

**CS609 Fall 2016 Solution HW#1**

1a) T1 → T2 → T3 Yes, it is serializable  
 R1(C) << W2(C); W2(A) << R3(A); R1(D) << R3(D)

b) T1 → T2 → T1 No, not serializable there is a cycle  
 R1(X) << W2(X); R2(X) << W1(X)

c) T3 → T1 → T2 → T3 No, not serializable there is a cycle  
 W3(A) << R2(A) and W3(C) << R2(C); R2(B) << W3(B)

2a) Not recoverable  
 W1(D) << R3(D) but C3 commits before C1

b) Strict

c) Recoverable but not ACA because W3(A) R1(A) so T1 reads from an uncommitted transaction

3a) R2(X) W2(X) (B1 ON R1(X)) R3(Y) W3(Y) R3(Y) (B3 ON R3(X)) W2(X) (B2 ON W2(Y)) deadlock T1 waiting on T2, T2 waiting on T1 and T3 waiting on T1

b) R2(X) W2(X) (B1 ON R1(X)) R3(Y) W3(Y) R3(Y) (A3 ON R3(X)) W2(X) W2(Y) C2 R1(X) W1(X) C1 R3(Y) W3(Y) R3(Y) R3(X) C3

c) R2(X) W2(X) (A2 on R1(X)) R1(X) R3(Y) W3(Y) W1(X) C1 R3(Y) R3(X) C3 R2(X) W2(X) W2(X) W2(Y) C2

4) T21, T23, T24 can execute concurrently as can T21, T22 but NOT T21, T23 or T21, T24

5a)

	X		Z	
	R	W	R	W
	0	0	0	0
R2(X)	2	0	R3(Z)	3
W2(X)	2	2	W3(Z)	3
ABORT T1 W(TS) > 1			R4(Z)	4
W3(X)	2	3		
R5(X)	5	3	R4(Z)	7
W4(X) ABORT T4 - R(TS) > 4				
C2				
C3				
C5				
R1(X) TS=6	6	3		
W1(X)	6	6		
C1				
W4(X) TS=7	6	7		
C4				

5b) MVCC

		X			Z	
	V	R	W	V	R	W
	V0	0	0	V0	0	0
R2(X)		2	0	R3(Z)	V0	3
W2(X)	V1/V0	2	2	W3(Z)	V1	3
R1(X)	V0	2	0	R4(Z)	V1	4
W3(X)	V2/V1	3	3			
W1(X) ABORT	T1 - V0	R(TS) > 1		R4(Z)	V1	7
R5(X)	V2	5	3			
W4(X) ABORT	T4 - V2	R(TS) > 4				
C2						
C3						
C5						
R1(X) TS=6	V2	6	3			
W1(X)	V3/V2	6	6			
C1						
W4(X) TS=7	V4/V3	7	7			
C4						

6) R W Read and write sets

T1	A,B	D
T2	Z,D	Z
T3	A	A
T4	C,D	A
T5	A	A

- a) C1 because rule 1; A2 because  $\{Z,D\} \cap \{D\}$ ; C3 because rule 1; A4 because  $\{C,D, A\} \cap \{A\}$ ; A5 because  $\{A\} \cap \{A\}$

Proof by example Using a view serializable schedule: R1(X) W2(X) W1(X) W3(X) where R and W sets are {X}

R1(X) W1(X) V1  
W2(X) V2  
W3(X) V3

C1 because rule1; A2 because  $\{X\} \cap \{X\}$ ; A3 because  $\{X\} \cap \{X\}$ ;

Does not allow a view serializable schedule, so Optimistic does not provide view serializability but conflict serializability