

Homework 7 (70 Points)

As for the previous homework, submit one .zip file containing six text files named Q1.txt to Q6.txt, each containing the answer to the corresponding question. Follow the formatting guidelines given in the questions.

We use the ARIES algorithm for logging and recovery. We consider the following log entries for all of the following questions (no pages are written to disk except if explicitly mentioned):

10 T1 writes P3
20 T2 writes P5
30 T1 writes P7
Frame steal - P3 gets written to disk
40 T3 writes P4
50 T1 writes P7
Frame steal - P7 gets written to disk
60 T3 writes P1

Q1) (10 Points) Assume flushedLSN is initially set to zero. Report the log sequence numbers after which flushedLSN is mandatorily updated according to the rules of write-ahead logging (you can assume that flushedLSN is updated immediately after the corresponding log entry, before any other operations such as page steals are processed). Also, report for each update to which value flushedLSN is updated (we always update to the minimal value that is admissible).

Q2) (10 points) Give the content of the dirty page table after above log (assume that the dirty page table is initially empty). Use the format (PageID, recLSN) for each entry.

Q3 (10 Points) Write the content of the transaction table after above log (assume that the transaction table is initially empty). Use the format (TransactionID, lastLSN, status) for each entry.

Q4) (10 Points) Assume that the database server crashes immediately after the last log entry above. The recovery phase starts from LSN 10 (no checkpoint). The analysis phase restores dirty page and transaction table to their state immediately before the crash. What is the first LSN considered in the REDO phase? Justify by one or two sentences.

Q5) (10 Points) The ARIES algorithm can avoid redoing operations if certain conditions are satisfied. Explain for each log entry (starting from the first entry considered in the REDO phase) whether it will be redone or why ARIES can avoid redoing it.

Q6) (20 Points) Report the CLR entries that are written during the UNDO phase. Report them in the same order in which the ARIES algorithm will write them and use the format "CLR TransactionID PageID" for each entry.