National University of Computer and Emerging Sciences, Lahore Campus

	Course:	**Advance Database Concepts**	**Course Code:**	**CS4064**
	Program:	**BS (Computer Science)**	**Semester:**	**Spring 2025**
	Date:	**Thu 13-Feb-2025**	**Total Marks:**	**10**
	Section:	**BCS-6A**		
	Roll No:			
	Quiz:	**2 (CCT) - Solution**		

Q. Consider the following schedule of actions listed in the order they are submitted to the DBMS:

S: $r_1(A); r_2(B); w_3(B); w_1(C); r_2(C); r_2(D); r_3(C); c_3; c_2; w_1(D); c_1.$

For each of the following concurrency control mechanisms, describe how the concurrency control mechanism handles the schedule. Assume that the timestamp of transaction *Ti* is *i*. For lock-based concurrency control mechanisms, add lock and unlock requests to the above schedule of actions as per the locking protocol. The DBMS processes actions in the order shown. If a transaction is blocked, assume that all its actions are queued until it is resumed; the DBMS continues with the next action (according to the listed schedule) of an unblocked transaction.

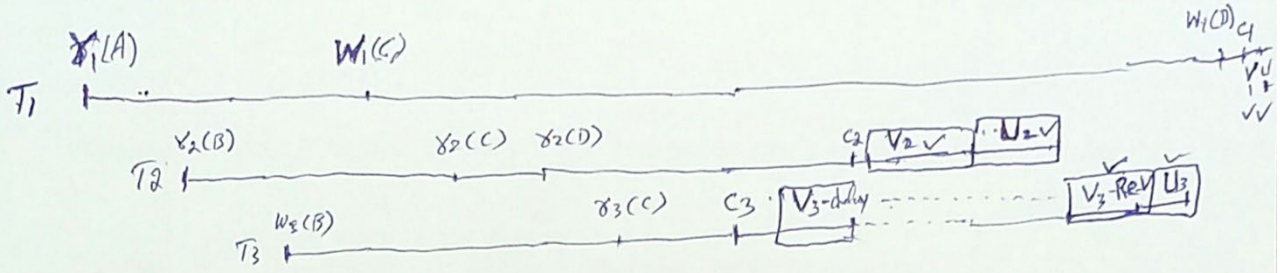
a. Rigorous 2PL with timestamps used for deadlock avoidance (Use wait-for-graph to deal with deadlock)
b. Optimistic concurrency control technique (Use defer the validation until a later time when the conflicting transactions have finished.)

a) Rigorous 2PL with deadlock avoidance (Use wait-for-graph to deal with deadlock)

Time ↓

Transaction T_1	**Transaction T_2**	**Transaction T_3**
s1-lock(A)		
r1(A)		
	s2-lock(B)	
	r2(B)	
		x3-lock(B) .. **wait** for T2 on B
x1-lock(C)		
w1(C)		
	s2-lock(C)…**wait** for T1 on C	
x1-lock(D)		
w1(D)		
c1, releases all locks		
unlock(A)		
unlock(C)		
unlock(D)		
	r2(C)…**wake-up**	
	s2-lock(D)	
	r2(D)	
	c2, releases all locks	
	unlock(B)	
	unlock(C)	
	unlock(D)	
		w3(B) …**wake-up**
		s3-lock(C)
		r3(C)
		c3, releases all locks
		unlock(C)
		unlock(B)

b) Optimistic concurrency control technique



V_3: BV: True (i.e. no overlapping committed Trans.)

FV: false · $WS(T_3) \cap (RS(T_1) \cup RS(T_2))$

$= \{B\} \cap \{\{A\} \cup \{B, C, D\}\}$

$= B$ — V_3 fail — delay validation Phase (conflict with T_2)

V_2: BV: True (i.e. no overlapping committed Trans.)

FV: True $WS(T_2) \cap (RS(T_1) \cup RS(T_3))$

$= \{\emptyset\} \cap \{\{A\} \cup \{C\}\}$

$= \{\emptyset\}$ — successful validation

V_3-Revalidate: BV: True $RS(T_3) \cap WS(T_2)$

$= \{C\} \cap \{\emptyset\}$

$= \emptyset$ — successful validation

FV: True $WS(T_3) \cap RS(T_1)$

$= \{B\} \cap \{A\}$

$= \{\emptyset\}$ — Successful validation

V_1: BV: True : $RS(T_1) \cap \{WS(T_2) \cap WS(T_3)\}$

$= A \cap \{\{\emptyset\} \cap \{B\}\}$

$= \{\emptyset\}$ — Successful validation

FV: True (no overlapping active Trans.)