Instructor: Ravi Mukkamala

CS 471: Operating System Concepts
Fall 2006
Examination II
Points: 150
November 11, 2006
Time: 8:30-11:30 AM
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.

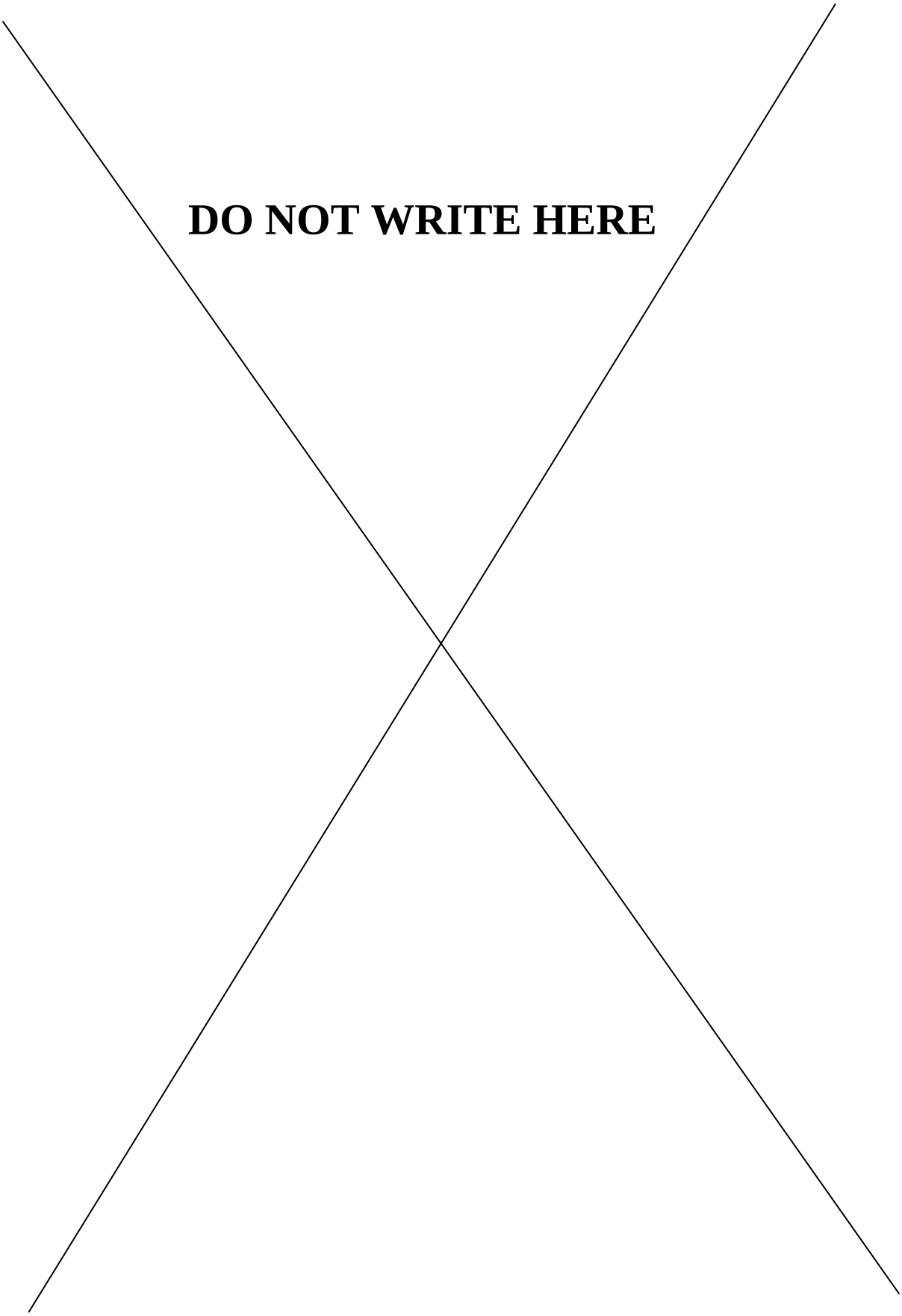
Name: _____ UID: _____

CS Unix ID: _____@cs.odu.edu

Question #	Points	
	Maximum	Obtained
1	30	
2	30	
3	30	
4	30	
5	30	
Total	150	

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

USE A BLACK PEN TO ANSWER THE QUESTIONS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Question 1.

