02439

Printed Pages—4 CS—503

B.Tech.

FIFTH SEMESTER EXAMINATION, 2005-2006

DESIGN ANALYSIS OF ALGORITHM

Time : 3 Hours *Total Marks : 100*

Note : *(i)* *Attempt **ALL** questions.*

(ii) *All questions carry equal marks.*

(iii) *In case of numerical problems assume data wherever not provided.*

(iv) *Be precise in your answer.*

1. Attempt *any four* of the following questions : **(5x4=20)**

   (a) Find the complexity of the following recurrence relation.

   $$T(n) = 9T(n/3) + n$$

   (b) Solve the following recurrence :

   $$T(1) = 1$$

   $$T(n) = 4T\ (n/3) + n^2 \text{ for } x \geq 2$$

   (c) Give an algorithm to count the number of leaf nodes in a binary tree t. What is its computing time ?

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(d) What do you mean by Asymptotic Notations ? Explain.

(e) Solve the following recurrence exactly :

$$t_n = \begin{cases} n & \text{if } n = 0, 1, 2 \text{ or } 3 \\ t_{n-1} + t_{n-3} - t_{n-4} & \text{otherwise} \end{cases}$$

Express your answer using the $\ominus$ notation.

(f) Find the best case and worst case time complexity of deletion in a binary tree.

2. Attempt *any four* of the following questions : **(5x4=20)**

(a) If $S_1 = \{ 1 \}$, $S_2 = \{ 3, 5 \}$, $S_3 = \{ 7, 9, 11 \}$ and so on.

Write a single line equation to find -

(i) the last element of S_n

(ii) sum of the elements of the set S_n

(b) What do you understand by Binomial Heap ? How to merge two binomial heaps ?

(c) What is a red black tree ? Explain its properties.

(d) Write an algorithm to perform insertion into a B-tree.

(e) Write an algorithm for inserting a node into Fibonacci Heap.

(f) Explain deletion procedure into a B-tree

3. Attempt *any two* of the following questions : (10x2=20)

(a) When and how Dynamic programming approach is applicable ?

Discuss matrix chain multiplication with reference to Dynamic programming Technique and also apply it on the following array.

30	1	40	10	25

(b) Discuss backtracking problem solving approach.

(c) Write a short note on dynamic programming.

4. Attempt *any two* of the following questions : (10x2=20)

(a) Given a graph G = $(V_1 E)$ and let V_1 and V be two distinct vertices. Explain how to modify Dijkastra's shortest path algorithm to determine the number of distinct shortest paths from U to V.

Also comments on whether Dijkastra's shortest path algorithm work correctly if weights are negative.

(b) Explain the Floyd Warshall algorithm with example.

(c) Prove that if the weights on the edge of the connected undirected graph are distinct then there is a unique Minimum Spaning Tree. Give an example in this regard. Also discuss Krushkal's Minimum Spanning Tree in detail.

5. Attempt *any two* of the following questions : (10x2=20)

    (a) Discuss KMP string matching algorithm and also find the prefix function for the following pattern :
a b a b b a b a a

    (b) Discuss problem class in detail, Also discuss the approximate and hard problems for Travelling Salesman Problem.

    (c) Explain Boyer-Moore algorithm for string matching for Text :

        "a b c a a b c c a a b b a b c a " Pattern a b c.

        Compute worst time complexity of this algorithm.

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