

General instruction(s):

Answer All Questions

- M - Max mark; CO - Course Outcome; BL - Blooms Taxonomy Level (1 - Remember, 2 - Understand, 3 - Apply, 4 - Analyse, 5 - Evaluate, 6 - Create)

Course Outcomes

CO2: Design scheduling algorithms to compute and compare various scheduling criteria.

CO3: Apply and analyze communication between inter process and synchronization techniques.

CO4: Implement page replacement algorithms, memory management problems and segmentation.

Q. No	Question	M	CO																																																																								
1.	Consider a system having 5 Processes(P0,P1,P2,P3,P4) and 5 resource types (A,B,C,D,E) with available resources: (3 2 2 2 3) The allocation and maximum matrices are given below. Allocation matrix: <table border="1"> <thead> <tr> <th>Process</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th>E</th> </tr> </thead> <tbody> <tr> <td>P0</td> <td>1</td> <td>0</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>P1</td> <td>1</td> <td>1</td> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>P2</td> <td>1</td> <td>0</td> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>P3</td> <td>0</td> <td>1</td> <td>1</td> <td>1</td> <td>0</td> </tr> <tr> <td>P4</td> <td>0</td> <td>0</td> <td>0</td> <td>1</td> <td>1</td> </tr> </tbody> </table> Maximum matrix: <table border="1"> <thead> <tr> <th>Process</th> <th>A</th> <th>B</th> <th>C</th> <th>D</th> <th>E</th> </tr> </thead> <tbody> <tr> <td>P0</td> <td>3</td> <td>2</td> <td>2</td> <td>2</td> <td>1</td> </tr> <tr> <td>P1</td> <td>2</td> <td>2</td> <td>2</td> <td>1</td> <td>2</td> </tr> <tr> <td>P2</td> <td>3</td> <td>1</td> <td>3</td> <td>1</td> <td>2</td> </tr> <tr> <td>P3</td> <td>1</td> <td>2</td> <td>2</td> <td>2</td> <td>1</td> </tr> <tr> <td>P4</td> <td>2</td> <td>1</td> <td>1</td> <td>2</td> <td>2</td> </tr> </tbody> </table> Calculate the need matrix and find the system is in safe state or not, finally show the safe sequence order of processes.	Process	A	B	C	D	E	P0	1	0	1	1	0	P1	1	1	0	0	1	P2	1	0	1	0	1	P3	0	1	1	1	0	P4	0	0	0	1	1	Process	A	B	C	D	E	P0	3	2	2	2	1	P1	2	2	2	1	2	P2	3	1	3	1	2	P3	1	2	2	2	1	P4	2	1	1	2	2	10	CO
Process	A	B	C	D	E																																																																						
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2.	A university has a single high-speed printer shared by two processes, P0 and P1. Both processes may request the printer at the same time. If both access the printer simultaneously, the output may become corrupted. Using Peterson's Algorithm, answer the following:	10																																																																									

**VIT**

Vellore Institute of Technology

REG.NO.:

SLOT: A2+TA2

SCHOOL OF COMPUTER SCIENCE ENGINEERING AND INFORMATION SYSTEMS

CAT-II

FALL SEMESTER 2026-2027

SESSION : II

	a) Identify the critical section in this scenario and state the Peterson's algorithm for P0 and P1.[4] b) Demonstrate a situation where both P0 and P1 request the printer simultaneously and Clarify how Peterson's algorithm guarantees mutual exclusion.[4] c) State the limitations of using Peterson's algorithm in modern multiprocessor system. [2]		CO3	
3.	A system has five processes competing for five shared resources arranged in a circular manner. Each process requires two adjacent resources to enter its critical section. Assume that all five processes simultaneously acquire their first resource and then wait for their second resource. Analyze the above situation and answer the following: a) Identify the classical synchronization problem represented by this scenario. [1] b) Using a suitable resource-allocation diagram, demonstrate how deadlock can occur. [3] c) Justify which conditions for deadlock are satisfied in this situation. [2] d) Propose two different synchronization strategies to prevent or avoid the deadlock. [2] e) Give details how your proposed solutions affect mutual exclusion, progress, and starvation. [2]	10	CO3	4
4.	A computer system has 4-page frames. During execution of a large application, the following page-reference string is recorded: 1, 2, 3, 4, 1, 5, 2, 1, 6, 2, 3, 7, 4, 2, 5, 1, 2, 6, 3, 4, 5, 2, 1, 7, 3 The operating system wants to evaluate the performance of different page replacement algorithms. a) Apply the FIFO page replacement algorithm to the above reference string and calculate the total number of page faults. [3] c) Apply the LRU page replacement algorithm and calculate the total number of page faults. [3] d) Apply the Optimal page replacement algorithm and calculate the total number of page faults. [2] e) Compare the results obtained from FIFO, LRU, and Optimal. Justify why the number of page faults differs and identify which algorithm requires knowledge of future page references. [2]	10	CO4	4
5.	A system has the following free memory blocks: 120 KB, 350 KB, 180 KB, 420 KB, 600 KB Five processes request memory in the following order: P1 = 250 KB, P2 = 390 KB, P3 = 110 KB, P4 = 500 KB, P5 = 170 KB	10	CO4	5

Answer the following:

- a) Apply the First Fit, Best Fit, and Worst Fit memory allocation strategies. Show the allocation and remaining memory after each process. [6]
- b) For each strategy, identify which processes are successfully allocated and which processes remain unallocated. [2]
- c) A new process $P_6 = 280$ KB arrives after P_1 – P_5 have been processed. Determine whether P_6 can be allocated under each strategy. Clarify your answer with reference to external fragmentation. [2]