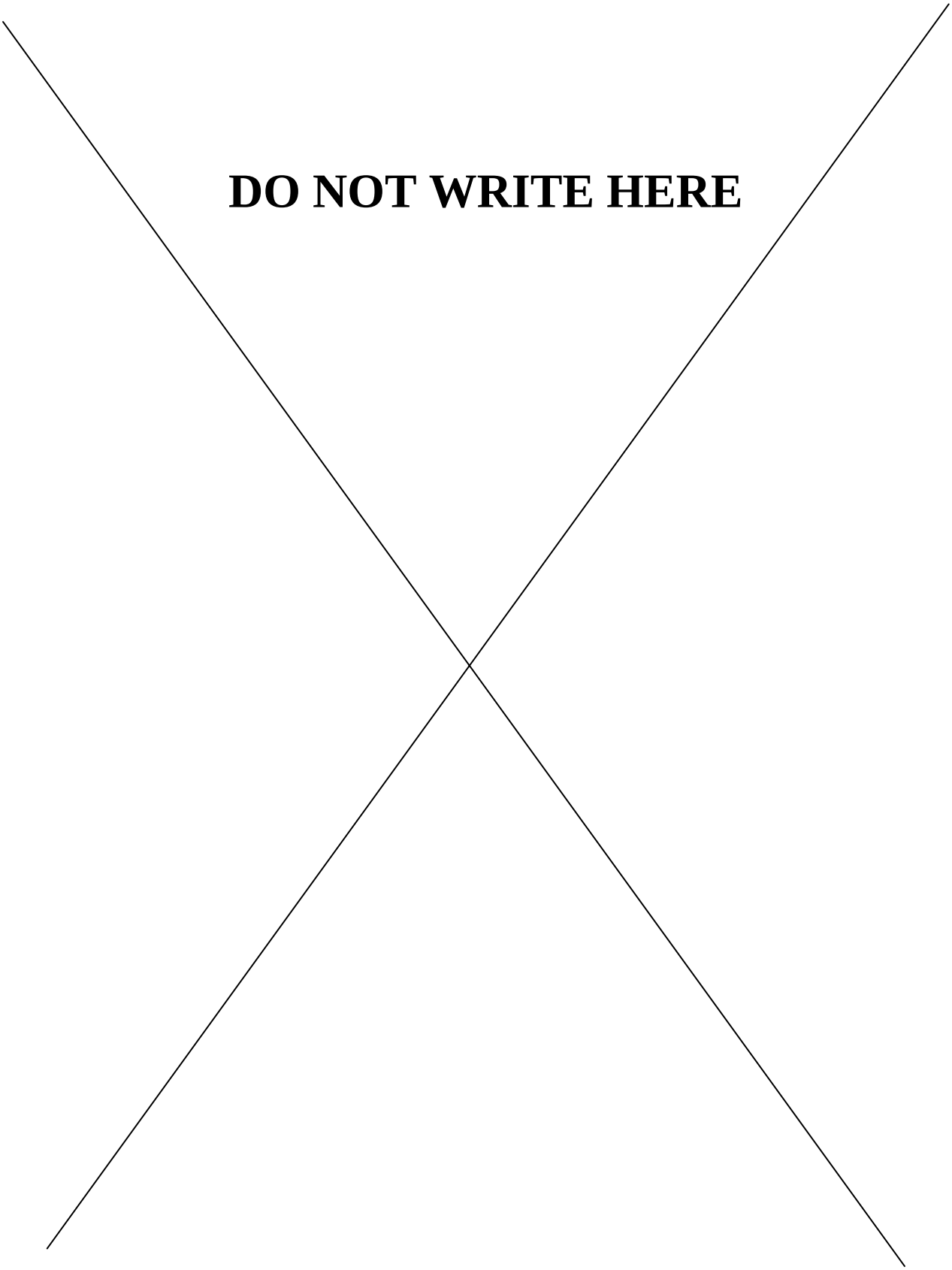
(a) How many page faults occur for **optimal page replacement** algorithm for the following reference string with 4 page frames?

1,2,3,1,3,4,2,4,5,2,3,6,4,5

WORK AREA

(b) In a virtual paging system, on the average 1 out of 10 page references result in a page fault. If average page-fault handling time is 2 milliseconds and main-memory access time is 200 nanoseconds, determine the effective access time in nanoseconds.

WORK AREA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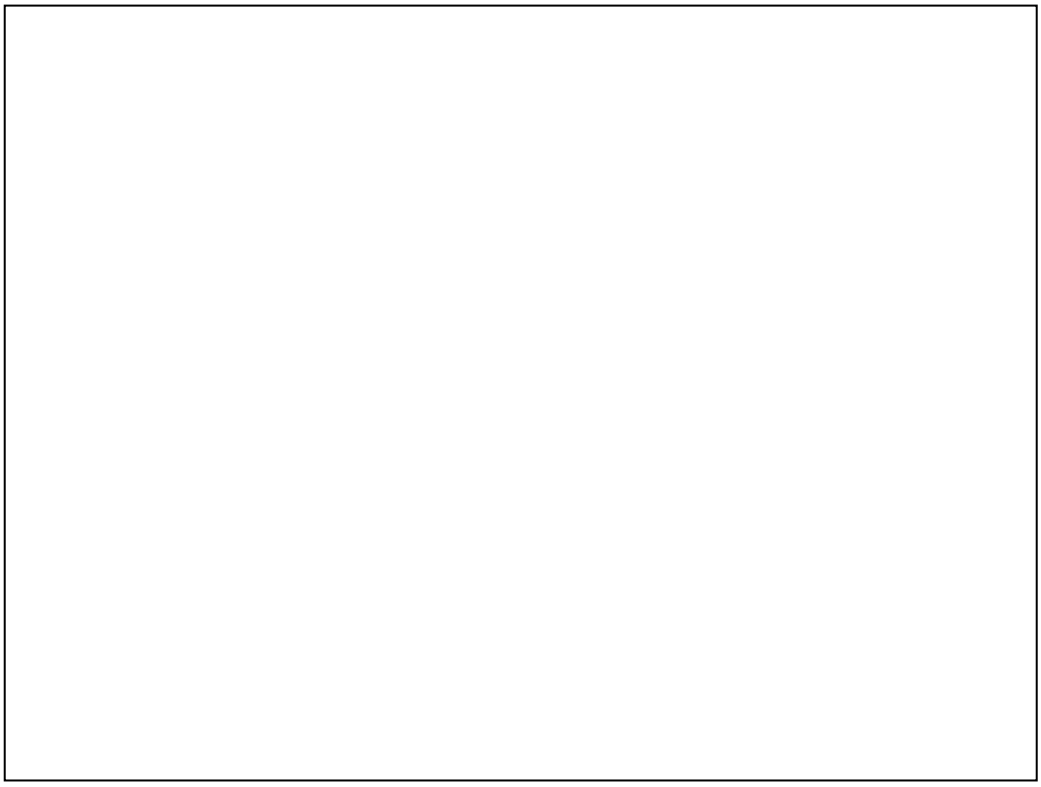
(c) A computer has 200 Mbytes of main memory. Out of this, only 100 Mbytes is allocated for user processes. If a system has 20 user processes at any time in the system, where 5 of them have 10 Mbytes size, 10 have 20 Mbytes size, and the remaining 5 have 50 Mbytes in size, determine the size of the memory that should be allocated to each process using **proportional allocation**. (1 Mbytes = 1024 kbytes; 1 kbytes = 1024 bytes)

