**Roll No.** | | | | | | | |

**Paper Code: TMC 301**

Paper Name Design and analysis of algorithms

Time: 1.5 Hours

MM: 50

Each question has two parts (a and b) . Attempt any one part of each question.

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|---|---|---|
| **Q1** | **10 MARKS** | |
| A | Explain the various criteria used for analysing algorithms. List the properties of various asymptotic notations. | CO1 |
| | OR | |
| B | What is the significance of the pivot element in quick sort algorithm? Write an algorithm for RANDOMIZED quick sort and analyse its time complexity. | CO1 |
| **Q2** | **10 MARKS** | |
| A | What do you understand by degree of a node in binary tree?<br>In a binary tree, the number of internal nodes of degree 1 is 5 and the number of internal nodes of degree 2 is 10. Find the number of leaf nodes in the binary tree. | CO2 |
| | OR | |
| B | Prove that the height of a balanced binary search tree is O(log n base 2).<br>While inserting the elements 71,61,84,69,67,66,83,63 in an empty binary search tree in the sequence shown, what will be the element in the lowest level? | CO2 |
| **Q3** | **10 MARKS** | |
| A | What are recurrence relation? Solve the following recurrence using recurrence tree method. T(n)= 2 T(n/2) +n | CO1 |
| | OR | |
| B | Solve the following recurrence using master method:<br>1. $T(n) = 3T(n/2) + n^2$<br>2. $T(n) = 4T(n/2) + n^2$<br>3. $T(n) = T(n/2) + 2^n$ | CO1 |
| **Q4** | **10 MARKS** | |
| A | What are the limitations of counting sort.<br>Demonstrate the counting sort algorithm steps to sort the following set of elements:<br>0,2,4,2,5,6,7,5,7,8,9,3,4,1 | CO1 |

| | | |
|---|---|---|
| | OR | |
| B | Suppose we do merge sort with a three-way split: divide the array into 3 equal parts, sort each part and do a 3 way merge. Write an algorithm for 3 way merge sort. Analyze its time complexity | CO1 |
| **Q5** | **10 MARKS** | |
| A | What are the properties of red Black tree? What is the advantage of using a red-black tree over a standard binary search tree?<br>Create a RB tree for following elements 10, 18, 7, 15, 16, 30, 25, 40, 60 | CO2 |
| | OR | |
| B | Explain the following terms with examples<br>1: Stable sorting<br>2: In-place sorting<br>3: External sorting | CO1 |