

## CS4500/5500, Operating Systems

### Spring 2019, Assignment 2

*Due date: midnight, Sunday May 5*

Please read the following:

- 1) Assignments are to be completed individually, no teamwork.
- 2) Total points possible: 100 pts.
- 3) If not otherwise stated, each problem is 5 pts.
- 4) Please add the following statement in the beginning of your submission.

*I have neither given or received unauthorized assistance on this work*

*Name:*

*Date:*

#### **Chapter 3:**

1. What is segmentation for?
2. For each of the following *decimal* virtual addresses, compute the virtual page number and offset for a 2-KB page and for a 4-KB page: 16000, 8192, 30000 (6 pts).
3. Given a two-level page table with 4-KB pages. Assume that each level uses 10 bits. What would be the *decimal* virtual address if PT1=5, PT2=2, offset=3?
4. Describe how does the clock page replacement algorithm work.
5. What are external and internal fragmentations?
6. Consider a system with 3 physical frames of memory that is given the following page memory reference sequence: 4, 2, 3, 0, 2, 1, 2, 3, 0, 1, 2, 1. What is the number of page faults that would occur for each of the following page replacement algorithms? (9 pts in total, 3 pts each)
  - a. Optimal page replacement algorithm
  - b. FIFO
  - b. LRU
7. Consider a virtual memory system that uses 16-bit virtual addresses and a page size of 256 bytes. Assuming a single-level page table, how many bits will be used to represent the page offset and the virtual page number, respectively? Assuming 4 bytes per page table entry, what is the size of the page table? (7 pts)

#### **Chapter 4:**

1. Discuss the advantages and disadvantages of the three file structures: byte, record, and tree structures.
2. What are memory-mapped files and what are the advantages.

3. Discuss the advantages and disadvantages of contiguous allocation, linked list allocation, and FAT.
4. Why the index allocation (e.g., i-node) requires much less space than FAT?
5. What is a symbolic link?
6. What are the tradeoffs between using a large disk block size vs. a small size?
7. Compare the free list-based and bitmap-based free disk block management.

### **Chapter 5:**

1. Give two examples (each) of block devices and character devices.
2. Suppose that a disk drive has 300 cylinders, numbered 0 to 299. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 15. The queue of pending requests, in FIFO order, is 86, 147, 291, 18, 95, 151, 175, 30. Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests, for each of the following disk-scheduling algorithms? (9 pts in total, 3 each)
  - a. FCFS
  - b. SSF
  - c. Elevator algorithm

### **Additional Problems for other chapters:**

1. Five processes A through E. They have estimated running times of 10, 6, 2, 7, and 8ms. For each of the following scheduling algorithms, determine the average process turnaround time and response time. Ignore process switching overhead. Assume processes arrive in order A to E, at 0ms, 1ms, 2ms, 3ms, and 4ms. (9 pts in total)
  - (a) Round robin, with quantum = 4ms. (3 pts)
  - (b) First-come, first-served. (2 pts)
  - (c) Shortest job first, preemptive and non-preemptive. (4 pts)