

CSCI 331: Operating Systems I
Midterm # 2 -- open book section

The entire exam is to be turned in at 4:20 PM. Work the closed book section first and turn it in before you consult your books and notes to work on the open book section. Write your answers to the open section on your own paper.

Question I. (20 points)

Consider a disk drive with the following characteristics:

- a. 40 cylinders
- b. 2 heads
- c. 9 sectors per track
- d. 512 byte sectors
- e. 360 rpm rotation rate
- f. 10 msec/cylinder seek time

Part (a):

How many bytes can be stored on the disk?

Part (b):

Under the standard Minix (and Unix) enumeration of the sectors of the disk, what is the physical position of logical sector number 555?

Part (c):

Assume the disk is single interleaved. Suppose we wish to read logical sectors 2, 3, and 4 on the track where the arm is presently positioned. If the three sectors must be read in order, on the average, how long will it take to read the three sectors.

Part (d):

Suppose the disk is positioned a cylinder 10 and moving upward and the disk requests have been queued in the following order: 24, 20, 30, 2, 6. How much seek time is needed in the following three algorithms: FCFS (first-come, first served), SSF (shortest seek first), and elevator?

Question II. (5 points)

The clock interrupt handler on a certain computer requires 2 msec (including process switching overhead) per clock tick. The clock runs at 60 Hz. What fraction of the CPU is devoted to the clock?

[This is Problem 23 on page 189 of Tanenbaum's book.]

Question II. (10 points)

Suppose a computer system has seven (7) tape drives. The computer is executing four jobs, *A*, *B*, *C*, and *D*. Before it began execution, each job was required to "declare" the maximum number of tape drives it would need to complete. These declarations were:

<i>A</i>	4
<i>B</i>	2
<i>C</i>	1
<i>D</i>	6

Right now job *A* has been allocated two (2) tapes drive while job *D* has been allocated three (3) tape drives.

Show that the present state is a **safe**, that is, show an order in which these four jobs can terminate.

Suppose job *B* requests two tape drives. If *B*'s request is granted, will the system still be in a safe state? If so, show an order in which the jobs can terminate.

Question IV. (10 points)

Consider the following page reference string

1 2 1 4 1 5 1 9 9 4 9 2

Assuming a computer with four (4) page frames, what page faults occur when this page reference string is processed using the following three page replacement algorithms:

- (a), FIFO (First In First Out)
- (b), Optimal
- (c), LRU (Least Recently Used)

Question V. (5 points)

Suppose a program is running on a machine that supports 1000 byte pages. (Why 1000? Because it's easier for humans to do the figuring.) The page table for the program is:

page	frame
0	5
1	X -- unmapped
2	2
3	7
4	8

What are the physical addresses corresponding to the following virtual addresses?

1776
3579
4000