MCA (Revised)
Term-End Examination
December, 2015

MCS-031 : DESIGN AND ANALYSIS OF ALGORITHMS
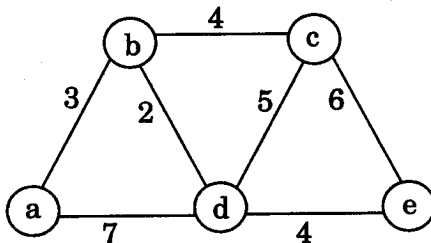
Time : 3 hours   *Maximum Marks : 100*

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

1. (a)   Write recursive binary search algorithm and analyse its run time complexity.   7

    (b)   Solve the recurrence :
 $$T(n) = 2T(n/2) + n; n \geq 2$$
          $$= 1 ; n < 2.$$ 4

    (c)   Using Dijkstra's algorithm, find the minimum distances of all the nodes from source node 'a' for the following graph :   7

(d) Construct a Turing Machine (TM) to accept all languages of palindromes on alphabet $\Sigma = (a, b)$. *6*

(e) Explain matrix multiplication using dynamic programming. *10*

(f) What is minimax principle ? Explain with the help of an example. *6*

2. (a) Obtain the minimum cost spanning tree for the following graph using Prim's algorithm. *5*
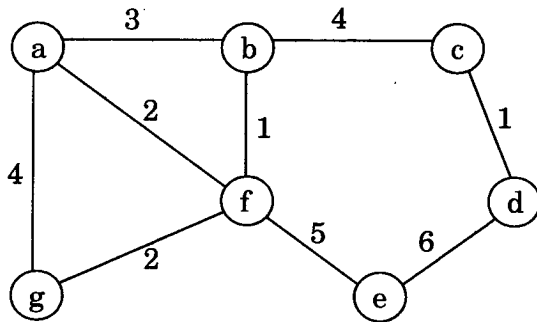
(b) Obtain the DFS tree for the graph given in Q.no. 2(a); considering node (a) as root node. *5*

(c) Explain the Chomsky's classification of grammars. *10*

3. (a) Enumerate any five well-known techniques for designing algorithms for solving problems. *5*

(b) Sort the following elements using Heap Sort :

   10, 28, 46, 39, 15, 12, 18, 9, 56, 2.

   Show each step, while creating a heap and processing a heap. 8

(c) For any set S of strings prove that $S^* = (S^*)^* = S^{**}$. 7

4. (a) Arrange the following growth rates in increasing order : 5

   $O(n^3)$, $O(3^n)$, $O(n \log n)$, $O(1)$, $O(\log n)$.

(b) For the function

   $f(x) = 4x^3 + 6x + 5$,

   show that (i) $f(x) = O(x^4)$

   but (ii) $x^4 \neq O(f(x))$. 5

(c) What is Pushdown Automata (PDA) ? Build a PDA that accepts the language even palindrome. 10

5. (a) What is Satisfiability problem ? Explain briefly. 5

(b) Prove that the running time of binary search algorithm in worst case is $O(\log_2 n)$. 5

(c) Using Bubble Sort, sort the following sequence in increasing order : 5

   11, 21, 6, 14, 8, 12, 28, 32.

(d) Write a note on regular languages. 5