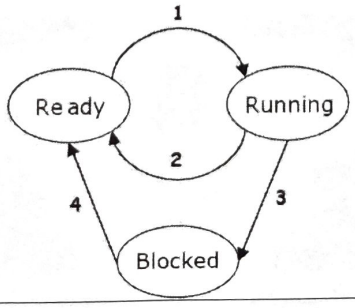
NATIONAL INSTITUTE OF TECHNOLOGY PATNA
Department of Computer Science and Engineering
End-Semester Examination (July-Dec 2022)

Subject: Operating System (CS34111) **Course: B.Tech.**

Full Marks: 60 Duration: 3 Hrs

Instruction: Answer any six questions

<table>
<tr><th>No.</th><th>Questions</th><th>Marks</th><th>CO</th><th>BL</th></tr>
<tr><td rowspan="3">1.</td><td>(a) Why is context switch an overhead? Illustrate with a diagram considering two processes.</td><td>3</td><td>1</td><td>2</td></tr>
<tr><td>(b) Let T1 be the time taken to switch from user mode to kernel mode of execution and T2 is the time taken to switch between two user processes. Which of the following is correct? Justify your answer.
i. T1 > T2 ii. T1 = T2 iii. T1 < T2
iv. Nothing can be said about the relation between T1 and T2</td><td>2</td><td>1</td><td>2</td></tr>
<tr><td>(c) Given Memory partitions of 100K, 500K, 200K, 300K, and 600K (in order),
i. How would each of the First-fit, Best-fit, and Worst-fit algorithms place processes of 212K, 417K, 112K, and 426K (in order)?
ii. Which algorithm in part (i) makes the most efficient use of memory? Justify your answer.</td><td>5</td><td>3</td><td>3, 4</td></tr>
<tr><td rowspan="2">2.</td><td>(a) Discuss paging with a suitable diagram. Explain how it helps to remove external fragmentation.</td><td>6</td><td>3</td><td>2</td></tr>
<tr><td>(b) Discuss thrashing and its causes. How working-set model helps to prevent thrashing?</td><td>4</td><td>3</td><td>2</td></tr>
<tr><td rowspan="2">3.</td><td>(a) Consider the following set of processes, with the length of the CPU burst time, and arrival time (in milliseconds).
<table>
<tr><th>Process</th><th>Arrival Time</th><th>Burst Time</th><th>Priority</th></tr>
<tr><td>P1</td><td>0</td><td>12</td><td>2</td></tr>
<tr><td>P2</td><td>2</td><td>7</td><td>4</td></tr>
<tr><td>P3</td><td>3</td><td>2</td><td>1</td></tr>
<tr><td>P4</td><td>4</td><td>5</td><td>0</td></tr>
<tr><td>P5</td><td>5</td><td>2</td><td>3</td></tr>
</table>
i. Draw Gantt charts that illustrate the execution of these processes using the pre-emptive SJF, Round robin (time quantum = 2), and pre-emptive priority scheduling algorithm (assume lower value having higher priority).
ii. Compute the turnaround time and waiting time of each process with respect to the scheduling algorithms given in part (a).</td><td>6</td><td>1</td><td>5</td></tr>
<tr><td>(b) In the following process state transition diagram for a uniprocessor system, assume that there are always some processes in the ready state:

</td><td>4</td><td>1</td><td>2</td></tr>
</table>

	Illustrate an instance for the occurrence of the following process transition 1, 2, 3, and 4.			
4.	(a) Comment upon the Race condition with a suitable example. How can semaphores be used to handle it?	4	2	2
	(b) Discuss Peterson's solution to the critical section problem. Justify its validity with respect to the requirements of a solution for the critical section problem.	6	2	4
5.	(a) What are the various techniques used for handling deadlock? Discuss how deadlock prevention differs from deadlock avoidance.	5	2	2
	(b) Consider the following snapshot of a system: P_0 P_3 P_4 P_1 P_2 **Allocation** **Max** **Available** A B C D A B C D A B C D P_0 2 0 0 1 4 2 1 2 3 3 2 1 P_1 3 1 2 1 5 2 5 2 P_2 2 1 0 3 2 3 1 6 P_3 1 3 1 2 1 4 2 4 P_4 1 4 3 2 3 6 6 5 Illustrate using the banker's algorithm that the system is in a safe state by demonstrating an order in which the processes may complete.	5	2	3, 4
6.	(a) Consider the following memory references made by a process: 1, 2, 3, 4, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 4, 5, 3 Assume four (4) frames are allocated to this process and all frames are initially empty. Calculate the number of page faults for the following algorithms: i. Optimal Algorithm ii. Least Recently Used	5	3	3
	(b) How does the Translation Look-aside Buffer enhance the efficiency of paging? Suppose paging system using TLB has an 80-percent hit ratio. If it takes 35 nanoseconds to search the TLB and 120 nanoseconds to access memory, what will be the effective memory access time?	5	3	2, 3
7.	(a) Differentiate between: (any two) i. Logical and Physical address space ii. Starvation and convoy effect iii. Acyclic-Graph directories and Tree-Structured directories	4	4	2, 4
	(b) Suppose that the disk drive has 5000 cylinders numbered 0 to 4999. The drive is currently serving a request at cylinder 143 and the previous request was at 125. The queue of the pending request is: 86, 1470, 913, 1174, 948, 1509, 1022, 1750, 130 i. Find out the total head movement (seek time) incurred while servicing these requests using FCFS, SSTF, C-SCAN, and LOOK scheduling algorithms. ii. Which of the algorithms in part (i) results in the minimum head movements and maximum head movement?	6	4	3, 4

5881 1721 3271