DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING,
SCHOOL OF ENGINEERING SCIENCES & TECHNOLOGY, JAMIA HAMDARD

BACKLOG SEMESTER III EXAMINATION 2024

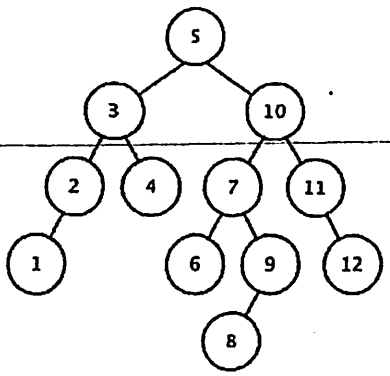
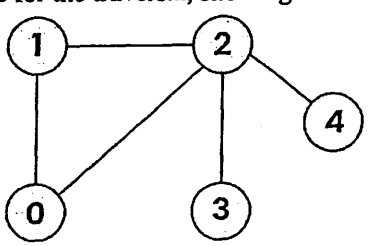
PAPER: DATA STRUCTURES AND ALGORITHMS — TIME: 3 HRS
CODE: BTCSE 303(BACKLOG) / BTCSEAI 303 (BACKLOG) — MAXIMUM MARKS: 75

SECTION A
All questions are compulsory (7*5)

S NO	Question	Marks	CO	BL
1.	Data are pushed to (PUSH operation) and popped from (POP operation) a stack in the following order: ***PUSH 2; TOP; PUSH 7; TOP; PUSH 6; PUSH 9; TOP; POP; POP; TOP;*** where the PUSH, POP and TOP operations of stack behave as discussed in the class. Write the values returned by TOP for the sequence of operations above.	5	CO2	3
2.	Convert the following Infix notation to Postfix notation. Show the step by step process 1. (A +B) * (C-D) 2. a+b*(c^d-e)^(f+g*h)-i	5	CO3	2
3.	Data are enqueued to (ENQ operation) and dequeued from (DEQ operation) a queue in the following order: ENQ 3; FRONT; ENQ 7; FRONT; ENQ 6; ENQ 9; FRONT; DEQ; DEQ; FRONT; where the ENQ, DEQ and FRONT operations of the queue behave as discussed in the class. Write the values returned by FRONT for the sequence of operations above.	5	CO2	3
4.	The preorder traversal sequence of a binary search tree is- 31 , 22 , 11 , 17 , 24 , 23 , 39 , 35 , 42 What is the postorder traversal sequence of the same tree?	5	CO1	2
5.	What do you mean by Data Structures? Explain the different types of data structures.	5	CO1	1
6.	What are arrays? Explain different types of arrays.	5	CO2	1
7.	Write any five properties of a B-Tree	5	CO2	1

SECTION B
Answer any 4 questions in Section B (4*10)

S.NO	QUESTIONS	Marks	CO	BL
1.	Write an algorithm to sort an array using the Bubble Sort technique. Provide the best-case and worst-case time complexity analysis for the Bubble Sort algorithm.	10	CO2	4

2.	Given the following AVL Tree: (a). Draw the resulting BST after 5 is removed, but before any rebalancing takes place. Label each node in the resulting tree with its balance factor. Replace a node with both children using an appropriate value from the node's left child. (b). Now rebalance the tree that results from (a). Draw a new tree for each rotation that occurs when rebalancing the AVL Tree (you only need to draw one tree that results from an RL or LR rotation).  	10	CO3	3
3.	Suppose you are responsible for managing the admission data for Jamia Hamdard Admissions 2025. The admission cycle begins in September 2024 and ends in November 2024. During this period, candidates may enroll in courses or withdraw their admissions. As the person in charge, you need to maintain records of all such activities while ensuring the following operations are handled efficiently: 1. Adding a candidate's admission record (e.g., adding admission to a course). 2. Removing a candidate's record (e.g., handling admission withdrawals). 3. Searching for a candidate's record (e.g., verifying enrollment in a course). 4. Maintaining unique student records (to prevent duplication). Which data structure would you choose to manage this data effectively, and why?	10	CO5	5
4.	What is a max-heap? Is the sequence <21, 15, 18, 8, 12, 11, 16, 5, 9> a max-heap? Justify your answer with a detailed explanation.	10	C04	3
5.	Given an undirected graph G(V,E) with V representing the set of vertices and E representing the set of edges, perform a Depth First Search (DFS) traversal starting from the source vertex 1. Explain the step-by-step procedure for the traversal, showing the order in which vertices are visited.  	10	CO5	3
6.	Given the following sequence of letters and asterisks: EAS*Y*QUE***ST***IO*N*** (a) Consider the stack data structure, supporting two operations push and pop, as discussed in class. Suppose that for the above sequence, each letter (such as E) corresponds to a push of that letter onto the stack and each asterisk (*) corresponds to a pop operation on the stack. Show the sequence of values returned by the pop operations. (b) Consider the queue data structure, supporting two operations insert and remove, as discussed in class. Suppose that for the above sequence, each letter (such as E) corresponds to an insert of that letter into the queue and each asterisk (*) corresponds to a remove operation on the queue. Show the sequence of values returned by the remove operations.	10	CO3	3

BLOOM'S TAXONOMY LEVELS (BL)
1-REMEMBERING, 2-UNDERSTANDING, 3-APPLYING, 4-ANALYZING, 5-EVALUATING, 6-CREATING