09822

MCA (Revised)

Term-End Examination

June, 2011

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.*

1. (a) Arrange the following growth rates in increasing order : O (3^n), O (n^2), O (1), O (n log n) **4**

   (b) Briefly discuss three basic actions and instructions that build a program in Von Newmann architecture machine. **4**

   (c) Write a recursive algorithm that finds the sum of first n natural numbers. **4**

   (d) Explain briefly The Fermat's Last Theorem. **4**

   (e) Using Principle of Mathematical Induction, Prove that the sum $2^0 + 2^1 + \ldots + 2^n$ is $2^{n+1} - 1$ for all $n \geq 1$. **4**

   (f) Using Insertion Sort or Bubble Sort, sort the following sequence in increasing order : 35, 37, 18, 15, 40, 12 **4**

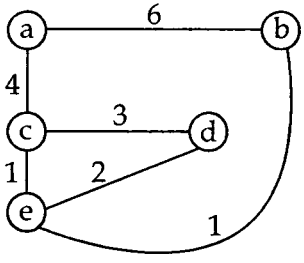
(g) Define Knapsack Problem and cite one instance of the problem. 4

(h) Consider a (hypothetical) country in which only notes available are of denominations 10, 40 and 60. Using Greedy algorithm, how do we collect an amount of 80. 4

(i) Briefly explain Kruskal's OR Prim's algorithm for finding minimal spanning tree of a graph. 4

(j) Name four undecidable problems, each with brief description. 4

2. (a) Using Dijkstra's algorithm, find the minimum distances of all the nodes from node 'b' which is taken as the source node, for the following graph. 10

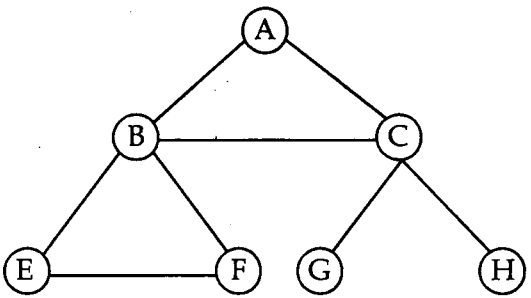


(b) Find a regular expression for the language 5

{∧, a, a b b, a b b b, a b b b b b b, ...}

(c) Briefly discuss Chomsky classification for Grammars. 5

3. (a) Trace how BFS (Breadth - First Search) traverses, i.e, discovers and visits the graph given below when starting at node A. 8



(b) Write pseudo-code for Depth-First search. 5

(c) Find the value of $(12)^{31}$ using not more than SIX multiplications and/or divisions. 7

4. (a) Write a program that computes the length of the diagonal of a right - angled triangle, the length of the two sides of which are given. 6

(b) For the function $f(x) = 4x^3 + 6x + 1$ show that (i) $f(x) = O(x^4)$ but (ii) $x^4 \neq O(f(x))$ 6

(c) Sort the following sequence of numbers using Quick Sort : 8, 6, 4, 12, 11, 5, 7 and 9. 8

5. (a) Design a Turing Machine that recognises the languages of all strings of even lengths over the alphabet {c, d}. **10**

(b) For each of the following pairs of lists, discuss whether PCP (Post Correspondence Problem) has a solution : **10**

(i) List A = (b, b a b b b, b a)

and List B = (b b b, b a, a)

(ii) List C = (a b, b, b) and

D = (a b b, b a, b b)