

**CS 471: Operating System Concepts**  
**Spring 2008**  
**Final Examination**  
**Points: 150**  
**May 1, 2008**  
**Time: 12:30-3:30 PM**  
**CLOSED BOOK**

Turning in this exam under your name confirms your continued support for the honor code of Old Dominion University and further indicates that you have neither received nor given assistance in completing it.

Name: \_\_\_\_\_ UID: \_\_\_\_\_

CS Unix ID: \_\_\_\_\_@[cs.odu.edu](mailto:cs.odu.edu)

Question #	Points	
	Maximum	Obtained
1	25	
2	25	
3	25	
4	25	
5	25	
6	25	
<b>Total</b>	<b>150</b>	

**YOU MUST WRITE ONLY IN THE SPACE PROVIDED. WORK  
OUTSIDE THIS SPACE WILL NOT BE GRADED.**

**USE A BLACK PEN TO ANSWER THE QUESTIONS**

**Question 1.**

- (a) In a disk, suppose the blocks 0-3, 6, 8, and 11-12 are free (assume that there are only blocks 0-19 on this disk). Show how this free-block information is represented using: (i) Bit vector (ii) Linked list (iii) Also, state the advantages of using bit-vector over linked list.

**WORK AREA**

- (b) Describe how the path name `/usr/fac/mukka/public_html/cs471s08/exams/exam2.pdf` is translated (or resolved) to a physical address by the client module in NSF.

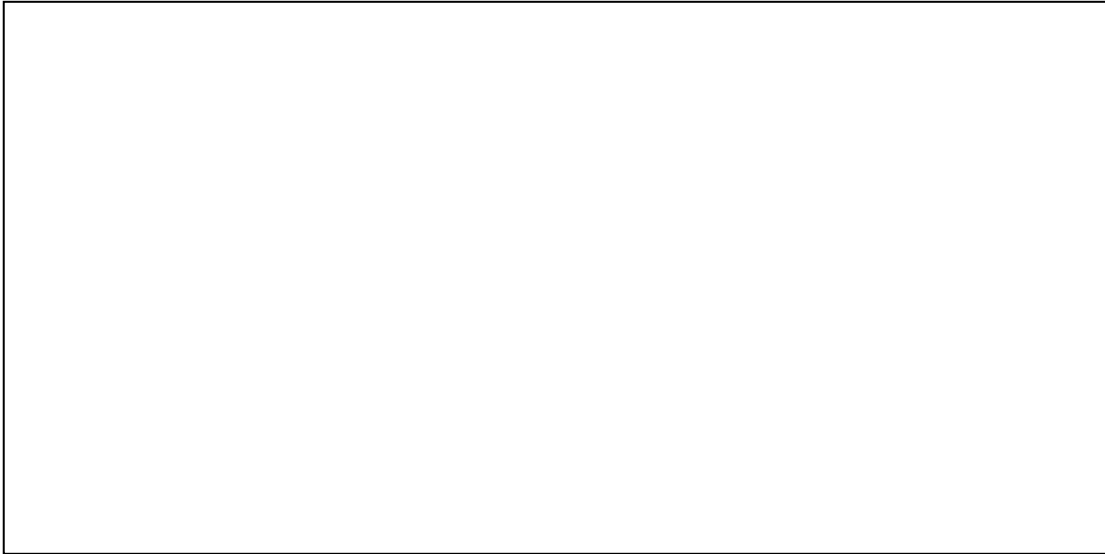
**WORK AREA:**

(c) On a disk, space is allocated using **linked** allocation. If a file F1 (6 logical blocks, 0-5) is allocated physical block addresses  $\langle 25, 17, 279, 55, 27, 99 \rangle$ , respectively. (i) What would be entries in the file directory? (ii) How many disk accesses are involved in reading the 4<sup>th</sup> logical block ? (iii) How many disk accesses does it take to delete block 3?

**Question 2.**

- (a) Suppose that a disk drive has 5000 cylinders, numbered 0..4999. The drive is currently serving a request at cylinder 2525. It previously served a request at cylinder 2530. The queue of pending requests, in FIFO order, is: 2500, 1500, 3000, 500, 2500. Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for SCAN disk-scheduling algorithm?

