Exercises

(Course: Database Management Systems)

Chapter 6

Database Recovery Techniques

Suppose that the system crashes before the [read_item, T₃, A] entry is written to the log in Figure 23.1(b). Will that make any difference in the recovery process?

Suppose that the system crashes before the [write_item, T₂, D, 25, 26] entry is written to the log in Figure 23.1(b). Will that make any difference in the recovery process?

Figure 23.6 shows the log corresponding to a particular schedule at the point of a system crash for four transactions T1, T2, T3, and T4. 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.

```
[start_transaction, T1]
[read_item, T1, A]
[read_item, T1, D]
[write_item, T1, D, 20, 25]
[commit, T1]
[checkpoint]
[start_transaction, T2]
[read_item, T2, B]
[write_item, T2, B, 12, 18]
[start_transaction, T4]
[read_item, T4, D]
[write_item, T4, D, 25, 15]
[start_transaction, T3]
[write_item, T3, C, 90, 40]
[read_item, T4, A]
[write_item, T4, A, 30, 20]
[commit, T4]
[read_item, T2, D]
[write_item, T2, D, 16, 25]
```

Figure 23.6
A sample schedule and its corresponding log.


Suppose that we use the deferred update protocol for the example in Figure 23.6. 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.

5. After a crash, we find the following log and transaction & dirty page tables at time of checkpoint:

<table>
<thead>
<tr>
<th>LSN</th>
<th>LAST_LSN</th>
<th>TRAN_ID</th>
<th>TYPE</th>
<th>PAGE_ID</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>T1</td>
<td>update</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>T1</td>
<td>update</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

Table 1 – The log at point of crash

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Specify the transaction and dirty page tables after the analysis phase.

**Table 1 – Transaction & Dirty Page Tables at time of checkpoint**

<table>
<thead>
<tr>
<th>TRANSACTION ID</th>
<th>LAST LSN</th>
<th>STATUS</th>
<th>PAGE ID</th>
<th>LSN</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>2</td>
<td>in progress</td>
<td>C</td>
<td>1</td>
</tr>
<tr>
<td>T2</td>
<td>3</td>
<td>in progress</td>
<td>B</td>
<td>2</td>
</tr>
</tbody>
</table>

```sql
3 0 T2 update C ...
4 begin_checkpoint
5 end_checkpoint
6 2 T1 commit ...
7 0 T3 update A ...
```

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