BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: MTECH
BRANCH: CSE/AI-ML

SEMESTER: I
SESSION: MO/2024

SUBJECT: CS531 DATA STRUCTURES AND ALGORITHMS

TIME: 3 Hours

FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

|			CO	BL
Q.1(a)	What is the purpose of asymptotic analysis? Solve the given recurrence relation using recursion tree and back substitution method: $T(n) =\{$ 1 if n = 0 $T(n-1) + \log n$ for n > 0 $\}$	[5]	CO2	BL5
Q.1(b)	Why is a doubly linked list more useful than a single linked list? Write an algorithm to remove duplicates element from sorted singly linked list?	[5]	CO1	BL4
Q.2(a)	How does a linked stack differ from a linear stack? Create an algorithm that uses only the stack and its operations to convert a decimal number to a binary number.	[5]	CO2	BL4
Q.2(b)	How do circular and linear queues differ from one another? Write algorithms to (i) insert an element in a circular queue and (ii) delete an element from a circular queue.	[5]	CO1	BL3
Q.3(a)	What is the difference between strictly binary tree and complete binary tree? Construct a binary tree from the given in-order and pre-order traversals: Pre-order traversal: P A S T Q E D X M R C F In-order traversal: T S Q A E D P M X C R F	[5]	CO3	BL3
Q.3(b)	How does the height of a binary search tree affect its performance? Construct an AVL tree for keys 45, 39, 56,12, 34, 78, 32,10, 89, 54, 67 and 81.	[5]	CO3	BL4
Q.4(a)	Write the outline of a sorting algorithm which consumes *O (N log N)* time for a list of size *N* in the best, worst and average cases. Explain the claimed time complexity and also determine its space complexity?	[5]	CO4	BL5
Q.4(b)	Create a heap (H) from the following numbers: 33, 42, 67, 23, 44, 49, and 74. Also, while constructing, draw the heap's memory representation?	[5]	CO3	BL4
Q.5(a)	Consider a graph shown in Figure-1, Use a Depth First Search (DFS) and Breath First Search (BFS) traversals to construct a DFS spanning tree and a BFS spanning tree for the provided graph.	[5]	CO5	BL5
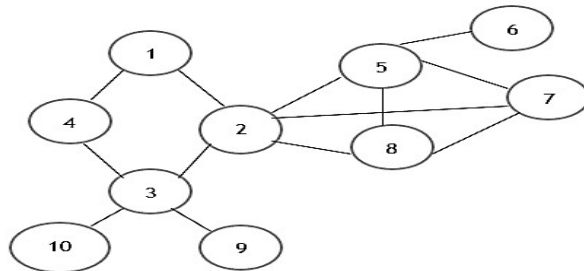
Figure-1

			CO	BL
Q.5(b)	When is a spanning tree called a minimum spanning tree? Take a weighted graph of your choice and determine its minimum cost spanning tree using Prim's and Kruskal's algorithms.	[5]	CO5	BL4