

Homework Assignment 3

CSC 4103 Operating System, Spring 2017

Name (Last, First): _____

Instructions: Submit your solutions (typed in hard copy) by **March 23rd (Thursday)** during the class time. Answer all questions completely and concisely. Late submissions will be penalized at the rate of 10% per day late and no more than 3 days late.

Questions (10 points = 1 point X 10)

1. Explain the difference between internal and external fragmentation. Explain the fragmentation issues with paging. (1 point)
2. What is the effect of allowing two entries in a page table to point to the same page frame in memory? Explain how this effect could be used to decrease the amount of time needed to fork a child process. (1 point)
3. On a system with paging, a process cannot access memory that it does not own; why? How could the operating system allow access to other memory? Why should it or should it not? (1 point)
4. Compare paging with segmentation with respect to the amount of memory required by the address translation structures in order to convert virtual addresses to physical addresses. (1 point)
5. What is the copy-on-write feature and under what circumstances is it beneficial to use this feature? What is the hardware support required to implement this feature? (1 point)
6. Under what circumstances do page faults occur? Describe the actions taken by the operating system when a page fault occurs. Explain why page fault is critical to system performance (1 point)
7. Consider the parameter Δ used to define the working-set window in the working-set model. What is the effect of setting Δ to a small value on the page fault frequency and the number of active (non-suspended) processes currently executing in the system? What is the effect when Δ is set to a very high value? (1 point)
8. 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? (1 point)
9. Consider a paging system with the single-level page table stored in memory. (1 point)

- a. If a memory reference takes 200 nanoseconds, how long does a paged memory reference take?
- b. If we add associative registers, and 75 percent of all page-table references are found in the associative registers, what is the effective memory reference time? (Assume that finding a page-table entry in the associative registers takes zero time if the entry is there.)

10. Consider the following page reference string: (1 point)

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3

Assuming the memory has 3 empty frames, illustrate the memory content for each page access and give the number of page faults that would occur for the LRU, FIFO, and Optimal replacement algorithms.