21 – ARIES Database Recovery

1. ARIES
    A. Algorithms for Recovery and Isolation Exploiting Semantics
    B. Main Ideas
        i. Write-Ahead Logging
        ii. Repeating History During redo
        iii. Logging Changes during undo
2. Log Sequence Numbers
    A. Log identifier and other information
    B. Type
        i. FlushedLSN : in Memory, last LSN in log on disk
        ii. pageLSN : in each page, newest update to the page
        iii. recLSN : in each page, oldest update to the page
        iv. lastLSN : in each txn, latest log record of the txn
        v. MasterRecord : in disk, LSN of last checkpoint
        vi. prevLSN : in every log, previous LSN in txn
    C. If page is flushed to disk, log should be flushed to disk first
       So flushedLSN >= pagLSN

3. Normal Commit & Abort Operations
    A. Commit
        i. Write COMMIT log
        ii. Flush log (up to COMMIT log)
        iii. Write TXN-END log
    B. Abort
        i. Compensation Log Records :
        log records for reverse operations of some previous operations
        initially, same with update log, but has “nextUndo” field.
        ii. Process
            1. Write ABORT log
            2. Rollback txn in reverse order, write CLR also
            3. Write TXN-END log
4. Fuzzy Checkpointing
    A. Non-Fuzzy Checkpointing
        i. Wait all Txns finishes, Halt all new-beginning txns
        ii. Flush all buffer
    B. Pause Checkpointing
        i. Pause modifying txns
        Need Active Transaction Table and Dirty Page Table
        ii. Flush all buffer
    C. Fuzzy Checkpointing
        i. Allow all txns running until checkpointing
        ii. Write ATT and DPT when writing CHECKPOINT-END log
        new beginning txn during checkpointing is not included in ATT at this time

5. Recovery Algorithm

    A. Analysis
    Find txns committed or failed after last checkpoint

    B. Redo
    repeat all operation

    C. Undo
    remove changes of failed txn