

CSE 444: Lab 4 Writeup

Linxing Preston Jiang Winter 2018

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1. Lab 4 focuses on adding rollback and recovery functionality to simpleDB upon abort and system crash. Specifically, we implemented STEAL (dirty pages may be evicted from the buffer pool even though the transaction hasn't committed yet), and NO FORCE (on transaction commit, no need to force write dirty pages to disk) for buffer pool management. In order to achieve this, we implemented log-based rollback and recovery which performs a redo-phase and an undo-phase

Main parts of lab4 include:

- `LogFile.rollback`: We need this method to roll back changes made by an aborted transaction. This method will read from the end of the log file and undo changes made by this transaction until its first active log record. It is also implemented that undo changes will append new CLR logs. More of this in the design part of this writeup.
 - `LogFile.recover`: We need this method to recover a simpleDB system upon unexpected crashes. It will start redoing from the beginning of the log file or the last checkpoint log if any, during which a map of active transactions to their first active log line is built. Then, undo-phase will use the active transaction map and undo any changes made by these transactions bottom up.
2. I suggest adding a new unit test for the correctness of how `setBeforeImage()` is used in `BufferPool`. When the transaction commits, there is a good chance that some pages which were dirty have been flushed to disk and are not dirty anymore. However, the before image of a page should be set if it was ever dirtied by this transaction. So the `setBeforeImage()` should be called on any pages which `LockManager` holds a lock on.
 3. Design decisions: I decided to add new type of log into `LogFile`, CLR. CLR logs can significantly help undo phase to *skip* any CLR records made by rollback actions. CLR has type `INT = 6`, and has the exact same format as `UPDATE` records. CLR records are appended during rollback actions and undo actions.
 4. Changes to API: I added a new CLR log as a sixth type.
 5. Missing elements: I believe I finished the entire Lab 4.