Branch : CSE & IT Batch : Hinglish

WEEKLY TEST – 04

Subject : Database Management System

Topic : Transaction & Concurrency Control

Maximum Marks 20

Q.1 to 6 Carry ONE Mark Each

[MCQ]

1. The application programmer is responsible to ensure which of the following properties?

(a) Atomicity
(b) Consistency
(c) Isolation
(d) Durability

[MSQ]

2. Which of the following scenarios may not lead to an irrecoverable schedule?

(a) A transaction performs write on a data item after it is read by an uncommitted transaction.
(b) A transaction reads a data item after it is written by an uncommitted transaction.
(c) A transaction reads a data item after it is read by an uncommitted transaction.
(d) A transaction reads a data item after it is written by a committed transaction.

[MSQ]

3. Choose the correct statements from the following.

(a) View serializability is a necessary and sufficient condition for serializability testing.
(b) Conflict serializability is sufficient but not necessary condition.
(c) Testing of conflict serializability is a polynomial problem.
(d) All the statements are true.

[MSQ]

4. Consider the following schedule using three transactions T_1, T_2 and T_3

T_1	T_2	T_3
R(x)		
	R(y)	
		R(y)
W(x)		
		W(x)
	R(x)	
	W(x)	

Then which of the schedule below is not the correct serialization of the above?

(a) $T_2 \rightarrow T_1 \rightarrow T_3$ (b) $T_2 \rightarrow T_3 \rightarrow T_1$
(c) $T_1 \rightarrow T_3 \rightarrow T_2$ (d) $T_3 \rightarrow T_1 \rightarrow T_2$

[MCQ]

5. Choose the correct statement from the following for schedule S given below:

T_1	T_2
R(A)	
	R(B)
W(A)	
	R(A)
	W(A)
	W(B)
R(B)	
W(B)	

(a) Schedule S is conflict serializable.
(b) Schedule S is view serializable.
(c) Schedule S is not serializable
(d) None of the above.

[MCQ]

6. Amongst the ACID properties of a transaction, the ____ property requires that the changes made to the database by a successful transaction always persist.

(a) Atomicity (b) Consistency
(c) Isolation (d) Durability

Q.7 to 13 Carry TWO Mark Each

[NAT]

7. Consider given two schedules:

S_1: $r_1(x)\ r_1(y)\ r_2(x)\ r_2(y)\ w_2(y)\ w_1(x)$

S_2: $r_1(x),\ r_2(x),\ r_2(y)\ w_2(y)\ r_1(y)\ w_1(x)$.

The number of schedules that is/are conflict serializable are?

[NAT]

8. Consider the given transactions:

T_1: $w_3(A)\ w_3(B)$

T_2: $r_2(A)\ r_2(B)$

T_3: $r_1(A)\ w_1(A)\ r_1(B)\ w_1(B)$

The number of concurrent schedules between T_1, T_2 and T_3 is / are _____that are non-serial.

[NAT]

9. How many view equivalent serial schedules are possible for the below schedule:

S: $w_1(A)\ r_2(A)\ w_3(A)\ r_4(A)\ w_5(A)$

[NAT]

10. Consider the following schedule:

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

The number of conflict equivalent schedules is/are_____.

[MCQ]

11. Consider the following schedule:

S: $r_1(A)\ r_2(B)\ r_3(C)\ r_1(B),\ r_2(C),\ r_3(A)$ $w_1(A)\ w_2(B)\ w_3(C)$

Choose the correct statements for the above schedule S.

(a) S is conflict serializable as $T_1 \rightarrow T_2 \rightarrow T_3$.
(b) There exist 30 conflict equal serial schedules for S.
(c) S is not conflict serializable schedule.
(d) None of these.

[NAT]

12. Consider given schedule:

S: $r_1(x),\ r_2(y),\ w_3(y),\ r_4(x),\ w_4(z),\ w_3(y)$

How many conflict serializable schedules exists for the above schedule S?

[MSQ]

13. Consider the given schedule S as follows:

S: $r_1(x)\ w_2(x)\ w_1(x)$, commit 2, commit 1.

Choose the correct statements regarding above.

(a) S is a recoverable schedule.
(b) S is conflict serializable.
(c) S is view serializable.
(d) S is not serializable.

Answer Key

1. **(b)**
2. **(a, c, d)**
3. **(a, b, c, d)**
4. **(a, b, d)**
5. **(c)**
6. **(d)**
7. **(1)**
8. **(414)**
9. **(2)**
10. **(15)**
11. **(c)**
12. **(12)**
13. **(a, d)**

Hints and Solutions

1. (b)

The application programmer or user is responsible to ensure the consistency property for any transaction. Atomicity and Durability are ensured by the recovery management component of DBMS software. While isolation is taken care by the concurrency controller of DBMD software.

2. (a, c, d)

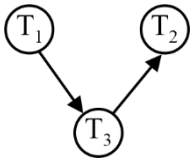
A transaction is said to be irrecoverable if it reads a data item after that data item is written by an uncommitted transaction.

