

Problem Set 14

CS 411

Due at the beginning of class on the first class day of the following week.
Sections 10.1–5

1. A certain computer provides its users with a virtual memory space of 2^{32} bytes. The computer has 2^{22} bytes of physical memory. The virtual memory is implemented by paging, and the page size is 4,096 bytes. A user process generates the virtual address 0x11123456. Explain how the system establishes the corresponding physical location. Distinguish between software and hardware operations.
2. Assume that we have a demand-paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if the replaced page is not modified, and 20 milliseconds if the replaced page is modified. Memory access time is 100 nanoseconds.

Assume that the page to be replaced is modified 70% of the time. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds?

3. Consider the following page reference string:

7, 2, 3, 1, 2, 5, 3, 4, 6, 7, 7, 1, 0, 5, 4, 6, 2, 3, 0, 1.

Assuming demand paging with three frames, how many page faults would occur for the following replacement algorithms? Show work.

- (a) LRU replacement
- (b) FIFO replacement
- (c) Optimal replacement