**WORK AREA:**

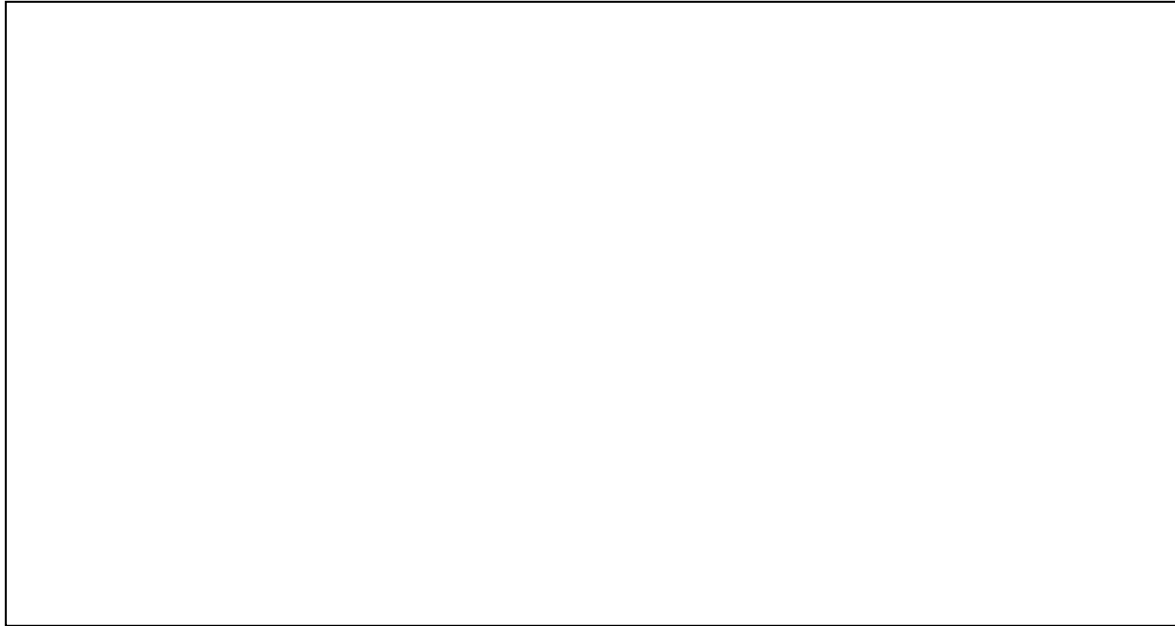


- (b) What are the advantages of RAID 0? What are the benefits of RAID 1? How does RAID 0+1 leverage the advantages of both these? (Refer to figure in the appendix)

**WORK AREA:**



(c) A disk drive rotates at 1500 RPM. It has 300 cylinders. Each cylinder has 100 tracks with each track having 50 sectors of 512-bytes each. (i) What is the average rotational latency for any request being serviced? (ii) What is the transfer rate/minute?



**Question 3.**

- (a) Given the following access matrix, answer the following questions: (i) If a program starts executing in domain D4, show the sequence of domains it goes through before executing in domain D3. (ii) What access rights does a program have when executing in domain D1?

**WORK AREA:**

- (b) What is one advantage of access lists for objects over capabilities? What is one disadvantage?

**WORK AREA:**

(c) How can the **principle of least privilege** be applied when we consider the execution of a program A by user X?



**Question 4.** Answer the following questions related to computer security.

(a) What is a replay attack? Give an example for such an attack.

(b) What is a Trojan Horse attack? Give an example for such an attack.

© What is the difference between asymmetric key encryption and symmetric key encryption?

Question 5.

(a) What is the primary advantage of a stateless server over a stateful server? What is the primary disadvantage?

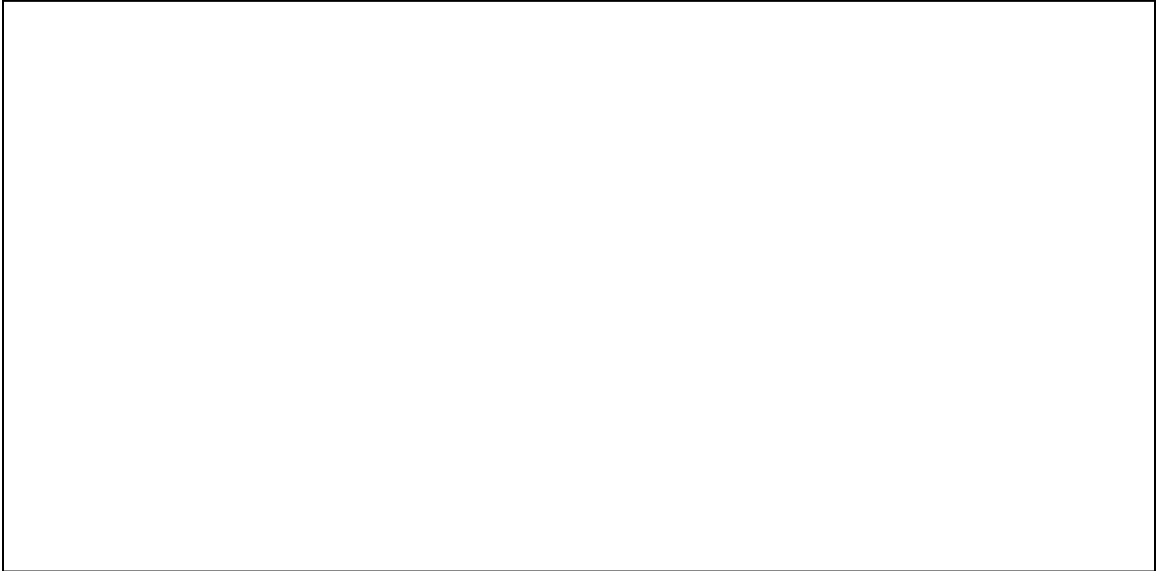
(b) What is the role of the client module in NFS file server? What is the role of the server module?

