

# COMP 3311: Database Management Systems

## Lecture 20 Exercises Transactions

**Exercise 1:** Indicate which of the following schedules involving  $T_1$  and  $T_2$  is serial, serializable or not serializable.  $r_i$  denotes a read (of Transaction  $T_i$ ) and  $w_i$  is a write (of Transaction  $T_i$ ).

a)  $r_1(A) w_1(A) r_2(A) w_2(A)$

$T_1$	$T_2$
read(A)	read(A) write(A)
write(A)	

b)  $r_1(A) r_2(A) w_1(A) w_2(B)$

$T_1$	$T_2$
read(A)	read(A) write(B)
write(A)	

c)  $r_1(A) r_2(A) w_1(A) w_2(A)$

$T_1$	$T_2$
read(A)	read(A) write(A)
write(A)	

d)  $r_2(A) r_1(A) w_2(B) w_1(A)$

$T_1$	$T_2$
read(A)  write(A)	read(A)
	write(B)

**Exercise 2:** For each of the following schedules, state whether it is serializable, recoverable and cascadeless. Justify your answers.  $r_i$  denotes a read (of transaction  $T_i$ ) and  $w_i$  a write (of transaction  $T_i$ ).

a)  $w_1(X) r_2(X) w_1(X) c_2 a_1$

Serializable: ☐ Yes ☐ No  
Justification:

Recoverable: ☐ Yes ☐ No  
Justification:

Cascadeless: ☐ Yes ☐ No  
Justification:

b)  $r_2(X) w_3(X) c_3 w_1(Y) c_1 r_2(Y) w_2(Z) c_2$

Serializable: ☐ Yes ☐ No  
Justification:

Recoverable: ☐ Yes ☐ No  
Justification:

Cascadeless: ☐ Yes ☐ No  
Justification:

c)  $r_1(X) w_2(X) c_2 w_1(X) c_1 r_3(X) c_3$

Serializable: ☐ Yes ☐ No  
Justification:

Recoverable: ☐ Yes ☐ No  
Justification:

Cascadeless: ☐ Yes ☐ No  
Justification:

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**Exercise 3:** For each of the following schedules, answer the questions.

a)

$T_1$	$T_2$	$T_3$
read(X)	read(Y)	
	write(Y)	
		write(Z)
write(X)	read(X)	
	write(X)	
		read(Y)
		write(Y)
write(Z)		

Serializable: ☐ Yes ☐ No Justification?  
  
 If there is an equivalent serial schedule, give it below.

b)

$T_1$	$T_2$
	write(B)
read(A)	
write(A)	
	read(A)
commit	
	commit

Serializable: ☐ Yes ☐ No Justification?  
  
 Recoverable: ☐ Yes ☐ No Justification?  
  
 Cascadeless: ☐ Yes ☐ No Justification?

c)

$T_1$	$T_2$
	read(A)
read(A)	
write(A)	
	write(B)
	commit
commit	

Recoverable: ☐ Yes ☐ No Justification?  
  
 Cascadeless: ☐ Yes ☐ No Justification?

**Exercise 4:** Consider the following schedule consisting of three transactions  $T_1$ ,  $T_2$ , and  $T_3$ .  $r_i$  denotes a read (of Transaction  $T_i$ ) and  $w_i$  a write (of Transaction  $T_i$ ), etc.

Schedule:  $r_3(Z) w_3(Z) r_1(X) r_2(Y) w_2(Y) w_1(X) r_1(Y) r_3(X)$

a) Show that the schedule is serializable by constructing the precedence graph.

b) What is the equivalent serial schedule?

c) Modify the original schedule so it becomes recoverable, but not cascadeless, by adding commit operations in the appropriate locations in the schedule.

Schedule:

$r_3(Z) \quad w_3(Z) \quad r_1(X) \quad r_2(Y) \quad w_2(Y) \quad w_1(X) \quad r_1(Y) \quad r_3(X)$

d) Modify the original schedule so it becomes both recoverable and cascadeless by adding commit operations in the appropriate locations in the schedule.

Schedule:

$r_3(Z) \quad w_3(Z) \quad r_1(X) \quad r_2(Y) \quad w_2(Y) \quad w_1(X) \quad r_1(Y) \quad r_3(X)$