Tutorial 9 — Isolation and Recovery

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Exercise 9-1

For the following transaction schedule, fill in the RW-timestamps for data items a and b, assuming we use the simple timestamp-ordering protocol.

How would the answer change if we used the Thomas Write Rule?

T_1	T_2	T_3	$TS_r(a)$	$TS_w(a)$	$TS_r(b)$	$TS_w(b)$
r_a						
	r_b					
		r_a				
w_a						
	r_a					
		w_b				
r_b						
	w_b					
		w_a				

Exercise 9-2

Under what conditions does the phantom read phenomenon occur?

Exercise 9-3

Suppose we need to recover from a system failure, and have the transaction log below.

Assuming we use an immediate update protocol with checkpointing, what log entries does the recovery system need to add to restore the database to a consistent state?

action	transaction	item	val	val'	flags
start	T_1				
write	T_1	a	1	2	
write	T_1	a	2	3	
checkpoint	$[T_1]$				
want to abort	T_1				
write	T_1	a	3	2	redo-only
start	T_2				
write	T_2	b	5	6	
write	T_2	b	6	7	
(system failure)					

Exercise 9-4

Where do the following recovery protocols belong in the table below?

1. deferred update
2. immediate update (*can* persist prior to commit)
3. strict immediate update (persist changes immediately)

	redo	no-redo
undo		
no-undo		

Exercise 9-5

What data is logged in order for the ARIES protocol to restore from a checkpoint?

Exercise 9-6

Suppose a checkpoint is made between LSN 7 and 8 in the following schedule.

What data is stored in the transaction table and the dirty page table?

Where should the REDO phase start scanning for operations?

Lsn	Last_lsn	Tran_id	Type	Page_id	Other_information
1	0	T_1	update	C	· · ·
2	0	T_2	update	B	· · ·
3	1	T_1	commit		· · ·
4	begin checkpoint				
5	end checkpoint				
6	0	T_3	update	A	· · ·
7	2	T_2	update	C	· · ·
8	7	T_2	commit		· · ·

Exercise 9-7

Why is it important for the ARIES protocol to look for the most recent *end-checkpoint* log record as opposed to the most recent *start-checkpoint* log record during its analysis phase (finding TT and DPT at last checkpoint)?