

CHENNAI

Continuous Assessment Test (CAT) – II OCTOBER 2025

Programme	:	B.Tech.	Semester	:	3
Course Code & Course Title	:	BCSE202L Data Structures and Algorithms	Slot	:	B1+TB1
Faculty	:	Dr. JOE DHANITH P R, Dr. MANIMEGALAI T, Dr. DOMINIC SAVIO M, Dr. ELAKIA Dr. KSHMA TRIVEDI, Dr. BENILA S, Dr. VIVEKANANDAN M, Dr. AFRUZA BEGUM, Dr. KARTHIKEYAN N, Dr. VALARMATHI K, Dr. KALAIPRIYAN, T., Dr. KANTHIMATHI S	Class Number	:	CH2025260101952, CH2025260101954, CH2025260101956, CH2025260101958, CH2025260101375, CH2025260101378, CH2025260101488, CH2025260101705, CH2025260101699, CH2025260101702, CH2025260101420, CH2025260101416
Duration	:	90 Mins	Max. Mark	:	50

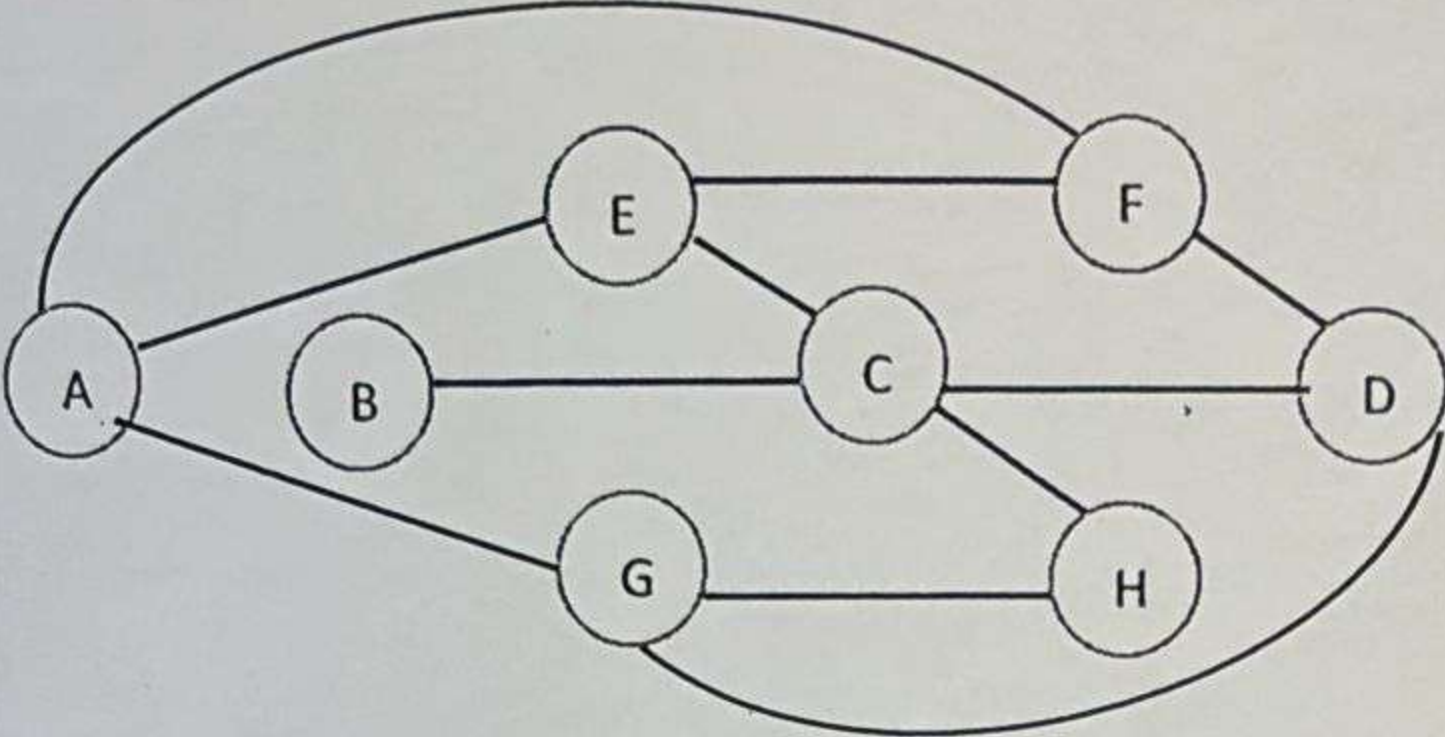
General Instructions:

