

Virtual Memory II Problems

CS 411

1. (This is an “over the top” version of this problem.) 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?

2. 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
3. Consider a demand-paging system with the following time-measured utilizations:

CPU utilization: 20%
Paging disk: 97.7%
Other I/O devices: 5%

For each of the following, say whether it will (or is likely to) improve CPU utilization. Explain your answers.

- (a) Install a faster CPU.
- (b) Install a bigger paging disk.
- (c) Increase the degree of multiprogramming.
- (d) Decrease the degree of multiprogramming.
- (e) Install more main memory.
- (f) Install a faster hard disk or multiple controllers with multiple hard disks.
- (g) Add prepaging to the page fetch algorithms.
- (h) Increase the page size.