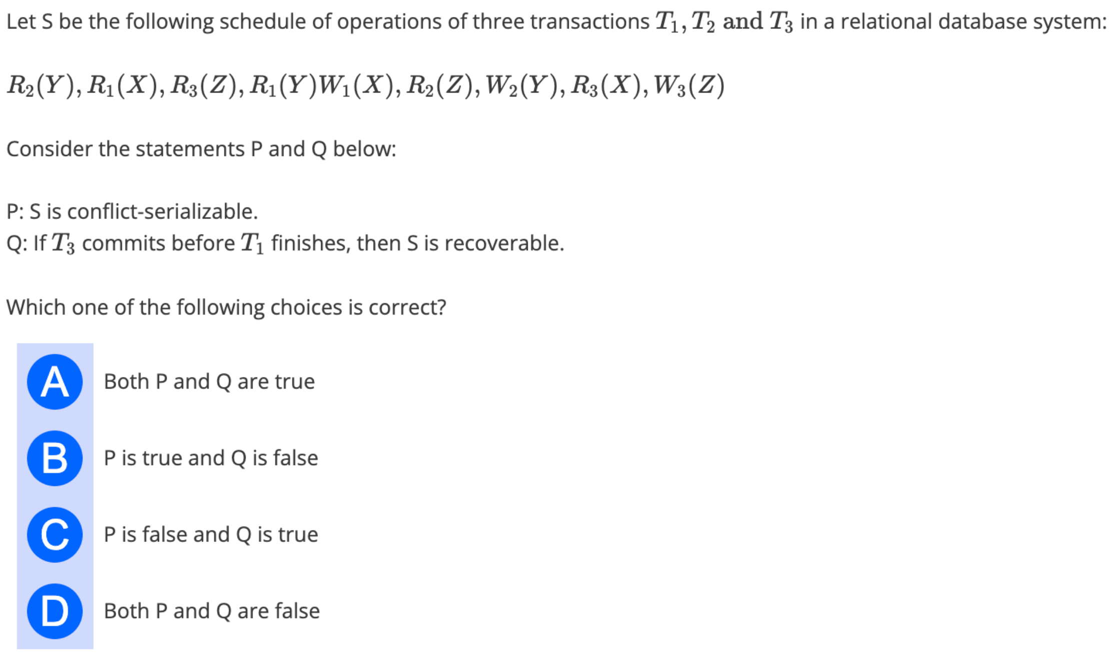
Which one of the following serial schedules is conflict equivalent to S?

A $T_1 \rightarrow T_3 \rightarrow T_4 \rightarrow T_2$

B $T_1 \rightarrow T_4 \rightarrow T_3 \rightarrow T_2$

C $T_4 \rightarrow T_1 \rightarrow T_3 \rightarrow T_2$

D $T_3 \rightarrow T_1 \rightarrow T_4 \rightarrow T_2$



Let S be the following schedule of operations of three transactions T_1, T_2 and T_3 in a relational database system:

$R_2(Y), R_1(X), R_3(Z), R_1(Y)W_1(X), R_2(Z), W_2(Y), R_3(X), W_3(Z)$

Consider the statements P and Q below:

P: S is conflict-serializable.
Q: If T_3 commits before T_1 finishes, then S is recoverable.

