



Continuous Assessment Test (CAT) – I AUGUST 2025

Programme	:	B.Tech Computer Science and Engineering	Semester	:	Fall 2025-2026
Course Code & Course Title	:	BCSE202L- Data Structures and Algorithms	Class Number	:	CH2025260100908 CH2025260100909 CH2025260100907 CH2025260100910 CH2025260100978 CH2025260100911 CH2025260100912 CH2025260100914 CH2025260100913 CH2025260100976
Faculty	:	Dr.RISHIKESHAN C A Dr.N G BHUVANESWARI Dr.ABISHI CHOWDHURY Dr.UMA MAHESWARI Dr.JOE DHANITH Dr.MARY SHAMALA L Dr.T RAJA SREE Dr.SENDHIL R Dr.PRAVIN RENOLD A Dr.KARTHIKA V	Slot	:	C1+TC1
Duration	:	1 hour 30 minutes	Max. Mark	:	50

General Instructions: Write only your registration number on the question paper in the box provided and do not write other information

- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks	CO	BT Level
1		A music streaming app allows users to create playlists from n available songs. The app wants to list all possible playlist combinations, including the empty playlist. For $n = 3$ songs $\{S_1, S_2, S_3\} \rightarrow \{\}, \{S_1\}, \{S_2\}, \{S_3\}, \{S_1, S_2\}, \{S_1, S_3\}, \{S_2, S_3\}, \{S_1, S_2, S_3\}$. Write a non-recursive algorithm to generate all playlists for n . Analyse the best-case, worst-case, and average-case time complexity.	10	1	K2
2	a)	Solve the recurrence relation: $T(n)=T(n/3)+T(2n/3)+n$ with $T(1)=O(1)$ to determine an asymptotic bound for $T(n)$.	6	1	K2
	b)	Given the recurrence $T(n)=6T(n/3)+n^2$, compare its asymptotic growth rate with that of $T(n)=6T(n/3)+n^2\log n$. Use the Master method to find the asymptotic bound. Identify which function grows faster and justify your answer. (Note: $\log_3 6 = 1.6309$)	4	1	K4
3		A company is building a scientific simulation engine for a physics lab. The engine accepts user-entered equations in infix notation, e.g., $(F * (D + M) / (A - B))$, evaluates them, and also stores them in	10	2	K3

		postfix form for faster repeated execution. Additionally, the system features a mechanical arm simulator that utilizes the Tower of Hanoi algorithm to test automated handling of disks. The design team proposes a stack-based approach to convert the given expression to postfix form and evaluate the postfix expression by assuming the values $F=10$, $D=2$, $M=3$, $A=5$, $B=1$. (i) Convert the expression $F * (D + M) / (A - B)$ to postfix notation. (4 marks) (ii) Evaluate the expression using the operand stack. (4 marks) (iii) Determine the number of moves required to solve the Tower of Hanoi with n disks. (2 marks)			
4		A bank uses a 1D array to store the number of transactions processed by one of its ATMs over 7 consecutive days: $transactions = [120, 150, 98, 175, 200, 130, 165]$ (i) Write a single algorithm to perform the following tasks: (8 marks) - Calculate the total number of transactions for the week. - Implement a function to compute the average daily transactions. - Using a search method with $O(n)$ time complexity, find the index/indices of the day(s) with the maximum and minimum transactions. - Count the number of days with more than 150 transactions. (ii) Find the overall time and space complexity of your algorithm. (2 marks)	10	3	K3
5		In a city-wide art festival, students submitted artwork that was judged and assigned a score between 0 and 50, rounded to the nearest whole number. After the event, the organizers collected a total of 30,000 scores. Due to consistent scoring behaviour by the judges, many scores were repeated, while some scores never occurred at all. The organizing team needs to generate a summary for reporting and analysis. Specifically, they want to: - Produce a list of all scores sorted in descending order - Identify all scores that never occurred in the dataset. - Find the score at the 90th percentile. Devise an efficient algorithm to meet the above requirements using an approach optimized for repeated values and a fixed value range. Also, compute the time complexity of your solution.	10	3	K4

*****All the best *****