Exam.Code:0916
Sub. Code: 6396

2014
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

I. Give short answers of the following:
a. Define time complexity and space complexity of an algorithm.
b. What are recurrence relations? Give example. List methods for solving recurrence relations.
c. Prove that if $f_1(n)=O(g_1(n))$ and $f_2(n)=O(g_2(n))$, then $f_1(n) + f_2(n) = O(g_1(n) + g_2(n))$.
d. State knapsack problem. Differentiate between fractional knapsack and 0/1 knapsack problem.
e. What do you mean by P, NP, NP-hard, and NP-complete problems? **(2 marks each)**

Section-A

II.
a. What are asymptotic notations? With the help of examples, describe various commonly used aysmptotic notations.
b. Use the master method to show that the solution to the binary-search recurrence $T(n) = T(n/2) + \Theta(1)$ is $T(n) = \Theta(lg\ n)$. **(5, 5)**

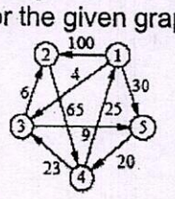
III.
a. Describe quick sort algorithm. Show how quick sort sorts the following sequence of keys 310, 285, 179, 652, 351, 423, 861, 254, 450, 520. Analyze the time complexity of the algorithm.
b. Write a recursive algorithm for binary search. Determine the time complexity of the algorithm by solving its recurrence relation using substitution method. **(5, 5)**

IV.
a. State activity selection problem. Give a greedy solution for the problem along with the algorithm. Analyze the time complexity of the given algorithm.
b. Define spanning tree. Describe Prim's algorithm for finding minimum cost spanning tree. Determine the time complexity of the algorithm. **(5, 5)**

Section-B

V.
a. Describe matrix-chain multiplication problem. Give a dynamic programming solution to the problem along with algorithm.
b. Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions is <5, 10, 3, 12, 5, 50, 6>. **(5, 5)**

VI.
a. What is n-queen's problem? Write a backtracking algorithm to solve n-queen's problem.
b. Write a dynamic programming-based algorithm to solve all-pairs shortest path problem. Solve all-pairs shortest path problem for the given graph. **(5, 5)**



VII. Write short notes on:
a. NP-completeness and reducibility
b. Graph coloring problem and its solution

(5, 5)

x-x-x