WORK AREA

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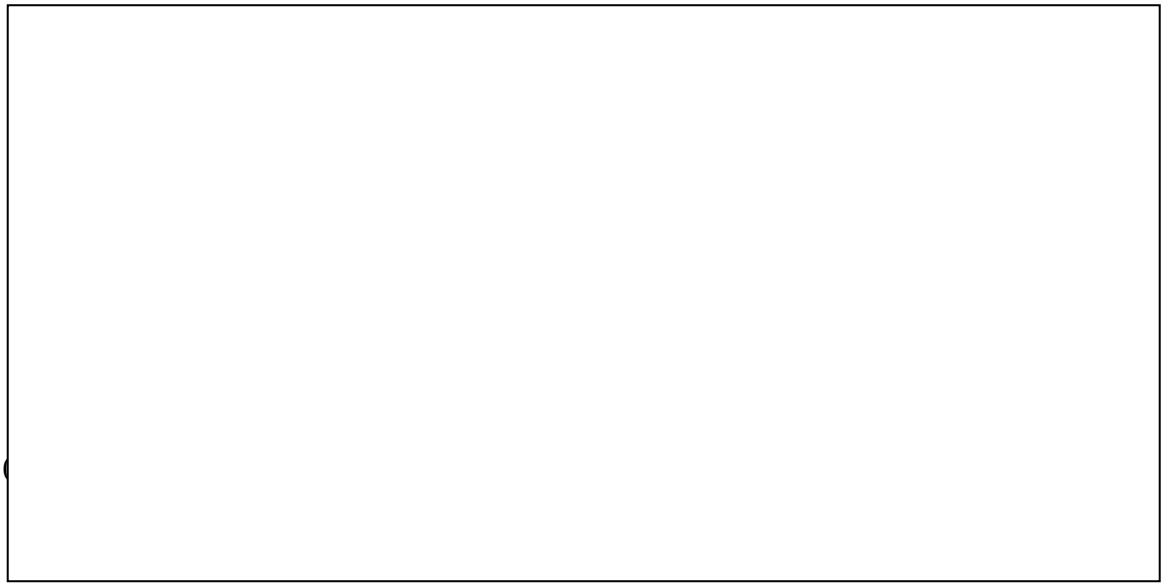
Question 2.

(a) On a disk, space is allocated using **linked** allocation. If a file F1 (8 logical blocks, 0-7) is allocated the following physical disk blocks (in that order), determine the number of disk accesses needed: (i) To read logical block 5; (ii) To append a new logical block at the end of the file.

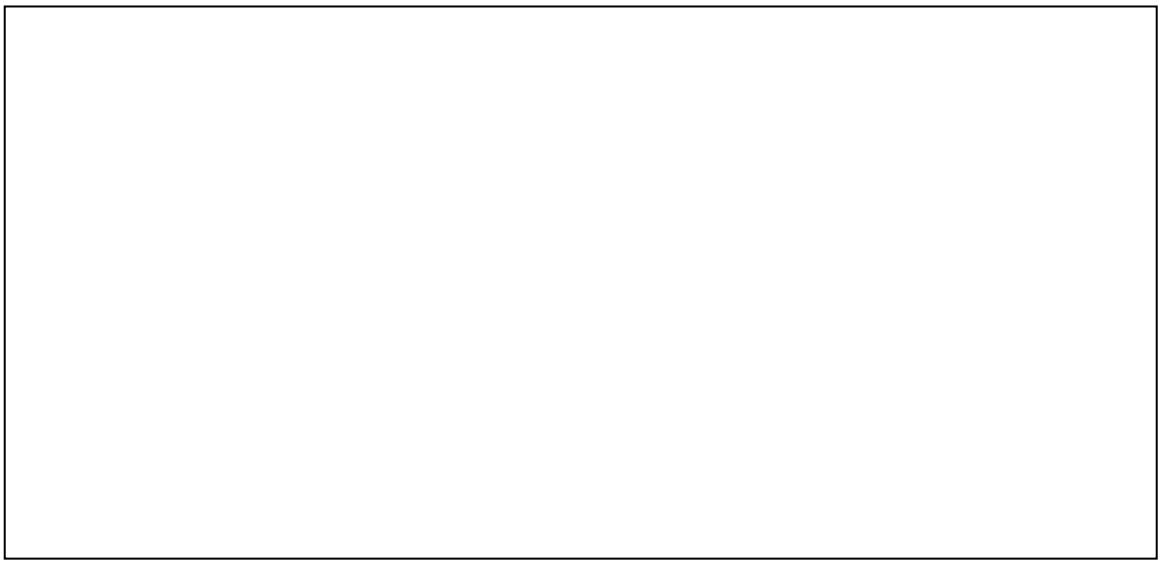
Physical blocks allocated to F1 (in order) are: 56, 289, 70, 1090, 12, 26, 550, 900

