CS 4760	**Operating Systems**	Test 3
Name:	Spring 2022	Max Pts: 74

Important: This is an open book test. You can use any books, notes, or paper. If there is a syntax error in any program segment, just write it down and you will get full credit for the problem. The test is 75 minutes long.

1. [6 pt] What is the difference between internal and external fragmentation?

2. [10 pt] Consider a machine with the memory access time for RAM to be 100ns. You are running processes that, on an average, have 1 page fault in 20,000 memory accesses. Out of these page faults, 1 in 10 pages turns up with its dirty bit set. The disk has a seek time of 10ms and is spinning at 14,400 rpm. Consider about 1ms for transfer time for data. At any time, there are, on an average, two processes in the device queue. Compute the effective memory access time for this system.

3. [6 pt] What is the purpose of translation lookaside buffer?

4. [6 pt] What elements are typically found in a page table entry? Briefly describe each of them.

5. [10 pt] Suppose the page table for the process currently executing on the processor looks like the following. All numbers are decimal, everything is numbered starting from 0, and all addresses are memory byte addresses. The page size is 1024 bytes.

Virtual page number	Valid bit	Reference bit	Modify bit	Page frame number
0	0	1	0	1
1	1	1	0	5
2	0	0	1	-
3	1	1	0	6
4	1	1	0	4
5	0	1	1	-
6	0	0	1	7
7	1	0	1	8

   What physical address, if any, would each of the following virtual addresses correspond to? (Do not try to handle any page faults, if any.)

   (a) 5625

   (b) 2417

   (c) 6871

6. [6 pt] What are typical operations that may be performed on a directory?

7. [6 pt] Some operating systems have a tree-structured file system but with limit the depth of the tree to some small number of levels. What effect does this limit have on the users? How does this simplify file system design (if it does)?

8. [6 pt] What delay elements are involved in a disk read or write?

9. [18 pt] Consider a disk with 256 cylinders, indexed from 0 to 255, with 0 being the innermost and 255 being the outermost cylinder. The system receives disk requests on the following tracks in the specified order

   83, 224, 123, 2, 34, 160, 45, 78. 110, 55

   The head is currently on cylinder 236, and is moving towards inner cylinder (cylinder 0). Give the total number of tracks traversed for the given requests using each of the following algorithms.

   (a) FCFS scheduling

   (b) SSTF scheduling

   (c) SCAN scheduling

   (d) C-SCAN scheduling, servicing requests as head moves outwards

   (e) LOOK scheduling

   (f) C-LOOK scheduling, servicing requests as head moves outwards