No. of Printed Pages : 4

MCS-031

13267

MCA (Revised)

Term-End Examination

December, 2010

MCS-031 : DESIGN AND ANALYSIS OF ALGORITHM

Time : 3 hours *Maximum Marks : 100*

*Note : **Question No. 1** is **compulsory**. Attempt **any three** from the rest of the questions.*

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1. (a) (i) Write a recursive procedure to find the product of first n natural numbers. **4**

(ii) Differentiate between 'problem' and 'instance of a problem' with an example for each. **4**

(b) (i) State five important characteristics of an algorithm. **4**

(ii) Explain the Four - Colour Problem. **4**

(c) (i) For the function defined by $f(x) = 7x^3 + 5x + 3$, show that $f(x) = O(x^3)$ **4**

(ii) Sort the following sequence of numbers in ascending order, using any of the well - known sorting algorithm : 4

78, 29, 28, 108, 48, 38.

(d) (i) Discuss three major steps of the general plan for Divide and Conquer technique. 4

(ii) Briefly discuss the Principle of Optimality in context of Dynamic Programming. 4

(e) (i) Name at least FOUR undecidable problems, with brief description of each. 4

(ii) In context of classes of problems, define the classes P and NP. 4

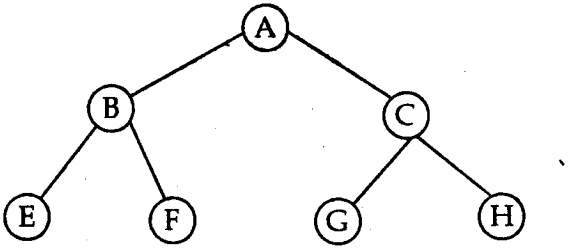
2. (a) Write an algorithm that finds the real roots, if any, of a quadratic equation $ax^2 + bx + c = 0$ with $a \neq o$, b, c as real numbers. 7

(b) Use Principle of Mathematical Induction to show that 6 divides $n^3 - n$. 7

(c) Show that $2^n = O(5^n)$ 6

3. (a) Compute the product 1026732 x 732912 using Karatsuba's method. 7

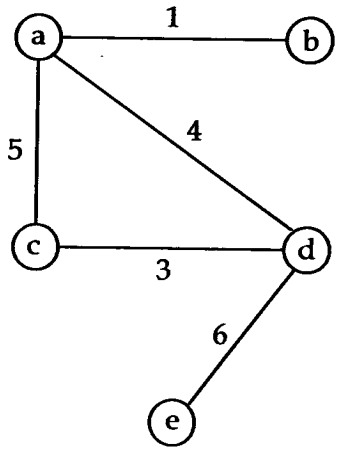
(b) Trace how DFS (Depth First Search) traverses, i. e. discovers and visits the graph given below when starting at node / vertex is A : 8



(c) Write pseudo - code for Breadth - First search. 5

4. (a) Using Dynamic Programming technique, find out minimum number of coins required to collect Rupees 8 (eight) out of coins of denominations 1, 4 and 6 rupees. 10

(b) Using either Prim's, or Kruskal's algorithm, find minimal spanning tree for the following graph. 10



5. (a) Explain the general steps in establishing NP - completeness proof of a given problem. 10

(b) If L_1 and L_2 are context - free languages then show that (i) $L_1 \cup L_2$ and (ii) $L_1 . L_2$ are context - free languages. 10