U.S.N.										

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

Autonomous Institute Affiliated to VTU

October 2024 Supplementary Examinations

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

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

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

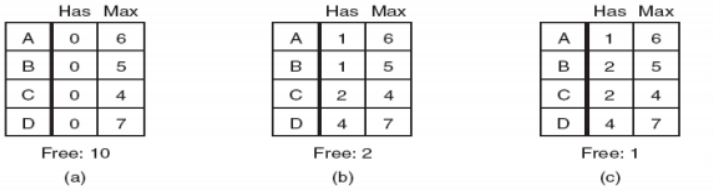
Course: Operating Systems

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

		UNIT - I	*CO*	*PO*	Marks
1	a)	What is a process? Explain the different states of process with neat diagram.	*1*	*1*	**6**
	b)	Define Operating System. List and explain different types of OS.	*1*	*1*	**6**
	c)	Elaborate the steps involved in making the system call read (fd, buffer, nbyte) with a neat diagram and list the system call with its description used for file management.	*2*	*1*	**8**
		UNIT - II			
2	a)	Explain mutual exclusion using critical region and the four necessary conditions for a good mutual exclusion.	*1*	*1*	**5**
	b)	Elaborate strict alternation approach to the mutual exclusion with a turn variable.	*1*	*1*	**7**
	c)	Consider the following set of 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. i. Draw two Gantt charts illustrating the execution of these processes using non preemptive priority (a smaller priority number implies a higher priority), and Round Robin (quantum=1) scheduling. ii. What is the turnaround time and waiting time of each process for each of the scheduling algorithms in part i?	*3*	*2*	**8**

<table>
<tr><td></td><td></td><td></td><td>iii. Which of the scheduling algorithm in part i results in the minimal average waiting time?</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>3</td><td>a)</td><td>Elaborate the working principles of the TSL (Test-and-Set-Lock) instruction using pseudocode, focusing how it ensures mutual exclusion.</td><td>2</td><td>1</td><td>5</td></tr>
<tr><td></td><td></td><td>b)</td><td>Explain producer-consumer problem along with its solution using semaphores.</td><td>1</td><td>1</td><td>7</td></tr>
<tr><td></td><td></td><td>c)</td><td>Consider the following five processes each having its own unique burst time and arrival time.

<table><tr><th>Process Queue</th><th>Burst time</th><th>Arrival time</th></tr><tr><td>P1</td><td>6</td><td>2</td></tr><tr><td>P2</td><td>2</td><td>5</td></tr><tr><td>P3</td><td>8</td><td>1</td></tr><tr><td>P4</td><td>3</td><td>0</td></tr><tr><td>P5</td><td>4</td><td>4</td></tr></table>i. Draw two Gantt charts illustrating the execution of these processes using Non preemptive Shortest Job First(SJF) and preemptive SJT scheduling algorithm.
ii. Calculate Average waiting time for both the methods mentioned in i.
iii. Which of the scheduling algorithm in part i results in the minimal average waiting time?</td><td>3</td><td>2</td><td>8</td></tr>
<tr><td></td><td></td><td></td><td>UNIT - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>4</td><td>a)</td><td>Consider the following page reference string. 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1, for a memory with three frames. How many page faults would occur for Least Recently Used (LRU) and optimal replacement algorithms? Which is most efficient among them?</td><td>3</td><td>2</td><td>8</td></tr>
<tr><td></td><td></td><td>b)</td><td>Illustrate swapping in memory management with a neat sketch.</td><td>1</td><td>1</td><td>6</td></tr>
<tr><td></td><td></td><td>c)</td><td>Explain how bitmaps and free lists are used to keep track of memory usage in memory management system.</td><td>2</td><td>1</td><td>6</td></tr>
<tr><td></td><td></td><td></td><td>OR</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>Given memory partitions of 100K, 500K, 200K, 300K, and 600K (in order), how would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)? Which algorithm makes the most efficient use of memory?</td><td>3</td><td>2</td><td>8</td></tr>
<tr><td></td><td></td><td>b)</td><td>Describe the structure of a page table entry with a neat diagram.</td><td>1</td><td>1</td><td>6</td></tr>
<tr><td></td><td></td><td>c)</td><td>Illustrate the relation between virtual addresses and physical memory addresses using page table.</td><td>2</td><td>1</td><td>6</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>UNIT – IV</td><td></td><td></td><td></td></tr>
<tr><td>6</td><td>a)</td><td>Elucidate the concept of deadlock and the necessary conditions for deadlock to occur.</td><td>1</td><td>1</td><td>6</td></tr>
<tr><td></td><td>b)</td><td>Consider four process A, B, C, and D, each of them has been granted a certain number of resource units as shown in resource allocation states (a) to (c). Identify the safe, unsafe state and justify the answer to serve the request.
 
Has Max
A 0 6
B 0 5
C 0 4
D 0 7
Free: 10
(a)
Has Max
A 1 6
B 1 5
C 2 4
D 4 7
Free: 2
(b)
Has Max
A 1 6
B 2 5
C 2 4
D 4 7
Free: 1
(c)</td><td>3</td><td>2</td><td>6</td></tr>
<tr><td></td><td>c)</td><td>Consider a system that contains five processes P1, P2, P3, P4, P5 and the three resource types A, B and C. Resource type A has 10 instances, resource type B has 5 instances, and resource type C has 7. Suppose that at time T_0, we have the following resource-allocation state.
<table>
<tr><th rowspan="2">Process</th><th colspan="3">Allocation</th><th colspan="3">Max</th><th colspan="3">Available</th></tr>
<tr><th>A</th><th>B</th><th>C</th><th>A</th><th>B</th><th>C</th><th>A</th><th>B</th><th>C</th></tr>
<tr><td>P1</td><td>0</td><td>1</td><td>0</td><td>7</td><td>5</td><td>3</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>P2</td><td>2</td><td>0</td><td>0</td><td>3</td><td>2</td><td>2</td><td colspan="3" rowspan="4"></td></tr>
<tr><td>P3</td><td>3</td><td>0</td><td>2</td><td>9</td><td>0</td><td>2</td></tr>
<tr><td>P4</td><td>2</td><td>1</td><td>1</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>P5</td><td>0</td><td>0</td><td>2</td><td>4.</td><td>3</td><td>3</td></tr>
</table>
Answer the following questions using the banker's algorithm:
i.What is the reference of the need matrix?
ii.Determine if the system is safe or not.
iii. What will happen if the resource request is (1, 0, 0) for process P1, can the system accept this request immediately?</td><td>3</td><td>2</td><td>8</td></tr>
<tr><td></td><td></td><td>UNIT – V</td><td></td><td></td><td></td></tr>
<tr><td>7</td><td>a)</td><td>Illustrate different schemes for defining the logical structure of a directory.</td><td>1</td><td>1</td><td>8</td></tr>
<tr><td></td><td>b)</td><td>Explain bit vector and linked list approach to manage the free disk blocks illustrating how the free blocks are linked together.</td><td>2</td><td>1</td><td>5</td></tr>
<tr><td></td><td>c)</td><td>Discuss direct and sequential access methods in file operations with suitable examples for each.</td><td>2</td><td>1</td><td>7</td></tr>
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