

MCA 2nd Semester Examination, 2013
DESIGN AND ANALYSIS OF ALGORITHM

PAPER—201

Full Marks : 100

Time : 3 hours

Answer any **five** questions

The figures in the right-hand margin indicate marks
Candidates are required to give their answers in their
own words as far as practicable

Illustrate the answers wherever necessary

1. (a) What do you mean by Asymptotic time complexity?
- (b) Show that the function f and g defined by $f(n) = 3n^4 - 5n^2$ and $g(n) = n^4$, where n is positive integer have the same order.
- (c) If $f(n) = a_0 + a_1n + a_2n^2 + \dots + \dots + a_m n^m$ and $a_m > 0$, then prove that $f(n) = O(n^m)$, where n is a positive integer. 2 + 6 + 6

(Turn Over)

2. (a) If

$$c(n) = \begin{cases} 2c\left(\frac{n}{2}\right) + 3, & \text{for } n > 2 \\ 2 & , \text{ for } n = 2 \end{cases}$$

Then prove that $c(n) = o(n)$, where $n = 2^k$ for some positive integer K .

(b) Write down Binary search algorithm and discuss its time complexity. $6 + (4 + 4)$

3. (a) Write an algorithm of Merge sort technique using Divide and Conquer method.

(b) Discuss the time complexity of Merge Sort.

(c) Write Tower of Hanoi algorithm using recursion. $6 + 4 + 4$

4. (a) What do you mean by Dynamic programming? Explain Matrix chain multiplication problem using Dynamic programming.

(b) What are the difference between dynamic programming and greedy approach? $(2 + 8) + 4$

5. (a) What is Back tracking method ? State the advantage of this method. Write the algorithm of N-Queens problem using Back tracking method.

(b) Define chromatic polynomial of a colored graph.

(c) Prove that a graph of n vertices is a complete graph iff its chromatic polynomial is given by

$$P_n(\lambda) = \lambda(\lambda - 1)(\lambda - 2) \dots (\lambda - n + 1)$$

where, λ is the number of colors.

$$(3 + 5) + 3 + 3$$

6. (a) Write a recursive procedure for postorder traversal of a binary tree. Draw a binary tree in which Inorder and postorder graph Traversal will give same listing of nodes.

(b) Write Breadth First Search graph traversal algorithm with its complexity.

(c) Write down Prim's algorithm for finding minimum spanning tree of a graph.

$$(2 + 2) + 6 + 4$$

(4)

7. (a) Write an algorithm of job sequencing with dead lines.

(b) What is Knapsack problem? Write an algorithm for Knapsack problem. Consider the following instance of the Knapsack problem : $n = 3$, $m = 20$, $(p_1, p_2, p_3) = (25, 24, 15)$ and $(w_1, w_2, w_3) = (18, 15, 10)$. Solve it by Knapsack algorithm.

(c) Define Np-hard and NP-complete problem.

$$5 + (1 + 3 + 3) + 2$$

[*Internal Assessment* : 30 Marks]