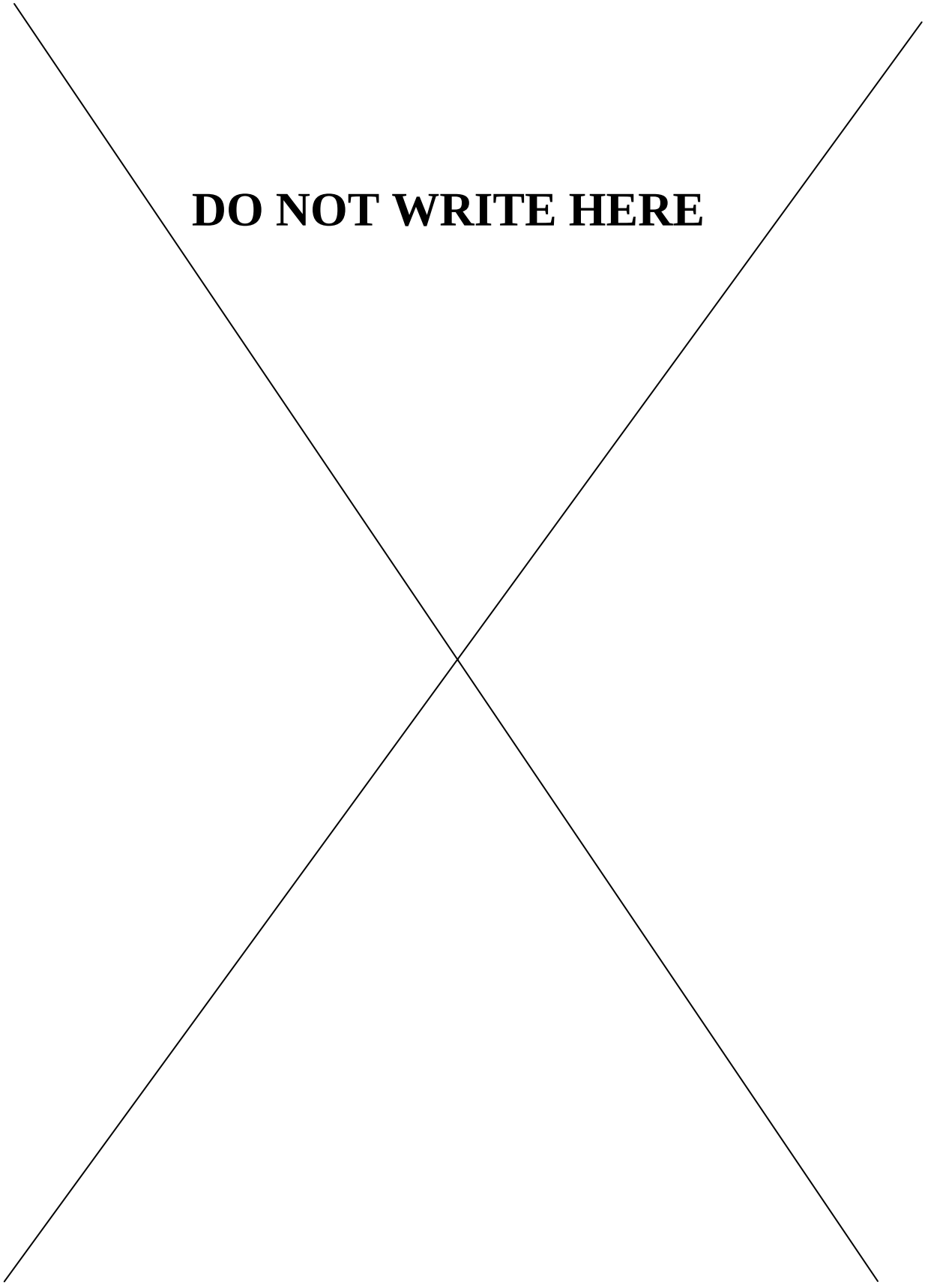
WORK AREA



(b) Briefly describe how the path-name translation takes place in NSF to lookup for the directory path: **/usr/fac/mukka/teaching/cs471fall06**.

