B/L/TX

Reg. No: 23MID0011

VIT
Vellore Institute of Technology

Final Assessment Test – November 2024

Course: CSI1002 - Operating System Principles
Class NBR(s): 1692/1699/1702/1712/1720
Time: Three Hours
Slot: C2
Max. Marks: 100

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

Answer ALL Questions
(10 X 10 = 100 Marks)

1. What is a trap? Justify the need for operating system being interrupt-driven. List five services provided by an operating system, and explain how each creates convenience for users.

2. With a neat diagram describe the context-switch between processes. What resources are used when a thread is created? How do they differ from those used when a process is created?

3. *Consider the set of processes with arrival time (in milliseconds), CPU burst time (in milliseconds) and priority (0 is the highest priority) shown below. None of the processes have I/O burst time. Draw a gantt chart and calculate the AWT and ATT for the FCFS, SJF and Preemptive Priority Process Scheduling algorithms,*

Process	Arrival time	Burst Time	Priority
P1	0	11	2
P2	5	28	0
P3	12	2	3
P4	2	10	1
P5	9	16	4

4. Consider the following snapshot of a system:

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	0	1	1	0	0	2	1	0	1	5	2	0
P1	1	2	3	1	1	6	5	2				
P2	1	3	6	5	2	3	6	6				
P3	0	6	3	2	0	6	5	2				
P4	0	0	1	4	0	6	5	6				

Answer the following using the banker's algorithm:

a) What is the content of the matrix Need?
b) Is the system in a safe state?
c) If a request from process P1 arrives for (0, 4, 2, 0), can the request be granted immediately?

8. Consider the below page reference string How many page faults would occur in the case? Using LRU and Optimal algorithm. Note that initially all the 3 frames are empty. Page reference string: 0,1,4,2,0,2,6,5,1,2,3,2,1,2,6.

9.a) Assume we have a paging system which uses associative registers. These associative registers have an access time of 30 ns, and the memory access time is 470 ns. The system has a hit ratio of 90 %. Find the effective access time.

Consider a logical address space of 64 pages of 1,024 words each mapped onto a physical memory of 32 frames.

- How many bits are there in the logical address?
- How many bits are there in the physical address?

OR

9.b) With a diagram explain the concept of fragmentation and paging.

10.a) Consider a file currently consisting of 100 blocks. Assume that the file-control block (and the index block, in the case of indexed allocation) is already in memory. Calculate how many disk I/O operations are required for contiguous, linked, and indexed (single-level) allocation strategies, if, for one block, the following conditions hold. In the contiguous-allocation case, assume that there is no room to grow at the beginning but there is room to grow at the end. Also assume that the block information to be added is stored in memory.

a) The block is added at the beginning.
b) The block is added in the middle.
c) The block is added at the end.
d) The block is removed from the beginning.
e) The block is removed from the middle.
f) The block is removed from the end.

OR

10.b) Suppose that the head of moving hard disk with 200 tracks numbered 0 to 199 is currently serving the request at track 143 and has just finished a request at track 125. If the queue request is kept in FIFO order, 86, 147, 91, 177 , 94, 150, 102, 175, 130 What is the total head movement to satisfy these requests for i) FCFS ii) SSTF disk scheduling algorithm.

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5. With an example show that, if the wait() and signal() semaphore operations are not executed atomically, then mutual exclusion may be violated.

The following program consists of 3 concurrent processes and 3 binary semaphores. The semaphores are initialized as S0=1, S1=0, S2=0. Comment on the number of times "print" will get executed with appropriate explanation.

Process P0	Process P1	Process P2
while (true) { wait (S0); print (0); signal (S1); signal (S2); }	wait (S1); signal (S0);	wait (S2); signal (S0);

6. List the necessary conditions for Critical Section Solution. Discuss various solutions to critical section problem using peterson's algorithm.

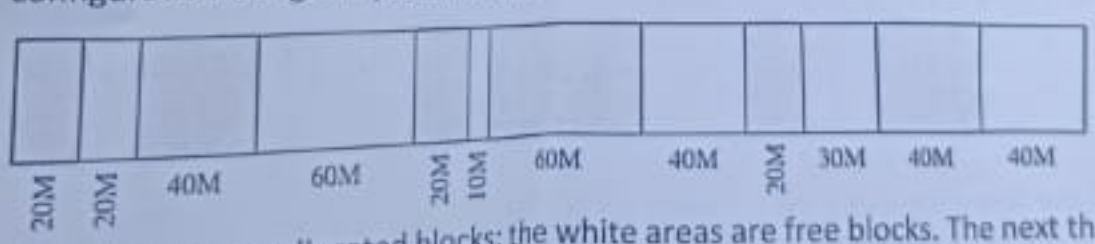
7. a) In a simple segmentation system with the following segment table:

Segment	Starting Address	Length (Bytes)
0	660	248
1	1752	422
2	222	198
3	996	604
4	1525	76

Determine the physical address for the following logical addresses; indicate segment faults.

i. 0, 198
ii. 2, 156
iii. 1, 530
iv. 3, 444
v. 0, 222

b) A dynamic partitioning scheme is being used, and the following is the memory configuration at a given point in time



The shaded areas are allocated blocks; the white areas are free blocks. The next three memory requests are for 40M, 20M, and 10M. Indicate the starting address for each of the three blocks using the following placement algorithms:

i. First-fit ii. Best-fit iii. Worst-fit