Exam.Code:0916
Sub. Code: 6396

2053

B.E. (Computer Science and Engineering)

Fourth Semester

CS-401: Analysis and Design of Algorithms

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: Attempt five questions in all, including Question No. I which is compulsory and selecting two questions from each Section.

x-x-x

1. Attempt the following:-

   (a) What is the significance of asymptotic notations. Support with the help of an example.

   (b) Explain the time complexity of the merge sort algorithm.

   (c) Compare greedy algorithms and dynamic programming.

   (d) Write the control abstraction for the least cost search.

   (e) Write the steps involved to prove a problem is NP-Complete? (5X2)

SECTION – A

2. (a) What is the smallest value of n such that an algorithm whose running time is $100n^2$ runs faster than an algorithm whose running time is 2^n on the same machine? [3]

   (b) Solve the following recurrence using the substitution method. Assume that T(n) is 1 for $n \leq 4$ else $T(n) = T(\sqrt{n}) + c$. [3]

   (c) Write an algorithm to delete an element x from a binary search tree t. What is the time complexity of your algorithm? [4]

3. (a) Write pseudocode for Strassen's matrix multiplication algorithm. Also perform its time and complexity analysis. Use the same to compute matrix product $\begin{pmatrix} 1 & 3 \\ 7 & 5 \end{pmatrix}\begin{pmatrix} 6 & 8 \\ 4 & 2 \end{pmatrix}$ [6]

   (b) Give a simple implementation of Kruskal's algorithm. [4]

4. Write a short note on the following: [5 X 2 = 10]

   (a) Knapsack Problem (b) Single source shortest path

SECTION – B

5. (a) What are the elements of dynamic programming? What are multistage graphs? Further, explain the usability of dynamic programming in multistage graphs with the help of an example. [4]

   (b) Let w = [5, 7, 10, 12, 15, 18, 20] and m = 35. Write an algorithm for sum of subsets problem and use the same to find all possible subsets of w that sum to m. Draw the portion of the state space tree that is generated. [4,1,1]

6. Explain the backtracking method. Use the same to solve N-Queen's problem. Explain your solution with the help of an example. Also perform the time and space complexity analysis of your solution. [10]

7. Write a note on the following:

   (a) Polynomial Time [3]

   (b) NP reducibility [3]

   (c) Write a note on Cook's Theorem. [4]

x-x-x