WORK AREA:

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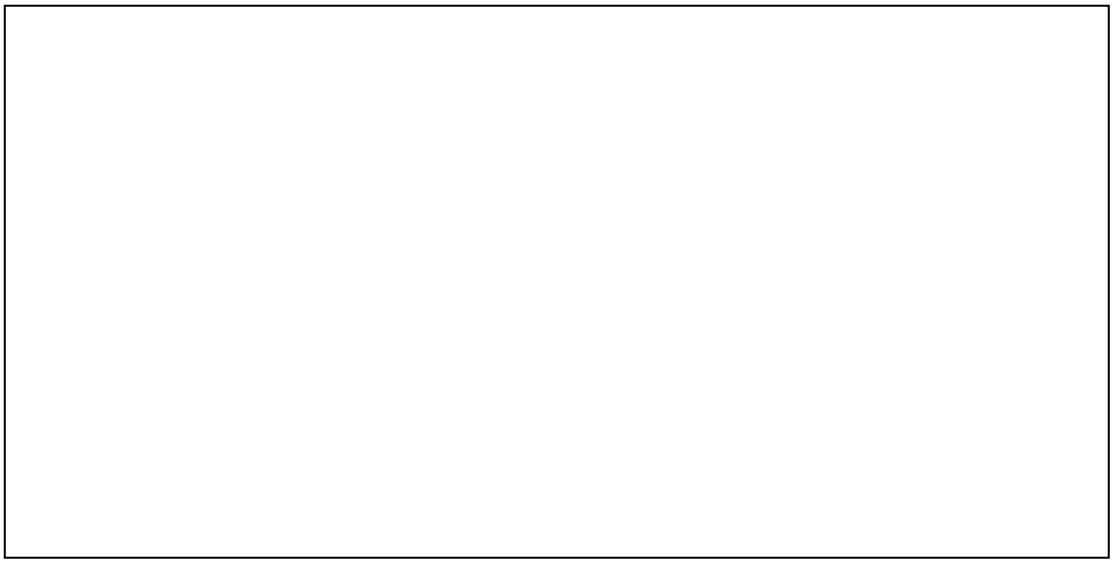
Question 3.

(a) Suppose that a disk drive has 5000 cylinders, numbered 0..4999. The drive is currently serving a request at cylinder 4000, and the previous request was at cylinder 120. The queue of pending requests, in FIFO order, is: 3500, 100, 4000, 500, 1000

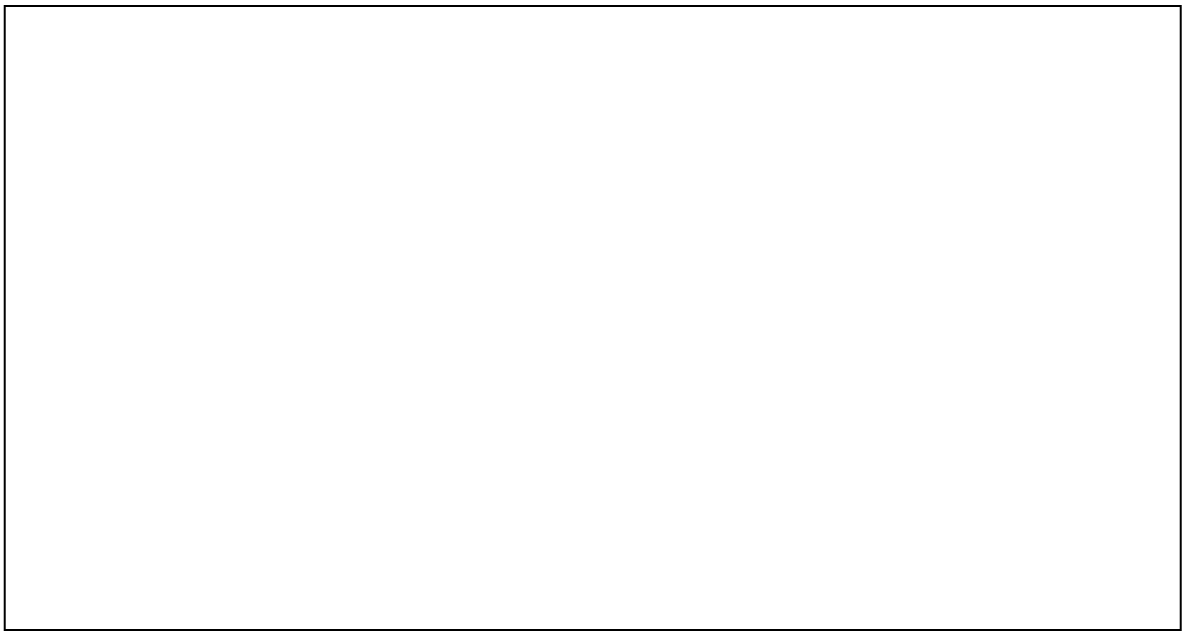
Starting from the current head position, what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for **SCAN disk-scheduling algorithm?**