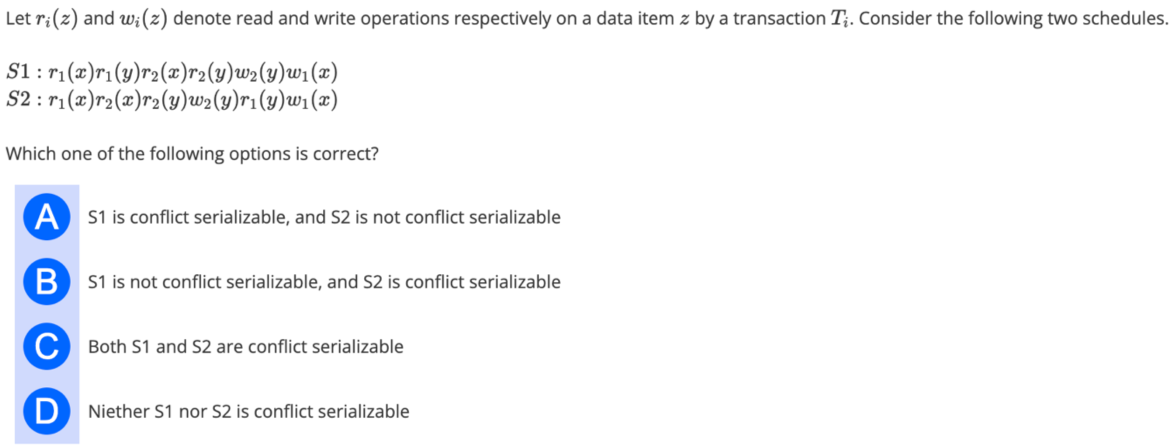
Which one of the following choices is correct?

A Both P and Q are true

B P is true and Q is false

C P is false and Q is true

D Both P and Q are false



Let $r_i(z)$ and $w_i(z)$ denote read and write operations respectively on a data item z by a transaction T_i. Consider the following two schedules.

$S1: r_1(x)r_1(y)r_2(x)r_2(y)w_2(y)w_1(x)$
$S2: r_1(x)r_2(x)r_2(y)w_2(y)r_1(y)w_1(x)$

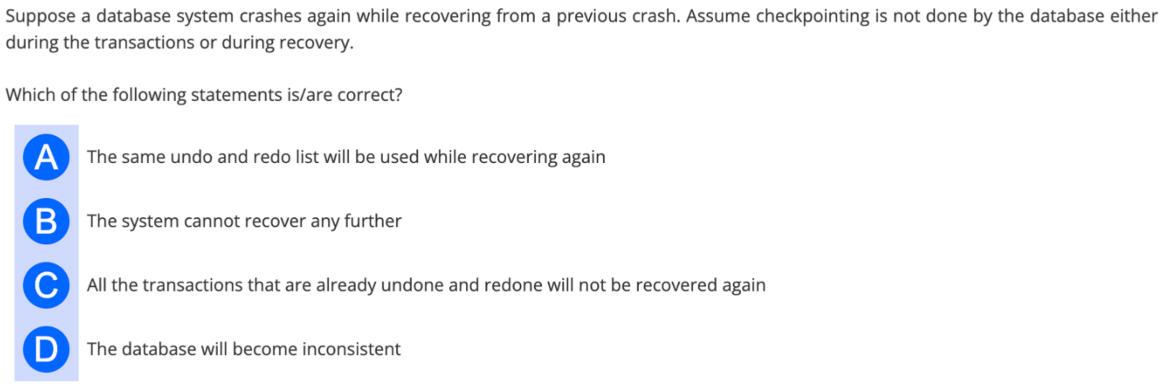
Which one of the following options is correct?

A S1 is conflict serializable, and S2 is not conflict serializable

B S1 is not conflict serializable, and S2 is conflict serializable

C Both S1 and S2 are conflict serializable

D Niether S1 nor S2 is conflict serializable



Suppose a database system crashes again while recovering from a previous crash. Assume checkpointing is not done by the database either during the transactions or during recovery.

Which of the following statements is/are correct?

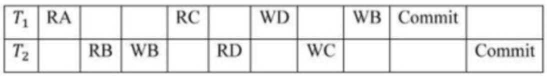
A The same undo and redo list will be used while recovering again

B The system cannot recover any further

C All the transactions that are already undone and redone will not be recovered again

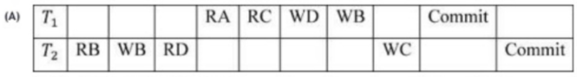
D The database will become inconsistent

Consider a schedule of transactions T1 and T2:



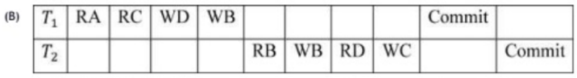
T_1	RA			RC		WD		WB	Commit	
T_2		RB	WB		RD		WC			Commit

Here, RX stands for "Read(X)" and WX stands for "Write(X)". Which one of the following schedules is conflict equivalent to the above schedule?



