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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: Computer Science and Engineering **Duration: 3 hrs.**
Course Code: 23CS4PCOPS **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.

		UNIT - I	CO	PO	Marks
1	a)	Describe the various services provided by an operating system with a neat diagram and demonstrate how these services benefit both users and the system itself.	CO1	PO1	10
	b)	Analyze the following fork function call program and determine the output, as well as the total number of processes and child processes created during the program's execution. *int main()* *{* *int val=25;* *if(fork()==0)* *printf("value=%d\n",++val);* *printf("value=%d\n",--val);* *return 0;* *}*	CO2	PO2	5
	c)	Evaluate the effectiveness of different inter-process communication methods, such as message passing, shared memory, and pipes, in terms of performance, scalability, and ease of implementation.	CO2	PO2	5
		OR			
2	a)	With a neat transition diagram, analyze how the operating system changes its mode of operation from user to kernel modes based on the instructions that are executed. Also mention the changes in the mode bit during the transition.	CO2	PO2	7
	b)	With a neat diagram of the PCB, Explain the information fields in the PCB.	CO1	PO1	7
	c)	Compare and contrast between the multiprogramming and multitasking system.	CO2	PO2	6
		UNIT - II			
3	a)	Describe the different types of multithreading models. Discuss their advantages and disadvantages, and provide examples where each model might be most effectively utilized.	CO1	PO1	10

		b)	Consider the following set of processes with Arrival Time, Burst Time and Priority given in milliseconds. Create a Gantt Chart where a lower number indicates a higher priority. Calculate the Average Waiting Time, Turnaround Time, and Response Time for the processes. Compare these metrics using both priority preemptive and non-preemptive scheduling.	***CO2***	***PO2***	**10**

Process	Arrival Time	Burst Time	Priority
P1	0	3	5
P2	2	2	3
P3	3	5	2
P4	4	4	4
P5	6	1	1

OR

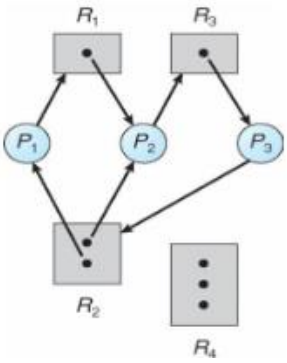
4	a)	Consider the following set of processes with arrival time and burst time given in milliseconds. Draw the Gantt Chart illustrating the execution of these processes using FCFS and non-preemptive SJF scheduling. What is the TAT and WT of each process in all cases? At what time the Ready-q has maximum number of processes in all the cases.	***CO2***	***PO2***	**10**

Process	Arrival-time	Burst-time
P1	0	10
P2	0	1
P3	3	2
P4	5	1
P5	10	5

	b)	List and Explain Threading issues in multithreaded programming.	***CO2***	***PO2***	**10**
		UNIT - III			
5	a)	Provide a code example to illustrate the solution to the bounded buffer problem and discuss how semaphores ensure synchronization between producer and consumer processes.	***CO2***	***PO2***	**10**
	b)	Apply Banker's algorithm for the following and find out whether the system is in safe state or not.	***CO2***	***PO2***	**10**

Process	Allocation				Max				Available			
	A	B	C	D	A	B	C	D	A	B	C	D
P0	4	0	0	1	6	0	1	2				
P1	1	1	0	0	2	7	5	0				
P2	1	2	5	4	2	3	5	6	3	2	1	1
P3	0	6	3	3	1	6	5	3				
P4	0	2	1	2	1	6	5	6				

OR

	6	a)	Analyze how the reader and writer make use of the semaphores to allow multiple readers to read at the same time. Only one single writer can access the shared data at the same time. Write the code for to demonstrate the same.	*CO2*	*PO2*	**10**
		b)	Describe the necessary conditions for deadlock. Write the description of the resource allocation graph given below and identify whether the graph shown below contains deadlock or not justify your answer. 	*CO2*	*PO2*	**10**
			UNIT - IV			
	7	a)	Given memory partitions of 200K, 700K, 500K, 300K, 100K, and 400K, apply the First Fit, Best Fit, and Worst Fit algorithms to allocate memory for requests of 315K, 427K, 250K, and 550K. Determine which algorithm makes the most efficient use of memory.	*CO2*	*PO2*	**10**
		b)	With a neat diagram explain the role of hardware support for relocation and limit registers in memory management. How do these registers work together to ensure the safe and efficient execution of processes?	*CO1*	*PO1*	**10**
			OR			
	8	a)	Given a reference pattern that accesses the sequence of blocks 4, 7, 6, 1, 7, 6, 1, 2, 7, 2, 5, 4, and assuming the cache uses associative mapping, find the hit ratio with a cache of four lines using the following replacement policies: LRU, LFU, and FIFO.	*CO2*	*PO2*	**10**
		b)	Describe the steps involved in handling page faults in a demand paging system with a neat diagram.	*CO1*	*PO1*	**10**
			UNIT - V			
	9	a)	Consider a disk with 200 cylinders numbered from 0 to 199. The read/write head is currently at cylinder 50, and the queue of pending requests is as follows: 82, 170, 43, 140, 24, 16, 190. Calculate the total distance traveled (in cylinders) by the disk arm to satisfy these requests using the FCFS, SSTF, LOOK, and SCAN algorithms. Provide illustrations with graphs for each algorithm.	*CO3*	*PO3*	**10**
		b)	Compare and contrast Acyclic-Graph Directories and Tree-Structured Directories in operating system storage management. Discuss their advantages, disadvantages, and use cases.	*CO2*	*PO2*	**10**

			OR			
	10	a)	Why are VMMs unable to implement trap-and-emulate-based virtualization on certain CPUs? In the absence of the ability to trap-and-emulate, what alternative method can a VMM use to implement virtualization?	***CO1***	***PO1***	**10**
		b)	Justify in detail "In what scenarios would you recommend using a Type 0 hypervisor versus a Type 1 hypervisor?"	***CO1***	***PO1***	**10**

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