COMP SCI 3004/7064 Operating Systems

Tutorial III-b

1. Which of the following programming techniques and structures are "good" for a demand-paged environment? Which are "not good"? Explain your answers?

    a. Stack

    b. Hashed symbol table

    c. Sequential search

    d. Binary search

    e. Pure code

    f. Vector operations

    g. Indirection

2. Suppose we have a demand-paged memory. The page table is held in registers. It takes 8 milliseconds to service a page fault if an empty page is available or 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 percent 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:
$$1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.$$

How many page faults would occur for the following replacement algorithms, assuming one, two, three, four, five, six, or seven frames? Remember all frames are initially empty, so your first unique pages will all cost one page fault each.

- LRU replacement

- FIFO replacement

- Optimal replacement

4. Segmentation is similar to paging, but uses variable-sized "pages". Define a segment-replacement algorithm based on FIFO page-replacement scheme. Remember that since segments are not the same size, the segment that is chosen to be replaced may not be big enough to leave enough consecutive locations for the needed segment.Consider the strategies for systems where segments cannot be relocated, and those for systems where they can.

5. Consider a demand-paged computer system where the degree of multiprogramming is currently fixed at four. The system was recently measured to determine utilization of CPU and the paging disk. The results are one of the following alternatives. For each case, what is happening? Can the degree of multiprogramming be increased to increase the CPU utilization? Is the paging helping?

a. CPU utilization 13 percent; disk utilization 97 percent

b. CPU utilization 87 percent; disk utilization 3 percent

b. CPU utilization 13 percent; disk utilization 3 percent

6. What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem?