

Continuous Assessment Test (CAT) – I - JANUARY 2025

Programme	:	B.Tech (Electronics and Computer Engineering, CSE, BEE BAI)	Semester	:	Winter 24-25
Course Code & Course Title	:	BCSE303L- Operating Systems	Slot	:	C1+TC1
Faculty	:	Dr.SREEJA P S Dr.PRADEEP K Dr.SAMBATH M	Class Number	:	CH2024250502066 CH2024250502068 CH2024250502069
Duration	:	1.30 Hrs	Max. Mark	:	50

General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information.
- Use statistical tables supplied from the exam cell as necessary
- Use graph sheets supplied from the exam cell as necessary
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks
1		<p>You are tasked with designing an operating system (OS) for a highly critical aerospace navigation system. The OS must be capable of maintaining uninterrupted operation of essential navigation functions, even in the event of component failures. It should ensure that only trusted modules are granted access to sensitive data, such as flight paths and mission-critical parameters, while separating less critical tasks, like monitoring and logging. Additionally, the OS must handle time-sensitive data, including sensor inputs and flight control adjustments, with minimal latency. The system should also support the seamless integration of new technologies, such as AI-driven predictive maintenance, without affecting the core system's functionality.</p> <p>Your objective is to identify the most suitable OS structure to meet these requirements. (2 marks)</p> <p>Provide a detailed explanation, with an appropriate diagram, of how this structure ensures fault tolerance, security, and real-time performance. (6 marks)</p> <p>In your perspective discuss the potential drawbacks of this structure and propose strategies to mitigate these challenges. (2 marks)</p>	10
2		<p>Devise a multithreaded program that performs various tasks based on the given input. The program should prompt the user to input a value N, then create separate worker threads. One thread will check for prime number, while another will calculate the sum of odd numbers in N. Once the worker</p>	10

		threads complete their tasks, the parent thread will display the results. (7 marks) Also discuss your interpretation of the shared resources across the threads. (3 marks)	
3		Consider a scenario where a parent process creates a child process using a system call. The child process is responsible for generating n random numbers. Devise a program to implement using C. Also, explain the consequences when the parent process terminates without properly reaping the child process. How will the child process be handled in this case? (6 + 4 marks)	10
4		<p>VIT Chennai is hosting a cultural festival with three competitions: a high-priority Public Speaking Contest with a 2- time unit for each student, a medium-priority Drawing Contest where students will participate in a sequence with a 4-time unit for each participant, and a low-priority Handwriting Contest where students will participate based on their arrival order at the Handwriting Contest area. All students must first participate in the Public Speaking Contest. After completing a competition, they cannot participate in that competition again and proceed to the next lower priority competition. Six students arrive at the registration desk at the following times: 8:00 AM, 8:02 AM, 8:03 AM, 8:05 AM, 8:07 AM, and 8:09 AM. Each student has a total allotted time for all competitions like 12, 3, 5, 2, 7, and 8 time units, respectively. Determine the order in which each student participates in each competition, draw Gantt Chart, calculate the Average Turnaround Time and Average Waiting Time for each student across all competitions.</p> <p>Discuss how the time allotted for each student in the Public Speaking and Drawing Contests could be adjusted to improve overall system performance.</p>	10
5		<p>Consider a system with uniprocessor and four processes X, Y, Z, T. Process X arrives at $t = 0$, and runs on the CPU for 12 time units before it finishes. Process Y arrives at $t = 4$, and requires an CPU time of 6 units before terminating. Process Z arrives at $t = 8$ and runs for 3 units of time on the CPU before terminating. Process T arrives at $t = 10$ and runs for 2 units of time on the CPU.</p> <p>Examine how a FIFO queue data structure can be applied for scheduling and explain how the scheduling process will prioritize tasks based on the shortest CPU burst time. Construct a Gantt Chart to illustrate the scheduling process and calculate the Completion Time, Average Turnaround Time, Average Waiting Time and Throughput. (5+5 marks)</p>	10