ROLL NO. _____

Code: CT42 **Subject: DESIGN AND ANALYSIS OF ALGORITHMS**

ALCCS

Time: 3 Hours **DECEMBER 2015** **Max. Marks: 100**

PLEASE WRITE YOUR ROLL NO. AT THE SPACE PROVIDED ON EACH PAGE IMMEDIATELY AFTER RECEIVING THE QUESTION PAPER.

NOTE:

- **Question 1 is compulsory and carries 28 marks. Answer any FOUR questions from the rest. Marks are indicated against each question.**
- **Parts of a question should be answered at the same place.**

Q.1 a. What is an algorithm? Give an example with illustration.

b. What is the difference between time complexity and space complexity?

c. Explain "Divide and Conquer Technique".

d. Compute the time efficiency for Towers of Hanoi problem.

e. What is the major difference between shortest path and longest path?

f. Describe the insertion sort.

g. Define NP-complete and NP-hard problems **(7 × 4)**

Q.2 a. Discuss the fundamental steps involved in the design and analysis of algorithm with a neat diagram. **(8)**

b. Write an algorithm for merging two sorted arrays to a single array. Explain how you will use this algorithm for Merge Sort. **(10)**

Q.3 a. Consider the following algorithm. **(10)**

Algorithm: CubeMe(n)
If n = 1 return 1
Else return CubeMe(n-1) + n*n*n

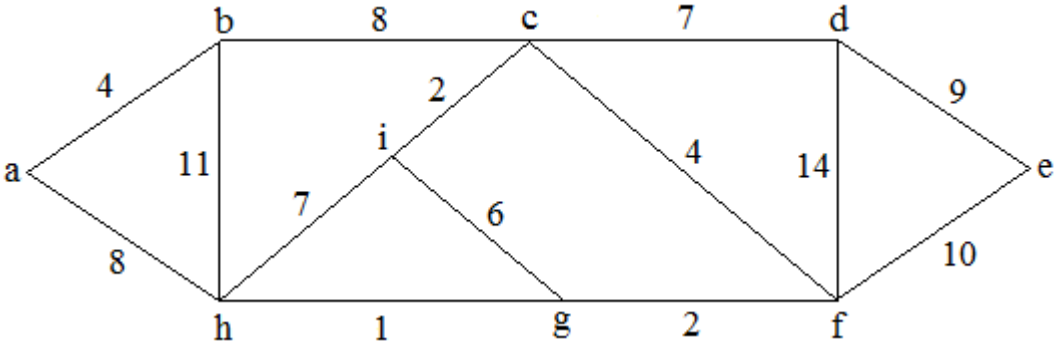
(i) What does this algorithm compute?
(ii) What is its basic operation? Justify your choice
(iii) How many times is the basic operation executed? Write down the recurrence relation. Justify
(iv) What is its initial condition? Justify.
(v) Derive the time efficiency class of this algorithm.
(vi) Name the efficiency class of the non-recursive version of the algorithm.
(vii) Between recursive & non-recursive versions, which is better? Justify

b. Explain with the help of an example how BFS differs from DFS. **(8)**

Q.4 a. Design an algorithm to sort the given list of elements using Quick Sort incorporating divide and conquer technique. Sort the following list using the same and compute its best case time efficiency : 4, 2, 0, 8, 7, 1, 3, 6 **(12)**

b. For the input 30, 20, 56, 75, 31, 19 and hash function h(K) = K mod 11 **(6)**
(i) Construct the open hash table
(ii) Find the largest number of key comparisons in a successful search in this table.

Q.5 a. Write down Prim's Algorithm for finding the Minimum Spanning Tree of a connected graph. Execute your algorithm on the following graph. **(10)**



b. Suppose that a graph G has a minimum spanning tree already computed, how quickly can we update the minimum spanning tree if we add a new vertex and incident edges to G. **(8)**

Q.6 a. Write down Knuth Morris Pratt algorithm for string matching. Compute the prefix function for the pattrn b a c b a b a b a a b c b a b **(12)**

b. What is the best case and worst case complexity of Naive String Matching algorithm (Simple text Searth). Give one example of Pattern and Text for both the cases. **(6)**

Q.7 a. Derive a recursive algorithm for solving the Longest Common Subsequence (LCS) problem. Determine an LCS of < b a a b a b a b > and < a b a b b a b b a > **(12)**

b. Define NP completeness. Prove that the circuit satisfiability problem is NP complete from the definition of NP completeness. **(6)**