CS 4760	**Operating Systems**	Test 3
Name:	Winter 2004	Max Pts: 66

Important: This is an open book test. You can use any books, notes, or paper. *Do not log into the computer, or use any communications device during the test.* Any calculations and rough work can be done on the back side of the test pages. You must show all your work. You will lose five points for not writing your name.

1. [10 pt] In a virtual memory system, 1 in 300 references (on average) causes a page fault. When the page fault is to be serviced, 1 in 9 pages have their dirty bit set. Let the average seek time for the disk be 11 milliseconds. The disk rotates at 7200 rpm. The average wait time in device queue is 5 milliseconds. Each block is 1K and there are 256 blocks per track. Let the memory access time be 100 nanoseconds when there is no page fault. Compute the average memory access time in this system.

2. [8 pt] I just bought a disk of 250GB capacity for my Unix box and decided to attach it to my system as a single partition. Each block in the disk is of size 2K bytes. Let us say that I have a boot block of size 1 block. Consider 1 block to be allocated for super block. Let each inode require 1K bytes. What can be the maximum formatted capacity of the disk? What is the maximum file size that can be stored on this disk if the system uses 12 direct blocks, 1 single indirect block, 1 double indirect block, and 1 triple indirect block? Assume that the system is a 32-bit machine.

3. [8 pt] Consider a process with 8 frames, each frame of size 2K. Let us say that we are working on a 16-bit machine. What can be the maximum size of page table in this case? The system currently has free frames list as: 3B, 04, 20, 0A, 09, 0D, 06, 0B, 10, 05, 00, 17. Show the page table that results when you put the process with 8 pages into memory. Translate the logical address 0XCAC5 and 0X0EB7 into physical addresses.

4. [4 pt] Unix file format is just a stream of bytes. But in a number of applications, we need to access random locations in files without having to read the file sequentially. How is this accomplished in Unix? Be specific to the point of giving me the function names required.

5. [18 pt] If FIFO page replacement is used with 5 page frames, how many page faults will occur with the reference string

6 5 0 4 2 1 5 1 4 1 2 4 5 4 4 3 9 7 4

if the frames are initially empty. Now repeat this problem for OPT, LRU, LFU, and second chance algorithm. How will it perform with a window size of 5 under the working-set algorithm (assume unlimited number of frames available for working set algorithm but working set window size is 5)?

6. [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

79 168 55 104 135 91 192 117 81 76 66

The head is currently on cylinder 41, and is moving towards outer cylinder. If the head requires 0.1ms to move from one track to the next, give the time required to service 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