

Total no. of Pages:2

Roll no.....

ODD SEMESTER **B.Tech**

MID TERM EXAMINATION

Sep-2025

COURSE CODE-CS205: Design & Analysis of Algorithms

Time: 01:30 Hours

Max. Marks: 25

Note : Assume suitable missing data, if any.

Q.1 (a) Solve the following recurrence relations (use any method)

(i) $T(n) = 8T(n/4) + n^2 \log n$

(ii) $T(n) = 9T(n/3) + \log n$

(b) Find the time complexity of the following recursive function using any method

```
int fun(int n) {  
    if (n <= 1) return 1;  
    return 2xfun(n/2) + fun(n/2) + fun(n/2)+5;  
}
```

[2+2+2=6M][CO1][BT4]

Q.2 The operation HEAP-DELETE (A, i) deletes the item in node 'i' from binary heap A. Propose an implementation of HEAP-DELETE that runs in $O(\log n)$ time for an n-element max heap.

[4M][CO2][BTL4]

Q3. Suppose you have an array of n elements containing only two distinct keys, true and false. Give an $O(n)$ algorithm to rearrange the list so that all false elements precede the true elements. You may use only constant extra space.

[4M][CO2][BTL3]

Q4. Using greedy strategies for the fractional knapsack find an optimal profit to the knapsack instance with number of items (n)=7, weight of knapsack (m)=15, profit vector as (10,5,15,7,6,18,3), and weight vector as (2,3,5,7,1,4,1)

[4M][CO3][BTL4]

Q.5 The figure below shows a simplified map of Delhi. The important population centers in the city are marked as nodes. All feasible metro links between these nodes are marked as edges, and the weight of each edge is the length of that link of metro line. Apply Kruskal or Prim's algorithm to find the MST for the resultant graph. The weight of each edge are RG-SB = 10, RG-KB = 7, RG-IGA = 14, RG-CK = 12, SB-KB = 8, KB-RN = 24, KB-CK = 10, KB-IGA = 19, KB-CP = 4, RN-CP = 22, CP-CK = 6, CP-GK = 17, CP-IGA = 20, CK-GK = 14, CK-M = 15, CK-IGA = 16, M-GK = 12, and M-IGA = 14. Write all the steps involved.

[7M][CO3][BTL5]

