

JK LAKSHMIPAT UNIVERSITY, JAIPUR

INSTITUTE OF ENGINEERING AND TECHNOLOGY

Mid Term II Examination, Dec 2022
B.Tech. Semester V

Roll No.....

CS1108: Operating Systems

Time: 3 hours

Max. Marks: 30

Instructions to students:

1. Do not write anything other than your roll number on the question paper.
2. Assume suitable data wherever required and mention it clearly.
3. Scientific calculators are allowed.
4. Attempt all the questions. Explain your answer wherever required

- Q.1** Q: Consider a user program of logical address of size 6 pages and page size is 4 bytes. The physical address contains 300 frames. The user program consists of 22 instructions a, b, c, . . . u, v. Each instruction takes 1 byte. Assume at that time the free frames are 7, 26, 52, 20, 55, 6, 18, 21, 70, and 90. Find the following? 04 (LO-6)
- A) Draw the logical and physical maps and page tables?
 - B) Allocate each page in the corresponding frame?
 - C) Find the physical addresses for the instructions m, d, v, r?
 - D) Calculate the fragmentation if exist?
- Q.2** Q: Consider a program consists of five segments: S0 = 600, S1 = 14 KB, S2= 100 KB, S3 =580 KB, and S4 = 96 KB. Assume at that time, the available free space partitions of memory are 1200-1805, 50 - 150, 220-234, and 2500-3180. Find the following: 4 (LO-6)
1. Draw logical to physical maps and segment table?
 2. Allocate space for each segment in memory?
 3. Calculate the external fragmentation and the internal fragmentation?
 4. What are the addresses in physical memory for the following logical addresses: (a) 0-580, (b) 1-17 (c) 2-66 (d) 3-82 (e) 4-20?
- Q.3** a) Consider a single level paging scheme. The virtual address space is 4 MB and page size is 4 KB. What is the maximum page table entry size possible such that the entire page table fits well in one page? 5 (LO-6)
- b) Consider a machine with 64 MB physical memory and a 32-bit virtual address space. If the page size is 4 KB, what is the approximate size of the page table?
- Q.4** Consider the following page reference using three frames that are initially empty. Find the page faults using a) FIFO algorithm and b) LRU algorithm, where the page reference sequence: 7,0,1,2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1? 04 (LO-6)
- Q.5** An operating system uses the banker's algorithm for deadlock avoidance when managing the allocation of three resource types X, Y and Z to three processes P0, P1 and P2. The table given below presents the current system state. Here, the Allocation matrix shows the current number of resources of each type allocated to each process and the Max matrix shows the maximum number of resources of each type required by each process during its execution. 4 (LO-5)

	Allocation			Max		
	X	Y	Z	X	Y	Z
P0	0	0	1	8	4	3
P1	3	2	0	6	2	0
P2	2	1	1	3	3	3

There are 3 units of type X, 2 units of type Y and 2 units of type Z still available. The system is currently in safe state. Consider the following independent requests for additional resources in the current state-

REQ1: P0 requests 0 units of X, 0 units of Y and 2 units of Z

REQ2: P1 requests 2 units of X, 0 units of Y and 0 units of Z

Which of the following will result in safe sequence of process execution?

1. Only REQ1 can be permitted
2. Only REQ2 can be permitted

Q.6 (a) Given a disk with 200 tracks, where track requests are received in the following order

55, 58, 39, 18, 90, 160, 150, 38, 184.

The starting position for the arm is track 100. Calculate the number of tracks crossed when the following algorithms are used

- First Come First Serve
- Shortest Seek First
- The elevator algorithm starting in the direction UP.

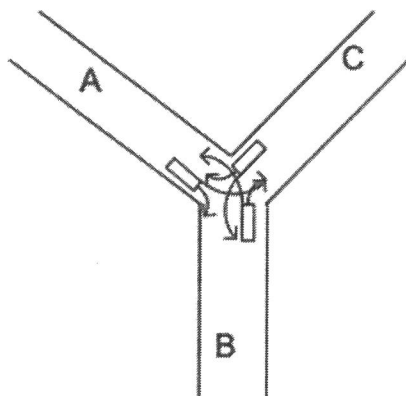
3
(LO-
7)

Q.7 A shared variable x , initialized to zero, is operated on by four concurrent processes W, X, Y, Z as follows. Each of the processes W and X reads x from memory, increments by one, stores it to memory and then terminates. Each of the processes Y and Z reads x from memory, decrements by two, stores it to memory, and then terminates. Each process before reading x invokes the P operation (i.e. wait) on a counting semaphore S and invokes the V operation (i.e. signal) on the semaphore S after storing x to memory. Semaphore S is initialized to two. What is the maximum possible value of x after all processes complete execution?

2
(LO-
4)

Q.8 Cars arrive at the intersection along the roads marked A, B, and C, and proceed to take a left or a right turn. Thus Car A taking a right turn goes to road B and taking a left turn goes to road C, etc. The intersection has no traffic light or any other traffic control signs. Each car knows the road it is on and the turn it wants to take. Cars along each road come in one at a time and execute a procedure LEFT or RIGHT to go left or right respectively, passing the identity of the road it is coming from as an argument. (Thus car coming on road B and wanting to take a left will execute LEFT(B)).

4
(LO-
4)



- a) Design the procedures LEFT and RIGHT using semaphores. The correct solution should support maximal parallelism, assure that no deadlocks occur, and there is no starvation. Of course there should be no collisions of the cars.
- b) How many semaphore variables does your solution require and why?
- c) What is the maximum number of cars that can be in the intersection in your solution?