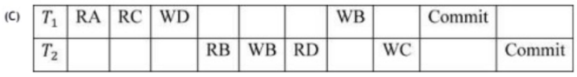
(A)

T_1				RA	RC	WD	WB		Commit	
T_2	RB	WB	RD					WC		Commit



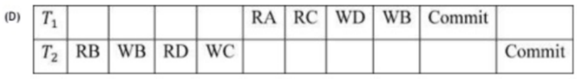
(B)

T_1	RA	RC	WD	WB					Commit	
T_2					RB	WB	RD	WC		Commit



(C)

T_1	RA	RC	WD				WB		Commit	
T_2				RB	WB	RD		WC		Commit



(D)

T_1					RA	RC	WD	WB	Commit	
T_2	RB	WB	RD	WC						Commit

A A

B B

C C

D D

Consider the following two statements about database transaction schedules:

I. Strict two-phase locking protocol generates conflict serializable schedules that are also recoverable.
II. Timestamp-ordering concurrency control protocol with Thomas' Write Rule can generate view serializable schedules that are not conflict serializable.

Which of the above statements is/are TRUE?

A I only

B II only

C Both I and II

D Neither I nor II

Two transactions T_1 *and* T_2 are given as:

$T_1 : r_1(X)w_1(X)r_1(Y)w_1(Y)$
$T_2 : r_2(Y)w_2(Y)r_2(Z)w_2(Z)$

where $r_i(V)$ denotes a read operation by transaction T_i on a variable V and $w_i(V)$ denotes a write operations by transaction T_i on a variable V. The total number of conflict serializable schedules that can be formed by T_1 *and* T_2 is ____________.

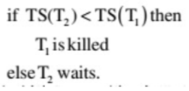
A 53

B 54

C 70

D 12

In a database system, unique time stamps are assigned to each transaction using Lamport's logical clock . Let TS(T_1) and TS(T_2) be the timestamps of transactions T_1 and T_2 respectively. Besides, T_1 holds a lock on the resource R, and T_2 has requested a conflicting lock on the same resource R. The following algorithm is used to prevent deadlocks in the database system assuming that a killed transaction is restarted with the same timestamp.



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if $TS(T_2) < TS(T_1)$ then
    $T_1$ is killed
else $T_2$ waits.
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Assume any transactions that is not killed terminates eventually. Which of the following is TRUE about the database system that uses the above algorithm to prevent deadlocks?

A The database system is both deadlock-free and starvation- free.

B The database system is deadlock- free, but not starvation-free.

C The database system is starvation-free but not deadlock- free.

D The database system is neither deadlock- free nor starvation-free.

Consider the following databases chedule with two transactions, T1 and T2.
$S = r_2(X); r_1(X); r_2(Y); w_1(X); r_1(Y); w_2(X); a_1; a_2$
where $r_i(Z)$ denotes a read operation by transaction T_i on avariable Z, $w_i(Z)$ denotes a write operation by T_i on avariable Z and a_i denotes an abort by transaction T_i.
Which one of the following statements about the above schedule is TRUE?

A S is non-recoverable

B S is recoverable,but has a cascading abort

C S does not have a cascading abort

D S is strict

Suppose a database schedule S involves transactions T1,...,Tn. Construct the precedence graph of S with vertices representing the transactions and edges representing the conflicts. If S is serializable, which one of the following orderings of the vertices of the precedence graph is guaranteed to yield a serial schedule?

A Topological order

B Depth-first order

C Breadth-first order

D Ascending orderoftransactionindices

Consider the following log sequence of two transactions on a bank account, with initial balance 12000, that transfer 2000 to a mortgage payment and then apply a 5% interest.

