ROLL NO. _____

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

ALCCS

Time: 3 Hours **JUNE 2016** **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. For each of the following functions, indicate how much the function's value will change if its argument is increased fourfold?
(i) $\log_2 n$ (ii) $\sqrt{n}$ (iii) n (iv) n^2

b. When a digraph is called strongly connected? What do you mean by strongly connected components?

c. What is the general strategy behind Divide-and-Conquer algorithms? Explain.

d. How B^+ trees are different from B trees?

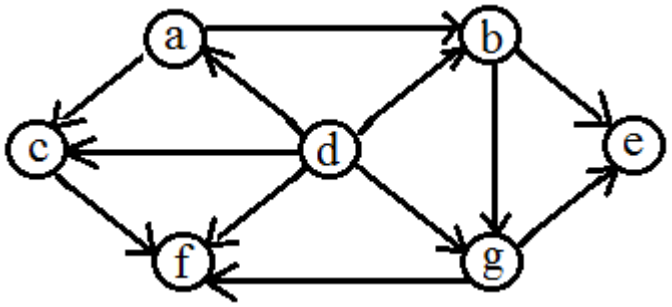
e. Explain worst-case and average case analysis of an algorithm.

f. Why Strassen's algorithm is not often a good choice algorithm for matrix multiplication?

g. Explain how one can generate a Huffman code without an explicit generation of a Huffman coding tree. **(7×4)**

Q.2 a. Design an algorithm for computing gcd (m, n) using Euclid's algorithm. Apply to find gcd (31415,14142). **(9)**

b. Apply the DFS-based algorithm to solve the topological sorting problem for the following digraphs: **(9)**



Q.3 a. Define Max-heap. Write Max_Heapify algorithm that maintains max-heap property. **(9)**

b. Apply quicksort to sort the list
E, X, A, M, P, L, E
in alphabetical order. Draw the tree of the recursive calls made. **(9)**

Q.4 a. Define AVL tree. Construct an AVL tree for the list 3, 6, 5, 1, 2, 4. **(9)**

b. For the input 30, 20, 56, 75, 31, 19 and hash function $h(K) = K \bmod 11$
(i) construct the open hash table.
(ii) find the largest number of key comparisons in a successful search in this table.
(iii) find the average number of key comparisons in a successful search in this table. **(9)**

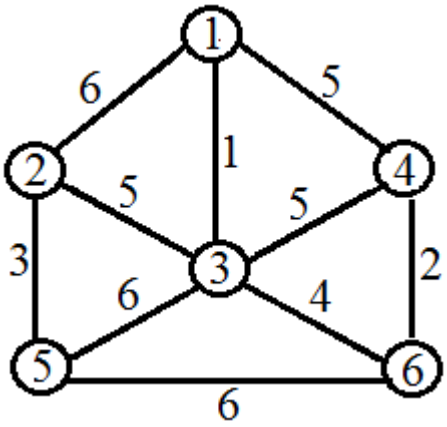
Q.5 a. Apply and explain mergesort to sort the following list: 8, 3, 2, 9, 7, 1, 5, 4. How efficient is mergesort? **(10)**

b. Solve the following instance of the knapsack problem by the Greedy algorithm. **(8)**

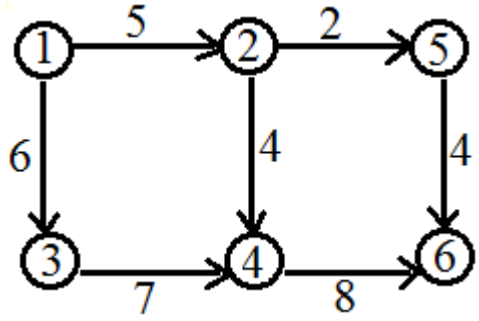
Item	Weight	Value	Value / Weight
1	4	$40	10
2	7	$42	6
3	5	$25	5
4	3	$12	4

The knapsack's capacity W is 10

Q.6 a. Explain Kruskal's algorithm for finding the Minimal cost Spanning tree of a graph. Apply algorithm to the following given graph. **(9)**



b. Apply the shortest-augmenting path algorithm to find a maximum flow and a minimum cut in the following networks. **(9)**



Q.7 a. What is Rabin Karp algorithm? Where it is used? Explain the concept behind this algorithm and calculate its time complexity. **(8)**

b. When a decision problem D1 is said to be
(i) polynomially reducible? (ii) NP-complete? **(6)**

c. If A is NP-complete then A is a member of P if and only if P = NP. **(4)**