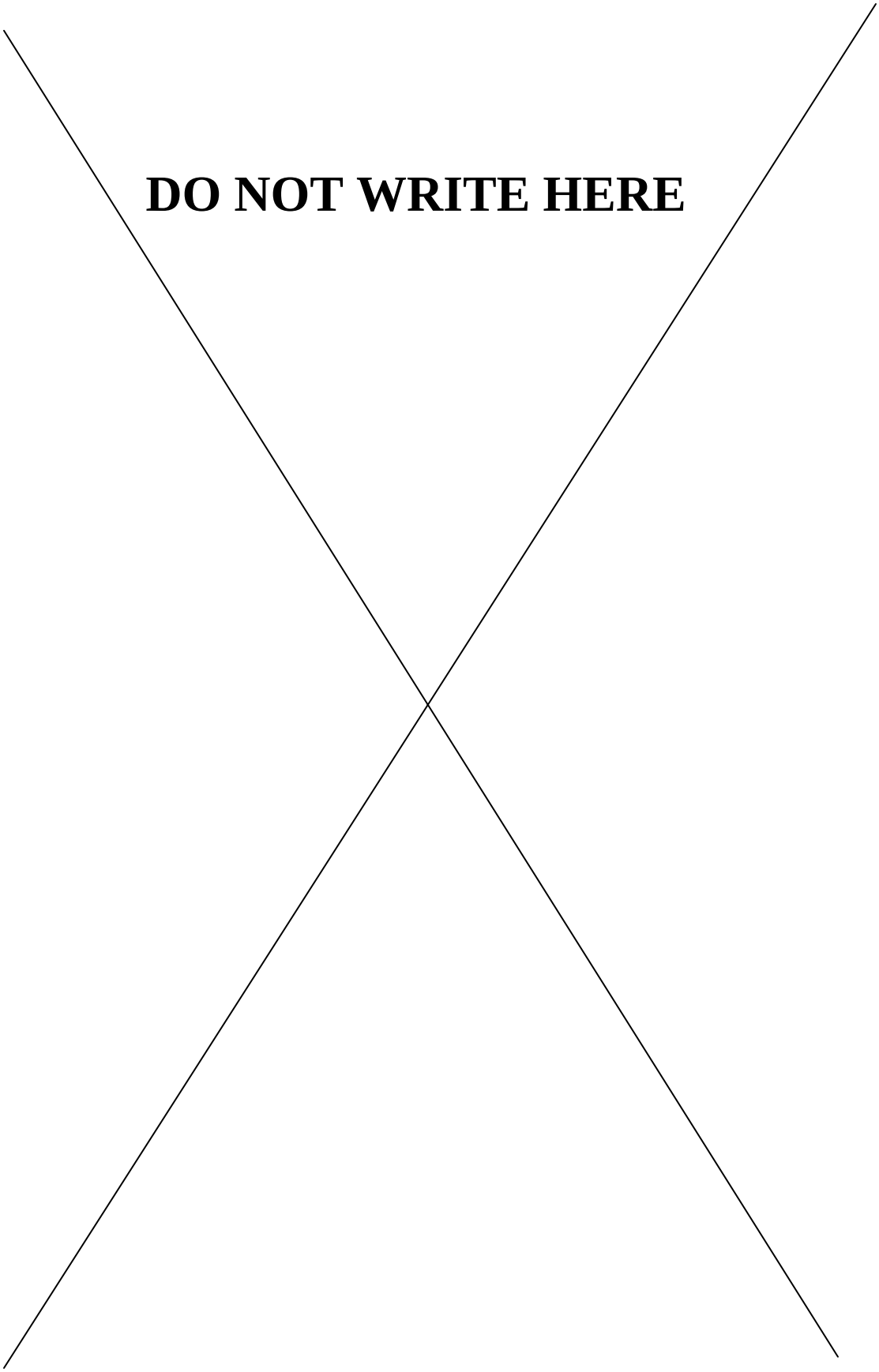
WORK AREA:



(b) In a disk drive, each track has 250 sectors (sector size = 1024 bytes). The disk drive rotates at 500 RPM. If the average seek time for a request is 3 milliseconds, determine the **sustained bandwidth** and **effective bandwidth** to service 9096-byte (in contiguous sectors) requests. The transfer rate of the disk is 15 Mbytes/second (1 Mega = 1024 kbytes; 1 kbyte = 1024 bytes).

WORK AREA:

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Question 4.

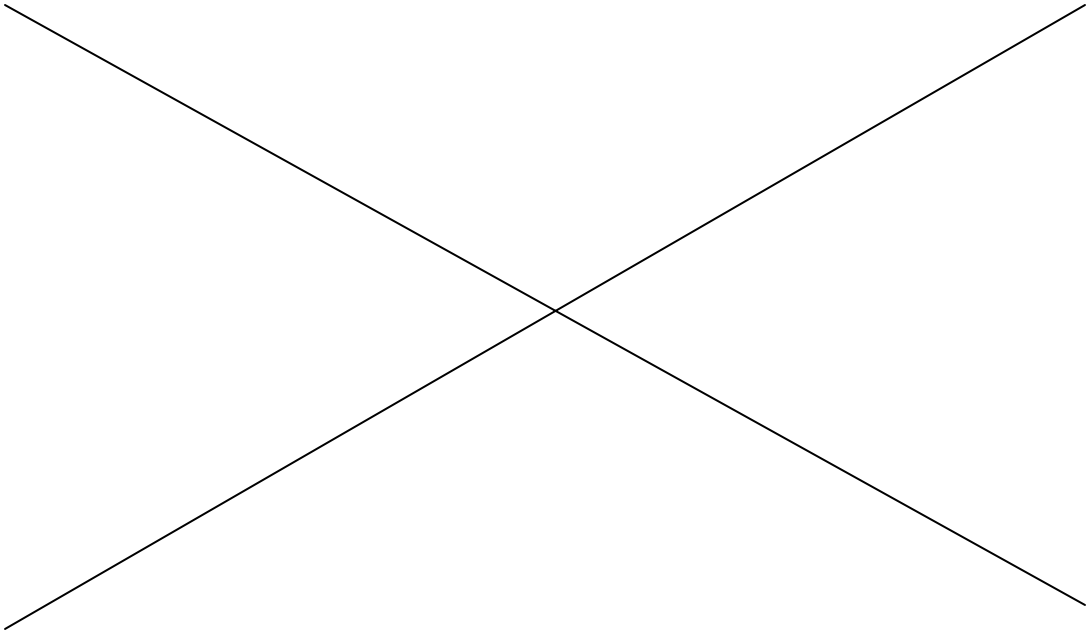
(a) Using the following access matrix, show the possible sequence of domains (and operations it is permitted to execute) that a program that **started in domain D3** would go through prior to its termination.

