53 (IT 504) DAAL

2019

DESIGN AND ANALYSIS ALGORITHM

Paper : IT 504

Full Marks : 100

Time : Three hours

The figures in the margin indicate full marks for the questions.

*Answer **any five** questions.*

1. *(a)* Define and differentiate asymptotic notations (O, Ω, Θ). 6

   (b) Draw the recursive tree for the recurrence relation

   $$T(n) = T(n/3) + T(2n/3) + n$$

   7

   (c) Solve the recurrence relation

   $$T(n) = T(n-1) + \frac{1}{n}$$

   7

Contd.

2. *(a)* Prove that if

$f(n)+a_m n^m + a_{m-1}n^{m-1} + ...+ a_1 n + a_0$

and $a_m > 0$, then $f(n) = O(n^m)$. 7

(b) Is $2^{n+1} = O(2^n)$? Is $2^{2n} = O(2^n)$? 6

(c) State and explain Master Theorem with examples. 7

3. Show steps of Kruskal's and Prim's algorithm to find minimum spanning tree of the graph shown in the *Figure* 1. 10+10=20

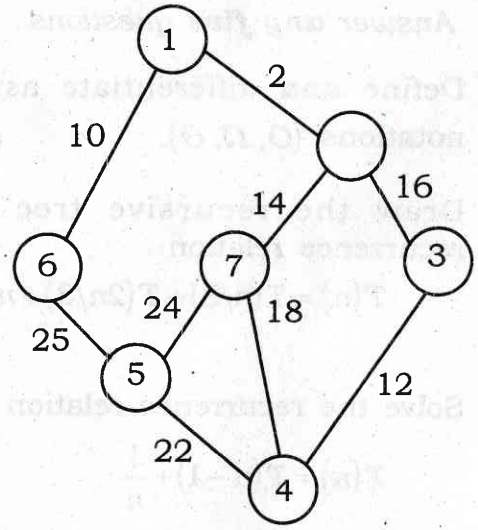

Figure 1

4. *(a)* Consider the array [4, 1, 3, 2, 16, 9, 10, 14, 8, 7].

(i) Draw the corresponding complete binary tree. 2

(ii) Illustrate the operation of Build-Max-Heap (*A*, 8) on the array to make a heap tree. 8

(b) Write an algorithm to delete the element in position *i* of a max heap tree. The complexity of your algorithm should be *O* (*log n*). 10

5. *(a)* Explain with suitable example, the principal operation of Quicksort algorithm. 10

(b) Find the time-complexity of Quicksort algorithm (average case). 10

6. *(a)* Suppose $A[1 : m]$ and $B[1 : n]$ both contains sorted elements in non-decreasing order. Write an algorithm that merges these items into $C[1 : m + n]$. 8

(b) Explain 4-Queen's problem. Write an algorithm of *n*-Queen's problem. 12

7. 20

(a) Differentiate between greedy and dynamic programming.

(b) Write the algorithm of travelling salesman problem using. dynamic programming.

(c) Discuss diagrammatically the relation among P Class, NP Class, NP Hard and NP Complete.