No. of Printed Pages : 4

MCS-031

08277

MCA (Revised)

Term-End Examination

June, 2012

MCS-031 : DESIGN AND ANALYSIS OF ALGORITHM

Time : 3 hours *Maximum Marks : **100***

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

1. (a) Write Euclid's algorithm for finding Greatest Common Divisor (G.C.D) of two natural numbers m and n. **4**

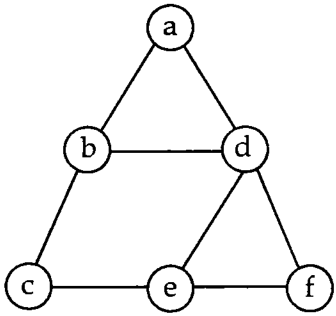
(b) Let fact (n) = 1 * 2 * 3.......* n where '*' denotes product of two integers and n is a natural number. Give a recursive definition of fact (n). **4**

(c) Name at least four well-known techniques for solving problems algorithmically. **2**

(d) For the function $f(x) = 3x^3 + 2x^2 + 1$, show that $f(x) = O(x^3)$ where 'O' denotes 'big oh'. **2**

(e) Explain how binary search method finds or fails to find the number 25 in the sorted list : 8, 12, 26, 35, 48, 57. **4**

(f) Explain how the nodes of the following the graph will be traced using breadth first search, starting at node 'a': 4



(g) Explain the method of pre-order traversal of a tree, using a suitable example of a tree, with at least eight nodes. 4

(h) Using Principle of Mathematical Induction, show that sum of first n natural numbers is $n(n+1)/2$. 4

(i) Explain the essential idea of Dynamic Programming. How does Dynamic Programming differ from Divide and Conquer approach for solving problems ? 4

(j) Using selection sort, sort the following sequence of numbers, in the increasing order : 4

15, 12, 18, 24, 13, 27,

(k) Name four undecidable problems, along with their special significance. 4

2. (a) Write an algorithm that finds the real roots, if any, of a quadratic equation : 5

$$ax^2 + bx + c = 0,$$

Where a $\neq$ 0, b and c are real numbers.

(b) Explain Chomsky classification for grammers, with an appropriate example. 5

(c) Write a recursive algorithm to find the sum of first n natural numbers. 5

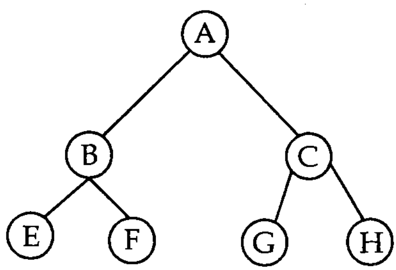
(d) Sort the following list using Merge Sort : 5

7, 9, 10, 8, 4, 6, 5.

3. (a) Find solution of the recurrence equation, given as follows : 5

$$F(n) - 4F(n-1) + 4F(n-2) = 0$$

(b) Trace how Depth First Search Traverses the following tree, when starting at node B : 7



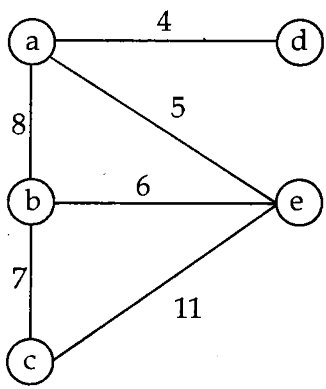
(c) Explain each of the following, with an appropriate example : 8

(i) Minimax Problem

(ii) Topological Sort

4. (a) Find the value of $(12)^{31}$, using not more than SIX (6) multiplications and/or divisions. 6

(b) Using either Prim's algorithm or Kruskal's algorithm, find a minimal spanning tree for the graph given as follows : 8



(c) Explain the meaning of each of the following expression : 6

(i) $(a+b)^*$

(ii) $a^* \, b \, a^* \, b \, a^*$

(iii) $(a+b)^* \, a \, b$

Where '$*$' denotes Kleene Closure.

5. (a) Find a grammer for the following language : 8

$$\{ a^m b^n ; m, n \in N, n > m \}$$

(b) Explain each of the following problems, together with their respective significance. 12

(i) Halting Problem

(ii) Post Correspondence Problem

(iii) Undecidable Problem