1.T1 start
2.T1 B old =1200 new =10000
3.T1 M old =0 new =2000
4.T1 commit
5.T2 start
6.T2 B old =10000 new =10500
7.T2 commit

Suppose the database system crashes just before log record 7 is written. When the system is restarted, which one statement is true of the recovery procedure?

A We must redo log record 6 to set B to 10500

B We must undo log record 6 to set B to 10000 and then redo log records 2 and 3

C We need not redo log records 2 and 3 because transaction T1 has committed

D We can apply redo and undo operations in arbitrary order because they are idempotent

Consider the following transaction involving two bank accounts x and y.

read(x); x:=x-50; write(x); read(y); y:=y+50; write(y)

The constraint that the sum of the accounts x and y should remain constant is that of

A Atomicity

B Consistency

C Isolation

D Durability

Consider the transactions T1, T2, and T3 and the schedules S1 and S2 given below.
T1 : r1(x); r1(Z) ; w1(x); w1(Z)
T2 : r2(x); r2(Z); w2(Z)
T3 : r3(x); r3(x); w3(Y)

S1: r1(x); r3(Y); r3(x); r2(Y); r2(Z); w3(Y); w2(Z); r1(Z); w1(x); w1(Z)
S2: r1(x); r3(Y); r2(Y); r3(x); r1(Z); r2(Z); w3(Y); w1(x); w2(Z); w1(Z)

Which one of the following statements about the schedules is TRUE?

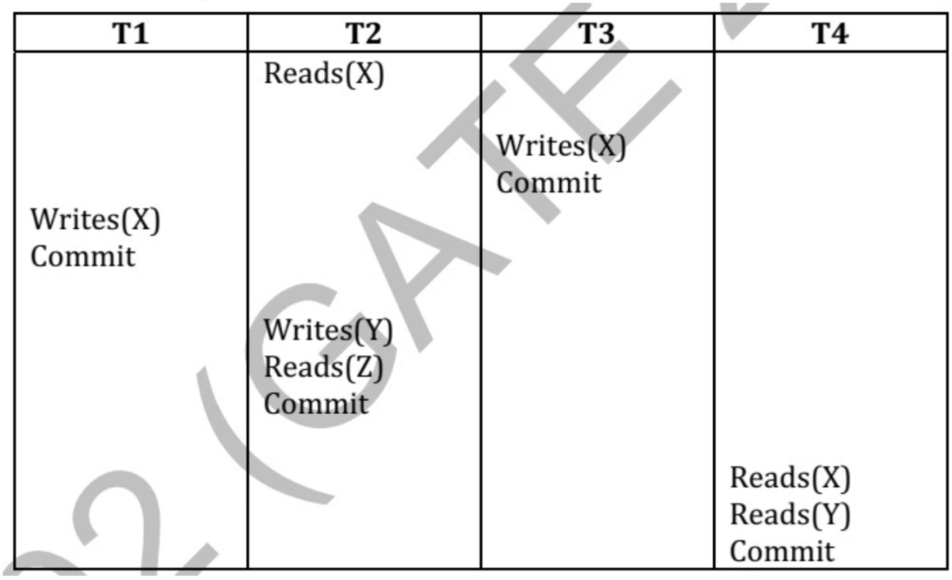
A Only S1 is conflict-serializable

B Only S2 is conflict-serializable.

C Both S1 and S2 are conflict-serializable

D Neither S1 nor S2 is conflict-serializable

Consider the following schedule S of transactions T1, T2, T3, T4:



T1	T2	T3	T4
	Reads(X)		
		Writes(X) Commit	
Writes(X) Commit			

	Writes(Y)
	Reads(Z)
	Commit		

			Reads(X)
			Reads(Y)
			Commit

Which one of the following statements is CORRECT?

A S is conflict-serializable but not recoverable

B S is not conflict-serializable but is recoverable

C S is both conflict-serializable and recoverable

D S is neither conflict-serializable nor is it recoverable