3. (a, b, c, d)

Conflict serializability is a sufficient but not necessary condition views serializability is both necessary and sufficient testing of conflict serializability is dense in polynomial time.

4. (a, b, d)

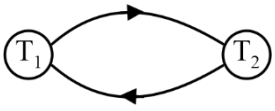
Checking for conflict serializability using precedence graph



Conflict serial schedule = $T_1 \rightarrow T_3 \rightarrow T_2$

5. (c)

If we check for precedence graph of S:



There exists cycle in precedence graph hence it is not conflict serializable.

Also need to check for no blind write present, therefore no view serializable.

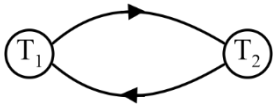
The schedule S is not serializable.

6. (d)

Durability property requires that the changes made to the database by a successful transaction should always persist, even if there is a failure of any blind.

7. (1)

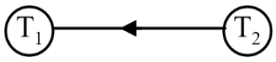
Precedence graph for S_1:



Cycle in precedence graph

$\therefore$ not conflict serializable.

Precedence graph for S_2:



No cycle in precedence graph

$\therefore$ S_2 is serializable as $T_2 \rightarrow T_1$.

Between S_1 and S_2 only S_2 is conflict serializable.

8. (414)

Number of concurrent schedules = $\frac{(n+m+k)!}{n!m!k!}$

Where n, m, and R are operations in transactions T_1, T_2, and T_3 respectively.

n = 2, m = 2, k = 4

$$\frac{(n+m+k)!}{n!m!k!} = \frac{8!}{2!2!4!}$$

$$= \frac{^{4}\cancel{8} \times 7 \times \cancel{6}^{3} \times 5 \times \cancel{4}!}{\cancel{4}! \times \cancel{2} \times \cancel{2}}$$

$= 20 \times 21$

$= 420$

Number of non-serial schedules = 420 – 3!

420 – 6 = 414

9. (2)

T_1	T_2	T_3	T_4	T_5
w(A)				
	r(A)			
		w(A)		
			r(A)	
				w(A)

Initial read: ____

Updated read: $T_1 \rightarrow T_2$ and $T_3 \rightarrow T_4$

Final write: T_5

- The view equal serial schedule will have T_5 fixed at the end

  _ _ _ _ _ T_5
- Also, $T_1 \rightarrow T_2$ and $T_3 \rightarrow T_4$ is also fixed to preserve updated read property

  However, $T_1 \rightarrow T_2$ and $T_3 \rightarrow T_4$ can be arranged in 2 ways
- The view equal serial schedules will be:

  $T_1 \rightarrow T_2 \rightarrow T_3 \rightarrow T_4 \rightarrow T_5$

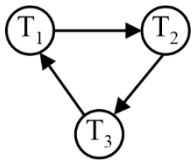
  $T_3 \rightarrow T_4 \rightarrow T_1 \rightarrow T_2 \rightarrow T_5$

10. (15)

There exists conflict for all the write operations, so their order cannot be changed.
Read operations have no conflict.
_____ $w_1(y)$ _____ $w_2(y)$ _____ $w_3(y)$
read on x by T_1 will be left of $w_1(y)$ so,
_____r_1 _____$w_1(y)$ _____$w_2(y)$ _____$w_3(y)$
Now r_2 can go to any of the 3 places left of $w_2(y)$, so.
_____r_1 _____w_1 _____r_2 _____w_2 _____w_3
Now r_3 can go to any of the 5 places left of $w_3(y)$. so, total conflict equivalent.
Schedule $\Rightarrow 3 \times 5 = 15$.

11. (c)

T_1	T_2	T_3
r(A)		
	r(B)	
		r(C)
r(B)		
	r(C)	
		r(A)
w(A)		
	w(B)	
		w(C)

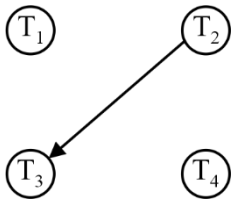


The schedule S is not conflict serializable.

12. (12)

T_1	T_2	T_3	T_4
r(x)			
	r(y)		
		w(y)	
			r(x)
			w(z)
		w(y)	

Checking for the precedence graph.



That means only constraint is T_2 should execute before T_3 while T_1 and T_4 can execute in any order.

($T_2 \rightarrow T_3$)

_____T_2 _____T3 _____.

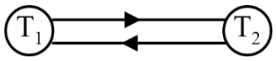
Both T_1 and T_4 can be in any of the 3 places. Therefore 3!

Also T_1 and T_4 execute any order therefore 2!. So, total conflict serializable schedule $\Rightarrow 3! \times 2! = 12$.

13. (a, d)

T_1	T_2
r(x)	
	$w_2(x)$
$w_1(x)$	
	commit
commit	

There exists no dirty read, therefore the schedule S is recoverable schedule



There exists cycle in precedence graph therefore it is not conflict serializable.

Now, check for view serializability:

Initial read: $T_1 \rightarrow T_2$

Updated read: ___

Final write $T_2 \rightarrow T_1$

Thus, for the given schedule no equivalent serial schedule possibole. Hence, schedule is not serializable.