Domain/object	F1	F2	F3	F4	D1	D2	D3	D4	D5
D1	read	Read	Write			Switch			
D2		Read	write						
D3			Read	Read					Switch
D4	write			write	Switch				
D5		Write	Write	read				Switch	

WORK AREA:

(b) Explain what type of security threats are being addressed by the following security mechanisms: (i) Digital signatures (ii) Encryption

WORK AREA:



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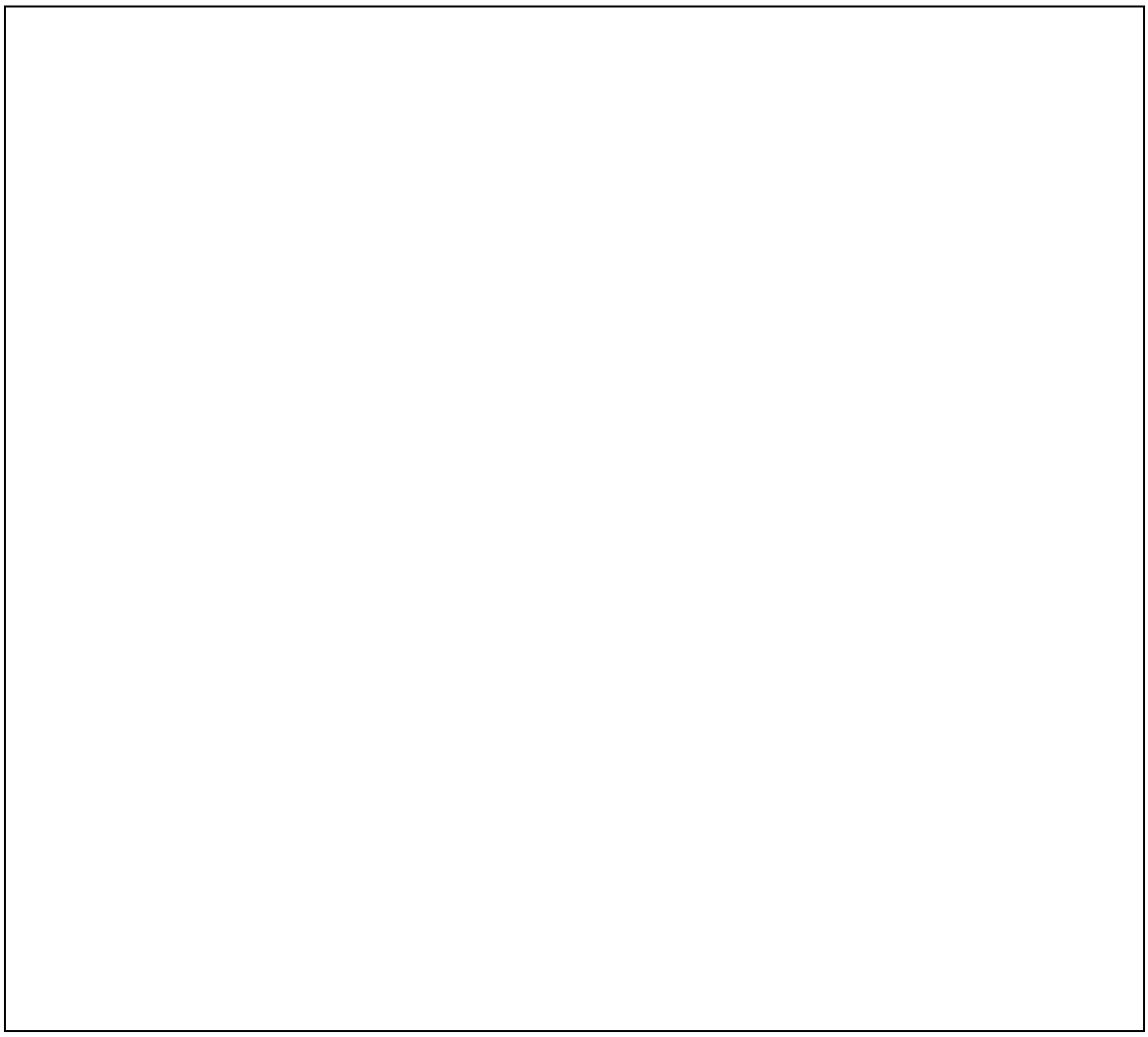
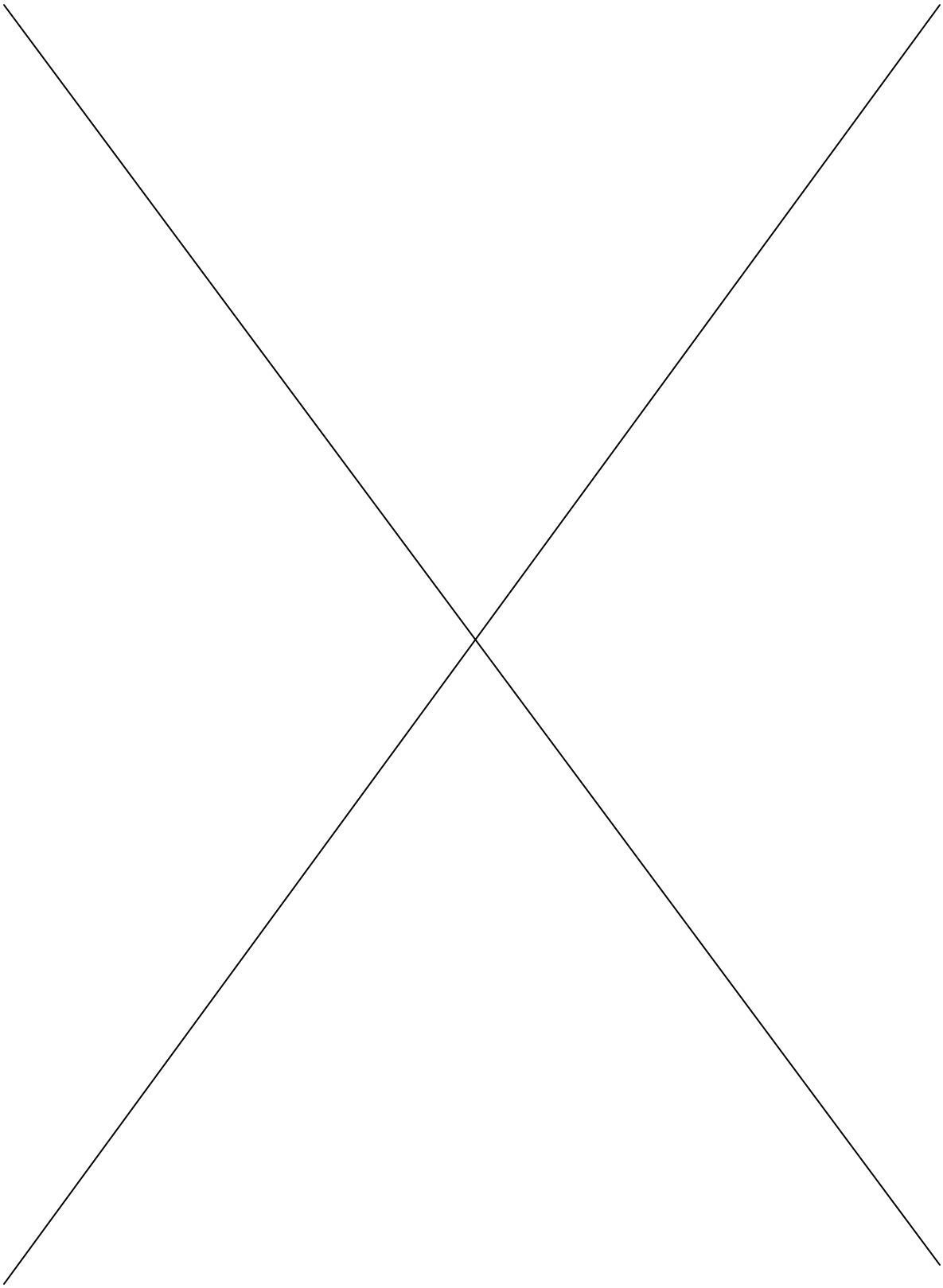
Question 5.

