(Please write your Exam Roll No.) *Exam Roll No.* 046

END TERM EXAMINATION

FOURTH SEMESTER [MCA] MAY 2017

Paper Code: MCA-202	*Subject: Design and Analysis of Algorithm*
Time: 3 Hours	*Maximum Marks: 75*

Note: Attempt any five questions including Q.no.1 which is compulsory. Select one question from each Unit.

Q1 (a) Write an algorithm to find the number of non-zero elements in an array and compute its time complexity.

(b) Define ω and θ asymptotic notations.

(c) Solve the recurrence relation $T(n) = 9T(n/3) + n$ using master method.

(d) Generate a binary search tree by inserting node values 10, 5, 40, 29, 26, 35, 71, 55, 90, 33, 66 in the given order.

(e) What is the maximum and minimum number of elements in heap of height h?

(f) Define an AVL tree and how is the balance factor of a node decided in it?

(g) Can Bellman Ford algorithm be applied on a graph with negative weights?

(h) Write the Huffman code of word "INDIA".

(i) Define 0/1 knapsack problem.

(j) What do you mean by an NP complete problem? **(2.5x10=25)**

Unit-I

Q2 (a) Let f(n) and g(n) are asymptotically non negative function then using the definition of θ-notation prove that

$$\max(f(n),\ g(n)) = \theta\left(f(n) + g(n)\right).$$ **(6)**

(b) Write a recursive function and its recursive relation for computation of factorial of an integer. Solve its recursive relation. **(6.5)**

Q3 (a) Solve the following recurrence relation

$$T(n) = 2T(n-1) \text{ and } T(0) = 1.$$ **(6)**

(b) Explain the substitution method to solve the recurrence relation. **(6.5)**

Unit-II

Q4 (a) Sort the following numbers using insertion sort.

54, 23, 20, 10, 59, 49, 38, 75, 46, 95, 64, 78, 26, 80, 81, 76 **(6)**

(b) Write an algorithm for depth first search of a graph and find its time complexity. **(6.5)**

Q5 (a) Explain heap sort with suitable example. **(6)**

(b) What do you mean by a red-black tree? Prove that maximum height of this tree can be $2 * \log(n+1)$ where n is the number of internal nodes in the tree. **(6.5)**

P.T.O.

Unit-III

Q6 (a) Write an algorithm to find the longest common subsequence. **(6)**
(b) Write an algorithm for finding a minimal cost binary search tree. **(6.5)**

Q7 (a) Explain Robin Karp string matching algorithm with suitable example. **(6)**
(b) Write Prim's algorithm for finding minimum cost spanning tree. **(6.5)**

Unit-IV

Q8 (a) Explain subset sum problem. Write a function for it. **(6)**
(b) Explain Hamiltonian circuit problem. **(6.5)**

Q9 Prove that CNF satisfibiality is an NP complete problem. **(12.5)**

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