CHAPTER 19: DATABASE RECOVERY TECHNIQUES

Answers to Selected Exercises

19.21 Suppose that the system crashes before the [read_item,T3,A] entry is written to the log in Figure 19.1(b); will that make any difference in the recovery process?

(a)

T_1	T_2	T_3
read_item(A)	read_item(B)	read_item(C)
read_item(D)	write_item(B)	write_item(B)
write_item(D)	read_item(D)	read_item(A)
	write_item(D)	write_item(A)

Figure 19.1
Illustrating cascading rollback (a process that never occurs in strict or cascadeless schedules). (a) The read and write operations of three transactions. (b) System log at point of crash. (c) Operations before the crash.

here we assume that if the transaction finished their actions, they will apply commit automatically.

(b)

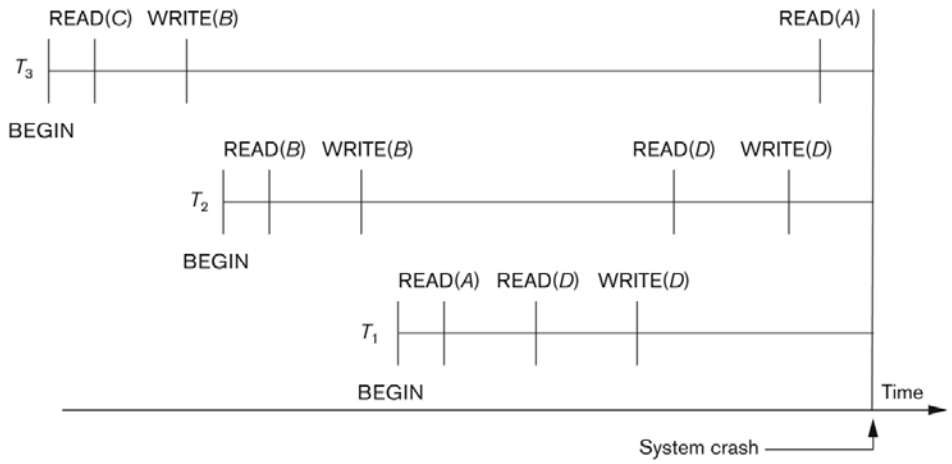
		A	B	C	D
		30	15	40	20
	[start_transaction,T_3]				
	[read_item,T_3,C]				
*	[write_item,T_3,B,15,12]		12		
	[start_transaction,T_2]				
	[read_item,T_2,B]				
**	[write_item,T_2,B,12,18]		18		
	[start_transaction,T_1]				
	[read_item,T_1,A]				
	[read_item,T_1,D]				
	[write_item,T_1,D,20,25]				25
	[read_item,T_2,D]				
**	[write_item,T_2,D,25,26]				26
	[read_item,T_3,A]				

System crash

* T_3 is rolled back because it did not reach its commit point.

** T_2 is rolled back because it reads the value of item B written by T_3.

(c)



19.22 Suppose that the system crashes before the [write_item,T2,D,25,26] entry is written to the log in Figure 19.1(b); will that make any difference in the recovery process?

19.23 Figure 19.7 shows the log corresponding to a particular schedule at the point of a system crash for the four transactions T1, T2, T3, and T4 of Figure 19.4. Suppose that we use the immediate update protocol with checkpointing. Describe the recovery process from the system crash. Specify which transactions are rolled back, which operations in the log are redone

and which (if any) are undone, and whether any cascading rollback takes place.

Figure 19.7
An example schedule and its corresponding log.

[start_transaction, T_1]
[read_item, T_1, A]
[read_item, T_1, D]
[write_item, T_1, D, 20, 25]
[commit, T_1]
[checkpoint]
[start_transaction, T_2]
[read_item, T_2, B]
[write_item, T_2, B, 12, 18]
[start_transaction, T_4]
[read_item, T_4, D]
[write_item, T_4, D, 25, 15]
[start_transaction, T_3]
[write_item, T_3, C, 30, 40]
[read_item, T_4, A]
[write_item, T_4, A, 30, 20]
[commit, T_4]
[read_item, T_2, D]
[write_item, T_2, D, 15, 25] ← System crash

(a)

T_1	T_2	T_3	T_4
read_item(A)	read_item(B)	read_item(A)	read_item(B)
read_item(D)	write_item(B)	write_item(A)	write_item(B)
write_item(D)	read_item(D)	read_item(C)	read_item(A)
	write_item(D)	write_item(C)	write_item(A)

(b)

[start_transaction,T_1]
[write_item, T_1, D, 20]
[commit, T_1]
[checkpoint]
[start_transaction, T_4]
[write_item, T_4, B, 15]
[write_item, T_4, A, 20]
[commit, T_4]
[start_transaction, T_2]
[write_item, T_2, B, 12]
[start_transaction, T_3]
[write_item, T_3, A, 30]
[write_item,T_2, D, 25] ← System crash

T_2 and T_3 are ignored because they did not reach their commit points.

T_4 is redone because its commit point is after the last system checkpoint.

Figure 19.4
An example of recovery using deferred update with concurrent transactions.
(a) The READ and WRITE operations of four transactions. (b) System log at the point of crash.

19.24 Suppose that we use the deferred update protocol for the example in Figure 19.7. Show how the log would be different in the case of deferred update by removing the unnecessary

log entries; then describe the recovery process, using your modified log. Assume that only redo operations are applied, and specify which operations in the log are redone and which are ignored.

19.25 How does checkpointing in ARIES differ from checkpointing as described in Section 19.1.4?

the main difference is that in ARIES, the main memory buffers which have been modified are not flushed into the disk, however, it writes in the LOG additional information in terms of Transaction table and Dirty page table when a checkpoint occurs.