EXAM ON FILE SYSTEMS AND I/O – SPRING 2003 CSC 262 – OPERATING SYSTEMS NICHOLAS R. HOWE

1. **Disk Scheduling** (16 points). Consider the table below, which shows a series of requests for access to particular disk tracks, along with the time at which the request is made. Assume for simplicity that servicing each request takes exactly 5 ms, and that no request may be satisfied before the time at which it is been issued. What would be the order in which the requests are serviced under each of the following disk scheduling algorithms?

Track:	0	13	11	12	8	19
Time:	0 ms	2 ms	3 ms	6 ms	8 ms	9 ms

a. FCFS

b. SSTF

c. SCAN

d. F-SCAN

2. Protection & Security (12 points). Consider the access control matrix at right.

a). Give the access control list for *File2*.

b). Give the capabilities list for *User2*.

		File1	File2	File3	File4		
U	Jser1	R*W*X			RW		
U	Jser2	R	RX		R*W*X*		
U	Jser3	R*W*X*	R*W*X*	R*W*X*	R*W*X*		

c). Which domain(s) are able to grant User2 permission to execute File1?

3. **Vocabulary** (24 points). Identify and describe the role and of the following parts of a system in one or two sentences.

- a). System Bus
- b). RAID
- c). *i*-node
- d). root directory
- e). cylinder (as part of a hard disk)
- f). device driver

4. **History** (10 points). Number the following developments in operating systems chronologically:

_____a). Spooling for offline printing

_____b). Time sharing

_____ c). Programs hardwired via plugboards

_____ d). PCs get memory protection

_____e). VLSI technology leads to inexpensive microchips

5. **Ext2 File System** (16 points). The diagram below shows the data structures maintained within a block group of the Ext2 file system. Identify all the data structures that would need to be used in order to complete each of the following tasks. Assume that nothing is cached in memory, so that all information for each part must be read in from the disk. (Note: each part will typically use several of the data structures below.)

SUPER	GROUP	BLOCK	INODE	INODE	DATA
BLOCK	DESCRIPTORS	BITMAP	BITMAP	TABLE	BLOCKS

- a). Determine how much free space is available on the disk.
- b). Locate a free inode and mark it used.
- d). Check the modification date of the root directory.
- d). Read the contents of the root directory of the disk.

6. **Performance Measures** (12 points). Suppose that a processor has 10 identical jobs to do. Running alone, each will take 100 μ s (0.0001 s) and use up 10% of the CPU's resources. Calculate the mean latency, utilization, and throughput for the CPU under each of the scenarios below. (You don't need to compute latency for the individual jobs.)

a. Sequential execution, where one job starts as soon as the previous one finishes.

b. Staggered execution, where one job starts immediately, and one new job starts each 10 μ s after that until all jobs are running.

7. **OS Structure** (10 points). Describe the role of the service layer in an OS such as Linux. Discuss its interaction with the layers immediately above and below it, contrasting its role with theirs. Use the example of the file system to provide specifics.