(c) Who is responsible for informing a client about a file update in NSF and ASF?

**Question 6.**

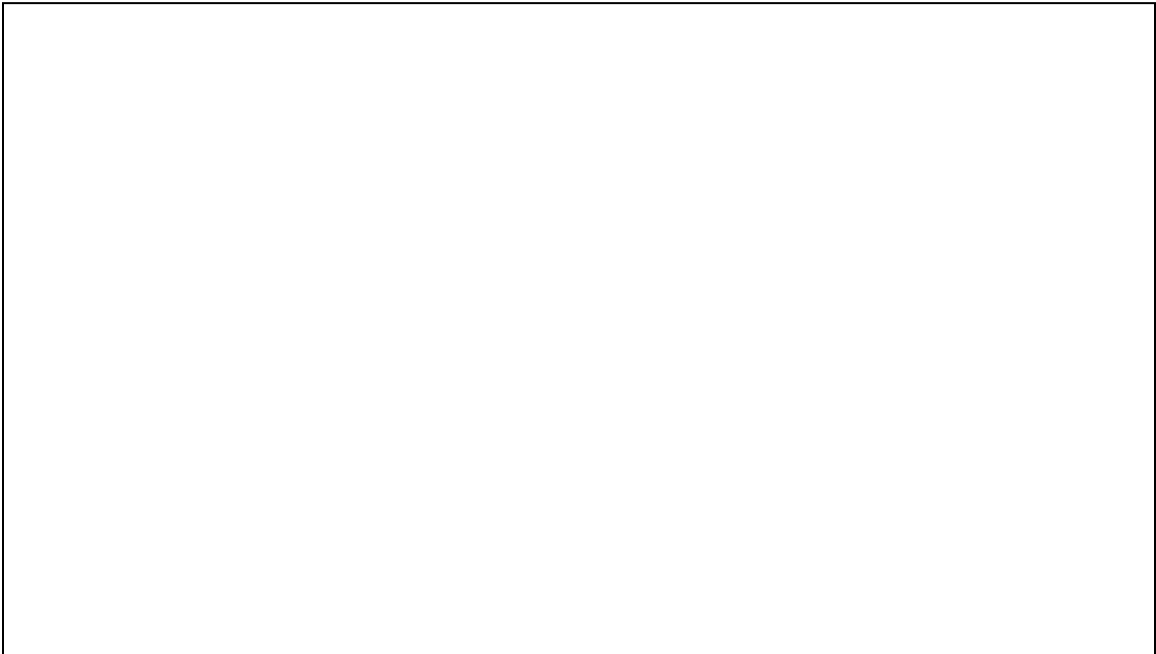
- (a) Suppose a process P1 with timestamp  $TS=150$  is holding a resource R1. At that time two other processes P2 (with  $TS=70$ ) and P3 (with  $TS=200$ ) also make a request for the same resource. Explain the outcome for P1, P2, and P3 in the wait-die scheme.

**WORK AREA:**

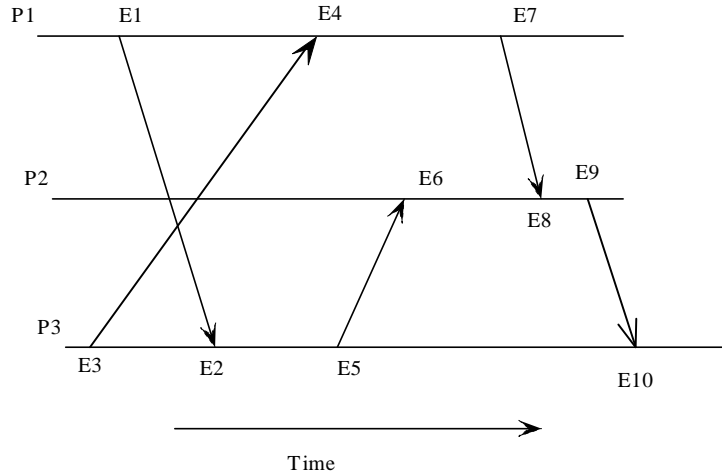


- (b) Repeat (a) above with wound-wait scheme.

**WORK AREA:**



(c) Using the following event diagram, determine the happened-before relationship (if it exists) in each pairs of events: (i)  $\langle E2, E8 \rangle$  (ii)  $\langle E5, E7 \rangle$  (iii)  $\langle E1, E6 \rangle$  (In other words, for each pair determine whether or not there is a happened-before relationship; if so how they are related. Justify)



**WORK AREA:**