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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

February 2025 Semester End Main Examinations

Programme: B.E. **Semester: IV**

Branch: Artificial Intelligence and Machine Learning **Duration: 3 hrs.**

Course Code: 24AM4ESOPS **Max Marks: 100**

Course: Operating Systems

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			CO	PO	Marks
		UNIT - I			
1	a)	Describe the various states a process using a state transition diagram.	*CO1*	*PO1*	**6**
	b)	Describe the architecture for multithreaded web server with a neat diagram.	*CO2*	*PO1*	**8**
	c)	Explain the roles and interactions between kernel and user mode in an operating system with a neat sketch.	*CO2*	*PO1*	**6**
		OR			
2	a)	Illustrate the use of fork and exec system calls.	*CO1*	*PO1*	**6**
	b)	Describe the various conditions under which a process can be terminated in an operating system.	*CO1*	*PO1*	**6**
	c)	Explain the multithreading models in detail with relevant examples.	*CO1*	*PO1*	**8**
		UNIT - II			
3	a)	In the following example, there are six processes named P1, P2, P3, P4, P5 and P6. Their arrival time and burst time are given below in the table. The time quantum of the system is 2 units. Apply the Round Robin Job scheduling algorithm and answer the following questions i. Represent the execution of the processes with the help of the Gantt chart. ii. Calculate the average turnaround time and average waiting time.	*CO2*	*PO2*	**10**

Process ID	Arrival time	Burst time
P1	0	4
P2	1	5
P3	2	2
P4	3	1
P5	4	6
P6	6	3

		b)	Elaborate the four necessary conditions and strict alternation approach to the mutual exclusion with a turn variable.	*CO2*	*PO1*	**10**
			OR			
	4	a)	Consider the set of 5 processes whose arrival time and burst time are given below. The CPU scheduling policy is a priority preemptive (The higher number represents higher priority) and shortest remaining time first.	*CO2*	*PO2*	**5**

Process id	Arrival time	Burst time	Priority
P1	0	4	2
P2	1	3	3
P3	2	1	4
P4	3	5	5
P5	4	2	5

i. Compute the average waiting time and average turnaround time.
ii. Illustrate the scheduling of the processes using the Gantt chart

		b)	Consider the set of 3 processes whose arrival time and burst time are given below:	*CO2*	*PO2*	**5**

Process id	Arrival time	Burst time
P1	0	9
P2	1	4
P3	2	9

Apply SRTF CPU scheduling policy using Gantt chart, and calculate the average waiting time and average turnaround time.

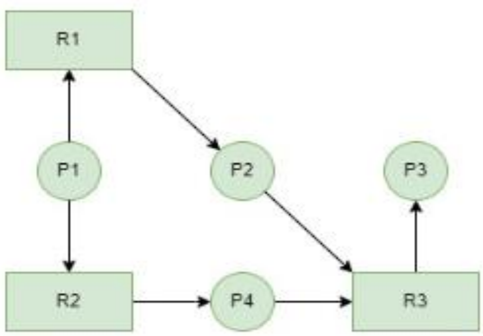
		c)	In a restaurant, the chef prepares dishes ordered by the customers where the orders are placed in order ticket system. When a customer places an order, it is queued in the ticket system. The restaurant's staff retrieves the orders from the queue and deliver them to the respective tables. Devise a solution to address the above scenario using semaphores. Justify with the help of pseudocode.	*CO2*	*PO2*	**10**
			UNIT - III			
	5	a)	Illustrate the mechanism of converting virtual addresses to physical addresses using memory management unit.	*CO2*	*PO1*	**6**
		b)	Apply FIFO and LRU page replacement algorithms for the given reference string 6,0,5,2,0,3,0,4,2,3,0,3,2,5,2,0,5,6,0,5(assuming 3 frame size) to find the total number of page faults, page hits, hit ratio and miss ratio.	*CO2*	*PO2*	**10**
		c)	With a help of neat diagram briefly explain the concept of swapping in memory management system.	*CO2*	*PO1*	**4**
			OR			
	6	a)	Describe the working of optimal page replacement algorithm and apply the same for a given page reference string: 1,2,3,4,2,1,5,6,2,1,2,3,7,6,3,2,1,2,3,6 with 3-page frames to find	*CO2*	*PO2*	**6**

