



VIT
Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)
CHENNAI

Reg. Number: 24BA11631

Continuous Assessment Test (CAT) – I - AUGUST 2025

Programme	B.Tech	Semester	FALL 2025-26
Course Code & Course Title	BCSE202L Data Structures and Algorithms	Class Number	CH2025260101952, CH2025260101954, CH2025260101956, CH2025260101958, CH2025260101375, CH2025260101378, CH2025260101488, CH2025260101705, CH2025260101699, CH2025260101702, CH2025260101420, CH2025260101416
Faculty	Dr. JOE DHANITH P R, Dr. MANIMEGALAI T, Dr. DOMINIC SAVIO M, Dr. ELAKIYA E, Dr. KSHMA TRIVEDI, Dr. BENILA S, Dr. VIVEKANANDAN M, Dr. AFRUZA BEGUM, Dr. KARTHIKEYAN N, Dr. VALARMATHI K, Dr. KALAI PRIYAN, Dr. KANTHIMATHI S	Slot	B1 + TB1
Duration	90 Mins.	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	CO	BT Level
1	a)	A perfect number is a positive integer that is exactly equal to the sum of its proper divisors (all positive divisors excluding the number itself). Example: $6=1+2+3$ Given an $m \times n$ matrix of natural numbers, for each element on the main diagonal: Calculate the sum of its row and the sum of its column independently. Then compute the absolute difference between these two sums. From all such differences, devise an algorithm to determine the largest value that is also a perfect number. (7 marks)	10	1	2
	b)	Compute the time complexity of your algorithm (3 marks)			
2	a)	Compute the time complexity of the following recurrence relations using a suitable method of your choice. $T(n) = T(n/4) + n$ (4 marks)	10	1	3
	b)	$T(n) = 4T(n/2) + n^4$ (4 marks)			

	c)	Find the time complexity of the following code using step count method (2 marks) <pre> for (int i = 0; i < n; i++) total += num[i] print("Sum =", total) for (int i = 0; i < n; i++) for (int j = 0; j < n; j++) printf("%d %d\n", arr[i], arr[j]); </pre>																							
3	a)	Using the roll numbers: [101,104,107,110,113,116,119,122,125,128] Trace the steps of your algorithm to locate roll number 113, showing midpoint calculations, comparisons, and how the search range changes until the element is found. (7 Marks)	10	3	4																				
	b)	State the recurrence relation for the worst-case time complexity and solve it. (3 Marks)																							
4		A retail analytics company processes daily inventory data from hundreds of stores. Each store provides a list of products with unique Product IDs and their stock quantities. Before running restock analysis and generating low-stock alerts, the inventory records must be arranged in ascending order of Product ID for efficient processing. Due to the large data volume and the possibility of processing parts of the data independently before combining them, the development team chooses an approach where the list is repeatedly broken down into smaller parts, sorted individually, and then combined into a single sorted list. <table border="1"> <tr> <td>Product ID</td> <td>104</td> <td>102</td> <td>105</td> <td>109</td> <td>107</td> <td>103</td> <td>108</td> <td>106</td> <td>101</td> </tr> <tr> <td>Quantity</td> <td>50</td> <td>10</td> <td>25</td> <td>15</td> <td>30</td> <td>12</td> <td>50</td> <td>10</td> <td>15</td> </tr> </table> a) Explain step-by-step how such a method can be applied to sort the above product list by Product ID. (7 Marks) b) State the worst-case time complexity of the method using Big O notation. (3 Marks)	Product ID	104	102	105	109	107	103	108	106	101	Quantity	50	10	25	15	30	12	50	10	15	10	3	4
Product ID	104	102	105	109	107	103	108	106	101																
Quantity	50	10	25	15	30	12	50	10	15																
5		Convert the following infix expression into its postfix form and evaluate it using a stack. Assume each letter's value corresponds to its alphabetical position (A = 1, B = 2, ..., Z = 26). Apply operator precedence and associativity rules carefully while handling parentheses. (5+5 marks) Expression: $A + B ^ (C + D) / (E + F * (G + H)) - I$	10	2	3																				