- Write only your registration number on the question paper in the box provided and do not write other information
- Only non-programmable calculator without storage is permitted

Answer all questions

Q. No	Sub Sec.	Description	Marks	CO	BT Level
1		In a multi-specialty hospital, patients arrive at the outpatient department (OPD) and are assigned token numbers in the order of their arrival. To manage the crowd, the hospital provides 5 reusable token slots. When all slots are filled, newly arriving patients are given the slots vacated by those already attended. Unlike the regular system, the doctor follows a special serving rule: patients are attended alternately from the beginning and from the end of the current queue of tokens. This ensures that both early arrivals and late arrivals get fair chances. On a particular day, the first set of patients arrive in the order: [P1, P2, P3, P4, P5. After some of these patients are attended and their slots become free, two new patients, P6 and P7 arrive and are assigned to the vacated token slots.			
	a	Give a Pseudo code and illustrate the state of the system step by step as patients are added and attended, clearly showing how the slots are reused.	6		
	b	Analyze the time complexity of adding a new patient when a slot is free and removing a patient when served.	1		
	c	Explain why this “slot reusing” approach is efficient for a high-turnover environment like a hospital OPD.	3		

2		In a university library, books are arranged on a shelf in such a way that each book has a reference pointing to the next book in the sequence, since the shelf space is limited and books cannot always be stored in contiguous slots. Assume that the current sequence of books in two shelves maintained as a single list (i.e the last book in shelf 1 has reference to the first book in shelf 2) are: Shelf1: [B10 → B20 → B30 → B40 → B50 → B60] Shelf2: [B15 → B25 → B35 → B45 → B55 → B65] Illustrate step-by-step how the following operations can be performed with the support of a pseudo code. a Delete the book in the 3rd place and 5th place from the shelves 1 and 2 respectively. b After the deletions, swap the books at every even position between the two shelves (i.e., swap position 2 of shelf1 with position 2 of shelf2, position 4 of shelf1 with position 4 of shelf2, ..., till the last index).		2	2
3		During a trekking expedition, a group of students explores a forest trail. The trail splits into multiple paths, and the guide notes the order of exploration in two different ways: • Visiting the camp, then left path, then right path A, B, C, D, E, F, G, H, I • Visiting left path, then camp, then right path F, B, A, D, C, E, G, I, H a Construct the binary tree representing the trekking route and draw the structure clearly. b Derive the traversal of the same tree in the pattern of left path, then right path then camp.		3	3
4		A supermarket chain maintains a database of product IDs to enable quick searching and billing. To organize the product IDs efficiently, the system uses the following rule: • If the new ID is smaller than the current node, it goes to the left side. • If the new ID is larger, it goes to the right side. The arrival order of product IDs for entry is: A7, A5, B2, B7, B5, A3, A2, A4, B9, A6 a Construct the tree from the provided product IDs (in the given order), display the tree after every insertion, and finally display it's in-order sequence.		3	3

	b	Search for product IDs A4 and B7 in the BST and trace the path of nodes visited during each search.	2		
	c	Delete the product IDs A5, A7, and B2 from the BST in the given order, and show the tree after each deletion.	3		
5		Google Maps represents cities as nodes and the roads connecting them as edges in a graph. Imagine a tourist planning a trip across South India. Each city on the map acts as a point of interest, while the roads serve as direct links that determine possible travel paths. By modelling this scenario as a graph, traversal techniques can be applied to explore the cities in different ways. 		3	3
	a	Represent the graph using adjacency list.	4		
	b	Demonstrate the order of visiting cities using both Depth First Search (DFS) and Breadth First Search (BFS), starting from the city A.	6		

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