	Q.No.		Question	CO	PO	Marks
			the total number of page faults, page hits, and page fault probability, percentage of page fault.			
		b)	Illustrate the working of second chance page replacement algorithm and apply the same to compute number of page faults, page hits, page hit ratio, and page miss ratio for the given page reference string: 0, 4, 1, 4, 2, 4, 3, 4, 2, 4, 0, 4, 1, 4, 2, 4, 3, 4 with 3-page frames.	*CO2*	*PO1*	**6**
		c)	Explain the concept of virtual memory and the structure of the page table in memory management system.	*CO2*	*PO1*	**8**
			UNIT - IV			
	7	a)	Assume that there are three resources A, B, and C. There are 4 processes P0 to P3. At T_0 we have the following resource-allocation state.	*CO2*	*PO2*	**10**

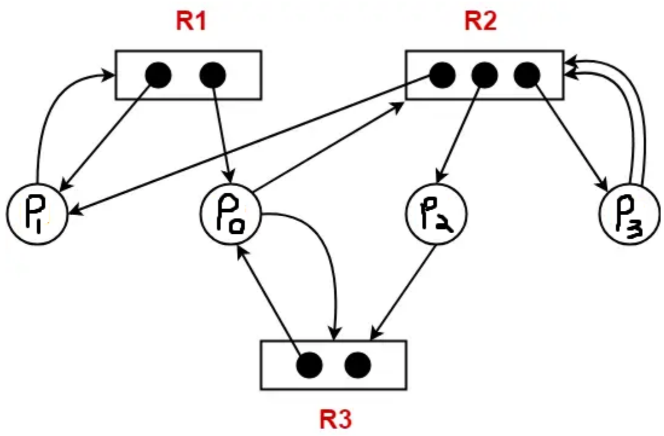
	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	1	0	1	2	1	1	2	1	1
P1	2	1	2	5	4	4			
P2	3	0	0	3	1	1			
P3	1	0	1	1	1	1			

i. Calculate the contents of need matrix.
ii. Is the system in a safe state? If so, find the sequence.

	Q.No.		Question	CO	PO	Marks
		b)	For a disk with 1000 cylinders (numbered 0-999), calculate the total number of tracks the disk arm must move to fulfill all the requests in the disk queue. Assume the previous request was serviced at track 756, and the disk arm is moving towards track 0. The disk queue contains requests for the following tracks: 811, 348, 153, 968, 407, and 500. Perform the calculations for the following disk scheduling algorithms and plot the corresponding graph: i. SSTF (Shortest Seek Time First) ii. SCAN (Elevator Algorithm).	*CO2*	*PO2*	**6**
		c)	i. For the given Resource Allocation Graph, write the wait-for-graph. ii. Justify whether there is any deadlock occurrence.	*CO2*	*PO2*	**4**



	Q.No.		Question	CO	PO	Marks
			OR			
	8	a)	Define deadlock. Discuss the necessary conditions for deadlock to occur in detail.	*CO1*	*PO1*	**6**
		b)	Consider a disk queue with requests for I/O to blocks on cylinders 98, 183, 41, 122, 14, 124, 65, 67. The head is initially at cylinder	*CO2*	*PO2*	**8**

			number 53. The cylinders are numbered from 0 to 199. Calculate the total head movement for the following disk scheduling algorithms: i) C-SCAN ii) C-LOOK			
		c)	Consider the resource allocation graph given below. Find if the system is in a deadlock state otherwise find a safe sequence. 	*CO2*	*PO2*	**6**
			UNIT - V			
	9	a)	Explain the following types of file system implementation: i)Contiguous ii)Linked list	*CO2*	*PO1*	**7**
		b)	A photo editing application allows users to open, modify, and save images. Describe the different file access methods (sequential and random) and explain which method is best suited for the application when a user needs to edit specific portions of an image file.	*CO2*	*PO2*	**6**
		c)	Describe the three major methods of allocating disk space for storing files with neat sketches and strategies involved in implementing file sharing.	*CO2*	*PO1*	**7**
			OR			
	10	a)	Discuss the concept of a file, highlighting its attributes and the operations performed on it.	*CO2*	*PO1*	**7**
		b)	Describe the Bit Vector and Linked List techniques for free space management.	*CO1*	*PO1*	**6**
		c)	Explain the direct and sequential access methods in file operations with suitable examples for each.	*CO1*	*PO1*	**7**

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