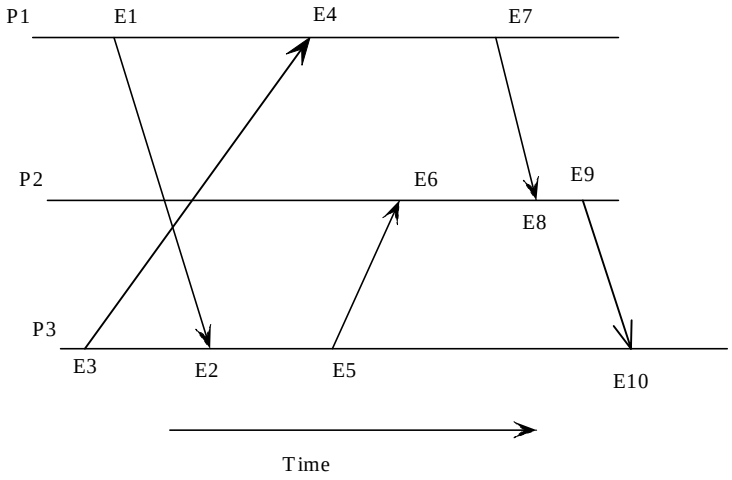
(a) Describe the out come of the following types of failures in a two-phase commit protocol involving four processes P1, P2, P3, and P4. P1 acts as a coordinator and a participant. (i) Coordinator P1 failed after sending prepare message to others but before it started phase 2 (ii) After sending "yes" in phase 1, P2 failed before receiving a decision from the coordinator in phase 2.

WORK AREA:





(b) Using the following event diagram, determine the timestamps assigned by the local nodes to events E1-E10 in a distributed system with 3 nodes running processes P1-P3, respectively. Assume that these are the only activities that have taken place during this time. The logical clocks at the three processes (P1-P3), prior to these events are 100, 2000, and 300, respectively.



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