05 – Buffer Pools & Memory Managements

1. Goal of Memory management

    A. Spatial control : often used pages keep close each other

    B. Temporal control : minimize the disk I/O

2. Buffer Pool Manager

    A. Frame : slots for pages

    B. Page table : In memory data structure that contains page copies

    C. Meta-data

        i. Dirty flag (flag for pages that are modified)

        ii. Pin/Reference Counter (keep count of threads using each page)

    D. Locks VS. Latches

        i. Lock : protect logical content (for transaction duration)

        ii. Latch : protect critical section (for operation duration)
            == Mutex == Spinlock

    E. Allocation Policies

        i. Global policies : decisions for all acive TXNs

        ii. Local policies : decisions for specific TXNs

    F. Optimization

        i. Multiple Buffer Pool : improve locality, specifying object issue

        ii. Pre-fetch : improve locality

        iii. Scan Sharing : reuse data retrieved during query computation

        iv. Buffer Pool Bypass : not store pages that won't be used in the future

        v. Bypass OS page cache : avoid redundant copies of pages and other issue

3. Replacement Policies

    A. LRU : page that has oldest timestamp will be evicted
       sequential flooding issue

    B. LRU-K : track last K references to each page to estimate next page that is
       needed

    C. Priority : use priority to estimate page is important

    D. Dirty page replacement

        i.   If victim page is dirty, we need to write back that page into disk

        ii. Background writing : periodically writes dirty pages to disk

4. What is it?

    A. Bifurcated Environment

        i.   How this actually work?

    B. LRU-K

        i.   How this actually work?