

**MASTER OF COMPUTER
APPLICATIONS (MCA) (REVISED)**

Term-End Examination

December, 2023

**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 Big theta (Θ) notation. Show that : 5

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

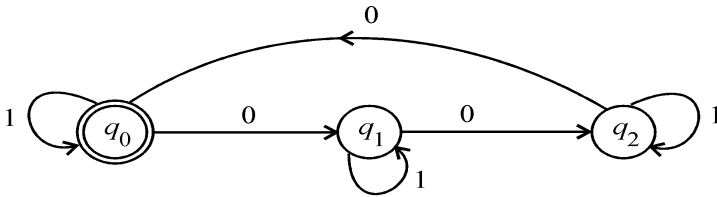
- (b) Write and explain the algorithm of selection sort. 5

- (c) Write the regular expression to generate strings of even length over the set of alphabets $\Sigma = [a, b]$. Also, draw a finite automata to accept this regular expression. 5

- (d) Write a recursive function to find the sum of all the elements in an integer array. Compare the terms recursive function and iterative functions. 5

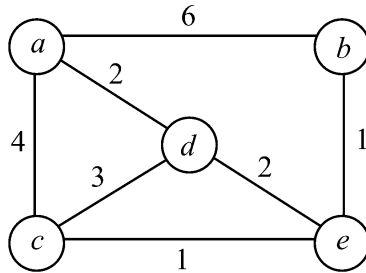
- (e) Draw the finite automata corresponding to the regular expression $(a+b)^*ab$. Also, compare the deterministic and non-deterministic finite automatas. 5
- (f) Enumerate *five* important characteristics of an Algorithm. 5
- (g) Discuss the best case and average case time complexity of Quick sort algorithm by writing their recurrence relation. 5
- (h) State Travelling-Salesperson problem. Comment on the nature of solution of the problem. 5
2. (a) What is the Principle of Optimality ? Derive the principle of optimality for multiplication of matrix chain. 5
- (b) Discuss chain matrix multiplication and its application. Compute the optimal number of scalar multiplications required to multiply the following matrices : 10
- A_1 of order 30×35
- A_2 of order 35×15
- A_3 of order 15×5
- (c) Explain the Kruskal's algorithm for the construction of Minimum Cost Spanning Tree. 5

3. (a) Find the regular expression for the following Finite-Automata : 6



- (b) Define Turing Machine (TM). Construct a TM for the language ODD PALINDROME, over input alphabet $\Sigma = \{a, b\}$. 8
- (c) Compare the dynamic programming technique and Greedy technique for solving problems. Give suitable example for each. 6
4. (a) Write Heap sort algorithm. Compute the time complexity of heap sort algorithm. Illustrate the heap sort algorithm to sort the sequence $\langle 10, 5, 12, 25, 2, 8, 13, 7 \rangle$. 10
- (b) Differentiate between NP-complete and NP-hard problem. Show that CLIQUE problem is NP-complete. 10
5. (a) Write Dijkstra's algorithm. Use it to find the minimum distance of all the nodes

from node 'b' which is taken as the source node for the following graph : 10



- (b) Write Karatsuba's method, use it to multiply 10752×5318 . Analyse the running time of this algorithm. 10