CS3223 Tutorial 8: MVCC

Wk 11, Sem 2, 2022/23

Questions to be discussed: 1, 2 & 4.

1. (a) Write down a serializable Snapshot Isolation (SSI) schedule that is not a conflict serializable schedule (CSS).

   (b) Write down a conflict serializable schedule (CSS) that is not a serializable Snapshot Isolation (SSI) schedule.

   (c) Write down a serializable Snapshot Isolation (SSI) schedule S (involving transactions T_1, T_2, and T_3) such that DSG(S) consists the edges $T_1 \overset{rw}{\rightarrow} T_2$ and $T_2 \overset{rw}{\rightarrow} T_3$.

2. For each of the following multiversion schedules, state whether it is multiversion view serializable (MVSS). If the schedule is MVSS, write down a serial monoversion schedule that is multiversion view equivalent to it.

   (a)

T_1:			$R_1(x_4)$		$W_1(x_1)$					$R_1(y_0)$	$W_1(z_1)$	
T_2:				$R_2(y_0)$				$R_2(x_0)$				$R_2(z_3)$
T_3:						$W_3(x_3)$	$W_3(z_3)$					
T_4:	$W_4(y_4)$	$W_4(x_4)$										

   (b)

T_1:			$R_1(x_4)$		$W_1(x_1)$					$R_1(y_4)$	$W_1(z_1)$	
T_2:				$R_2(y_0)$				$R_2(x_1)$				$R_2(z_3)$
T_3:						$W_3(x_3)$	$W_3(z_3)$					
T_4:	$W_4(y_4)$	$W_4(x_4)$										

   (c)

T_1:			$R_1(x_4)$		$W_1(x_1)$					$R_1(y_4)$	$W_1(z_1)$	
T_2:				$R_2(y_0)$				$R_2(x_3)$				$R_2(z_3)$
T_3:						$W_3(x_3)$	$W_3(z_3)$					
T_4:	$W_4(y_4)$	$W_4(x_4)$										

   (d)

T_1:			$R_1(x_3)$		$W_1(x_1)$					$R_1(y_0)$	$W_1(z_1)$	
T_2:				$R_2(y_4)$				$R_2(x_4)$				$R_2(z_1)$
T_3:						$W_3(x_3)$	$W_3(z_3)$					
T_4:	$W_4(y_4)$	$W_4(x_4)$										

3. (Exercise 17.3, R&G) For each of the following schedules, state whether it is a Snapshot Isolation schedule under the First-Committer-Wins rule.

   (a) R_1(X), R_2(X), W_1(X), W_2(X), $Commit_1$, $Commit_2$

   (b) W_1(X), R_2(Y), R_1(Y), R_2(X), $Commit_1$, $Commit_2$

   (c) R_1(X), R_2(Y), W_3(X), R_2(X), R_1(Y), $Commit_1$, $Commit_2$, $Commit_3$

   (d) R_1(X), R_1(Y), W_1(X), R_2(Y), W_3(Y), W_1(X), R_2(Y), $Commit_1$, $Commit_2$, $Commit_3$

   (e) R_1(X), W_2(X), W_1(X), $Commit_2$, $Commit_1$

   (f) W_1(X), R_2(X), W_1(X), $Commit_2$, $Commit_1$

   (g) R_2(X), W_3(X), $Commit_3$, W_1(Y), $Commit_1$, R_2(Y), W_2(Z), $Commit_2$

   (h) R_1(X), W_2(X), $Commit_2$, W_1(X), $Commit_1$, R_3(X), $Commit_3$

   (i) R_1(X), W_2(X), W_1(X), R_3(X), $Commit_1$, $Commit_2$, $Commit_3$

4. Consider the following schedule involving transactions T_1, T_2, T_3, and T_4 which are executed in a database system using the Snapshot Isolation protocol with the First Committer Wins Rule.

   Assume the following values for the state of the database before the start of the schedule:

$$a_0 = 10, \quad b_0 = 20, \quad c_0 = 30.$$

Timestamp	T_3	T_1	T_2	T_4	**Comments**
1	$R_3(c)$				
2			$R_2(b)$		
3			$W_2(b)$		T_2 updates b to 45.
4			$Commit_2$		
5	$R_3(b)$				
6	$W_3(b)$				T_3 updates b to 60.
7		$R_1(a)$			
8		$R_1(b)$			
9		$W_1(a)$			T_1 updates a to 100.
10				$R_4(b)$	
11				$R_4(a)$	
12				$W_4(b)$	T_4 updates b to 16.
13	$R_3(a)$				
14	$W_3(c)$				T_3 updates c to 200.
15		$W_1(c)$			T_1 updates c to 40.
16		$Commit_1$			
17				$R_4(b)$	
18				$R_4(c)$	

   (a) Write down the value read by $R_3(b)$ at timestamp 5.

   (b) Write down the value read by $R_1(b)$ at timestamp 8.

   (c) Write down the value read by $R_4(b)$ at timestamp 10.

   (d) Write down the value read by $R_4(a)$ at timestamp 11.

   (e) Write down the value read by $R_3(a)$ at timestamp 13.

   (f) Write down the value read by $R_4(b)$ at timestamp 17.

   (g) Write down the value read by $R_4(c)$ at timestamp 18.