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MCS-031

MASTER OF COMPUTER APPLICATION (MCA) (Revised)

Term-End Examination

December, 2020

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 remaining questions.*

1. (a) Define theta (θ) notation. Show that : 5

$$n^2 + 3 \log n = \theta (n^2)$$

(b) Explain algorithm for randomization of quick sort. 5

(c) Define algorithm. State any ***four*** important characteristics of an algorithm. 5

(d) Define NP complete problem. List any ***three*** NP complete problems. 5

(e) If L_1 and L_2 are context-free languages, then show that $L_1.L_2$ are context-free languages. 5

(f) Apply merge sort algorithm to sort the following array elements : 5

4, 6, 2, 3, 8, 5, 7, 1

(g) Differentiate between divide and conquer and dynamic programming design techniques for solving problems. 5

(h) Explain Chomsky's classification of grammar. 5

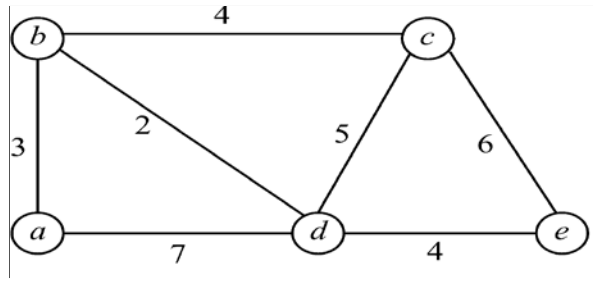
2. (a) Explain ambiguity in Context-Free Grammar (CFG). Write CFG for the following languages :

(i) Even palindromes over $\{a, b\}$ 5

(ii) $L = \left\{ a^n b^m c^m d^n \,\middle|\, m, n \geq 1 \right\}$ 5

(b) Using Dijkstra's algorithm, find the minimum distance of all the nodes from source node 'a' from the following graph :

5+5



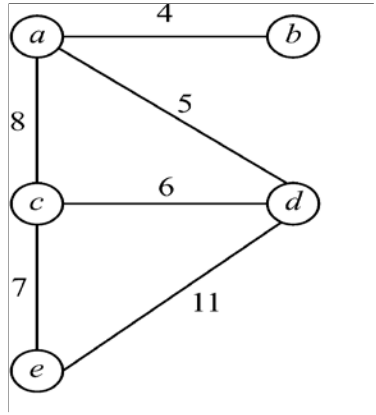
3. (a) Write principle of optimality. Explain, how dynamic programming can be used to solve chain matrix multiplication problem. 10

   (b) Define clique problem. Show that clique problem is NP complete. 10

4. (a) What is satisfiability problem ? Explain briefly. 5

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

   (c) Write Prim's algorithm to find Minimum Spanning Tree (MST). Use Prim's algorithm to find MST for the graph given below : 5+5



5. (a) Write short notes on the following : 5×3=15

(i) Heap sort and its time complexity

(ii) Post Correspondence Problem (PCP)

(iii) Vertex Cover Problem (VCP)

(b) Show that the running time of Strassen's algorithm is $O(n^{2.81})$. 5