U.S.N.										

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: 22AM4PCOPS **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 process states using a state transition diagram.	CO1	PO1	**6**
	b)	Illustrate interprocess communication with an example.	CO1	PO2	**6**
	c)	Describe the architecture of multithreaded web server with a neat diagram.	CO2	PO1	**8**
		OR			
2	a)	Microsoft develops a text editor that automatically saves documents to the disk when the save button is pressed. Illustrate different system calls used in this scenario.	CO1	PO2	**10**
	b)	Instagram emphasizes on building a real time messaging interface. Illustrate the classical thread model and describe the implementation of threads in both user and kernel space, ensuring optimal performance and responsiveness for the messaging interface.	CO2	PO1	**10**
		UNIT - II			
3	a)	Illustrate how Producer- Consumer Problem can be implemented using semaphores.	CO2	PO1	**6**
	b)	Explain mutual exclusion using critical region and the four necessary conditions for a good mutual exclusion.	CO1	PO2	**6**
	c)	Consider the following set of 5 processes, with the length of the CPU-burst time given in milliseconds: Process | Burst Time | Priority P1 | 10 | 3 P2 | 1 | 1 P3 | 2 | 3 P4 | 1 | 4 P5 | 5 | 2 The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0.	CO3	PO3	**8**

			i. Draw Gantt charts illustrating the execution of these processes using a priority (a smaller priority number implies a higher priority), and Round Robin (quantum= 1) scheduling algorithms. ii. Calculate the average turnaround time and average waiting for each of the scheduling algorithms			
			OR			
	4	a)	i) Define Dining Philosophers problem. Discuss the solution for Dining Philosopher's problem using semaphores. ii) Each user requires 400kb of memory (350kb code + 50kb data). How much memory is required for 50 users? Shared pages allow "multiple users to share the same memory pages for code" that is identical among them, if so how much memory required for 50 users.	*CO3*	*PO4*	**10**
		b)	Consider the following set of processes, with the length of the CPU burst time given in milliseconds Process | Burst Time | Priority P1 | 2 | 2 P2 | 1 | 1 P3 | 8 | 4 P4 | 4 | 2 P5 | 5 | 3 The processes are assumed to have arrived in the order P1, P2, P3, P4, P5, all at time 0. i. Draw Gantt charts that illustrate the execution of these processes using the following scheduling algorithms: SJF, non-preemptive priority (a larger priority number implies a higher priority), ii. Compute waiting time and turnaround time of each process for each of the scheduling algorithms in part a?	*CO2*	*PO3*	**10**
			UNIT - III			
	5	a)	Elucidate the working of Optimal page replacement algorithm with an example.	*CO1*	*PO1*	**5**
		b)	Discuss the working principle of Working Set page replacement algorithm. Apply the same algorithm for a given page reference string: 2,6,1,5,7,7,7,5,1,6,2,3,4,1,2,3,4,4,4 with window size(W)=5. Calculate the number of Page faults, Page hits, Hit ratio, and Miss ratio.	*CO3*	*PO3*	**10**
		c)	Describe the benefits of Virtual memory technique.	*CO1*	*PO1*	**5**
			OR			
	6	a)	Describe the two ways to keep track of memory usage.	*CO3*	*PO3*	**10**
		b)	How Second chance page replacement algorithm differ from FIFO page replacement algorithm? Apply second chance page	*CO1*	*PO2*	**5**

<table>
<tr><td></td><td></td><td></td><td>replacement algorithm for the given page reference string: 2, 3, 2, 1, 5, 2, 4, 5, 3, 2, 3, 5 with 3-page frames. Calculate the following:
i. number of page faults
ii. page hits
iii. page hit ratio
iv. page miss ratio.</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>c)</td><td>How virtual addresses can be converted into physical addresses using Memory Management Unit. Describe with an example.</td><td>CO2</td><td>PO3</td><td>5</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Describe the concept of a file with its attributes and operations.</td><td>CO3</td><td>PO4</td><td>5</td></tr>
<tr><td></td><td></td><td>b)</td><td>Explain contiguous and linked disk space allocation methods with diagram.</td><td>CO1</td><td>PO1</td><td>5</td></tr>
<tr><td></td><td></td><td>c)</td><td>A disk drive has 5000 cylinders, numbered 0 to 4999. The drive is currently Serving a request at cylinder 143. The queue of pending requests in FIFO order is 86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130. Starting from current head position, what is a total distance travelled (in cylinders) that the Disk arm to satisfy the requests using FCFS, SSTF, SCAN, LOOK and C-LOOK algorithms.</td><td>CO3</td><td>PO4</td><td>10</td></tr>
<tr><td></td><td colspan="6">OR</td></tr>
<tr><td></td><td>8</td><td>a)</td><td>Illustrate on different components of disk architecture and highlight the importance of disk formatting in Operating Sytems.</td><td>CO2</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>VMware is developing a new AI-based operating system designed to support various types of file systems seamlessly. The experts have decided to implement a Virtual File System (VFS) layer. Highlight the importance of this decision and elucidate how the VFS works.</td><td>CO3</td><td>PO4</td><td>10</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>9</td><td>a)</td><td>Define deadlock. Identify and explain briefly the necessary conditions for the deadlock to occur.</td><td>CO1</td><td>PO1</td><td>5</td></tr>
<tr><td></td><td></td><td>b)</td><td>Consider the following snapshot of a system:
<table>
<tr><th rowspan="2">Process</th><th colspan="4">Allocation</th><th colspan="4">Max</th><th colspan="4">Available</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>D</th><th>A</th><th>B</th><th>C</th><th>D</th><th>A</th><th>B</th><th>C</th><th>D</th></tr>
<tr><td>P0</td><td>2</td><td>0</td><td>0</td><td>1</td><td>4</td><td>2</td><td>1</td><td>2</td><td>3</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>P1</td><td>3</td><td>1</td><td>2</td><td>1</td><td>5</td><td>2</td><td>5</td><td>2</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P2</td><td>2</td><td>1</td><td>0</td><td>3</td><td>2</td><td>3</td><td>1</td><td>6</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P3</td><td>1</td><td>3</td><td>1</td><td>2</td><td>1</td><td>4</td><td>2</td><td>4</td><td></td><td></td><td></td><td></td></tr>
<tr><td>P4</td><td>1</td><td>4</td><td>3</td><td>2</td><td>3</td><td>6</td><td>6</td><td>5</td><td></td><td></td><td></td><td></td></tr>
</table>
Apply Banker’s algorithm to find the following:
i) Is the system being safe? If so, give the safe sequence.
ii) If process P2 requests (0, 1, 1, 3) resources can it be granted immediately?</td><td>CO3</td><td>PO3</td><td>10</td></tr>
<tr><td></td><td></td><td>c)</td><td>Illustrate Master – Slave multiprocessors with an example.</td><td>CO2</td><td>PO1</td><td>5</td></tr>
<tr><td></td><td colspan="6">OR</td></tr>
<tr><td></td><td>10</td><td>a)</td><td>The system administrator at Microsoft noticed that the company's servers experienced a Blue Screen of Death (BSOD) error on July</td><td>CO3</td><td>PO4</td><td>10</td></tr>
</table>

			19th, 2024, causing them to get stuck and wait for other servers to release their resources. This deadlock situation significantly disrupted services for aircraft and satellites. Illustrate how the system administrator can implement different deadlock recovery strategies to resolve this issue.			
		b)	Elucidate on different types of Multi-Processing Operating Systems with their advantages and disadvantages.	*CO1*	*PO1*	**10**

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