CS 376	**Operating Systems**	Test 3
Name:	Spring 2002	Max Pts: 53

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 will lose five points for not writing your name.

1. [4+6 pt] I have a floppy disk with 1.44MB [unformatted] capacity. The data blocks are 512 bytes each.

   (a) The floppy keeps track of free space by using a bit vector approach. What is the size of bit vector for the floppy? What is the formatted capacity using the bit vector approach?

   (b) Now consider that the same floppy has to have a Unix filesystem, with an empty boot block of size 1 block. Consider 1 block to be allocated for super block. Let each inode require 1024 bytes. What can be the maximum formatted capacity of the floppy? What is the maximum file size that can be stored on this floppy if the system uses 12 direct blocks, 1 single indirect block, and 1 double indirect block?

2. [5 pt] In a virtual memory system, 1 in 72 references (on average) causes a page fault. When the page fault is to be serviced, 1 in 6 pages have their dirty bit set. Let the average seek time for the disk be 10 milliseconds, the average latency be 1 millisecond, and the average wait time in device queue be 10 milliseconds. In addition, the transfer time per page is 1 millisecond. Let the memory access time be 100 nanoseconds when there is no page fault. Compute the average memory access time in this system.

3. [2 pt] I have read permission for a given directory on my Unix box. However, when I try to `cd` into the directory, I get a message `Permission denied`. What could be wrong?

4. [18 pt] If FIFO page replacement is used with 4 page frames, how many page faults will occur with the reference string

10 15 11 0 4 3 11 9 5 2 10 0 6 13 6 13 15 2 6

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)?

5. [18 pt] Disk requests come in to the disk driver for cylinders 134, 140, 75, 217, 51, 253, 248, 137, 150, 120, 231, and 30, in that order. A seek takes 2 msec per cylinder moved. The arm is currently at cylinder 204. The cylinders are numbered from 0 to 255. How much seek time is needed for

   (a) FCFS scheduling

   (b) SSTF scheduling

   (c) Elevator algorithm (initially moving away from cylinder 0)

   (d) C-SCAN scheduling (initially moving away from cylinder 0) satisfying requests as the head moves towards cylinder 0

   (e) LOOK scheduling (initially moving towards cylinder 0)

   (f) C-LOOK scheduling (initially moving towards cylinder 0) satisfying requests as the head moves away from cylinder 0