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MCS–031

MASTER OF COMPUTER APPLICATIONS (REVISED) (MCA)

Term-End Examination

June, 2025

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) What is an algorithm ? Write an algorithm to find real roots of a quadratic equation. 5

   (b) By using principle of mathematical induction, show that 6 divides $n^3 - n$, where n is a non-negative integer. 5

   (c) Write and explain Fermat's Last Theorem. 5

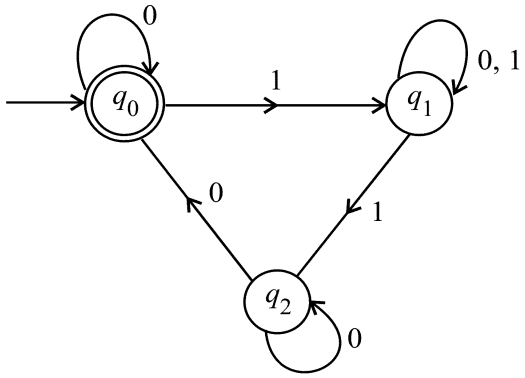
(d) What is Sorting ? Write and implement insertion sort algorithm for the following list of elements : 5

80, 32, 31, 110, 50, 40

(e) Describe Prim's algorithm for minimal spanning tree of a graph, using an example. 5

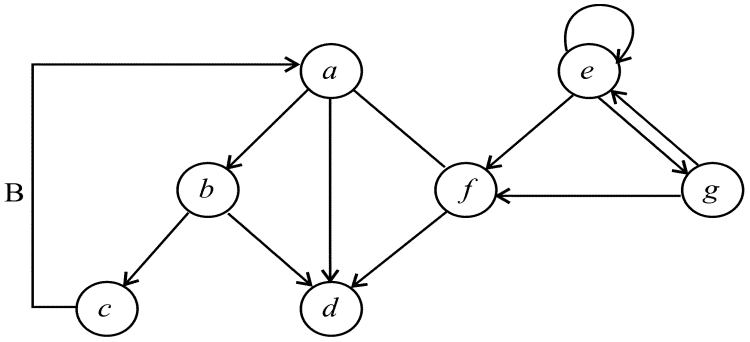
(f) What is dynamic programming ? Compare it with divide and conquer approach. 5

(g) Define regular expression. Find the regular expression for the following finite automata : 5



(h) What is an undecidable problem ? Explain it with an example. 5

2. (a) Write Depth First Search (DFS) algorithm ? Classify different types of edges of the directed graph G(V, E). Traverse the given graph using DFS : 10



(b) Define Strassen's algorithm. What are the various limitations of Strassen's algorithm ? Multiply any *two* matrices using Strassen's algorithm. 10

3. (a) Write principle of optimality. Explain chain matrix multiplication with a suitable example. 10

(b) Explain the Chomsky classification of grammar. When a grammar is said to be ambiguous ? Discuss. 10

4. (a) Explain Randomized Quick Sort ? How is it different from Quick Sort ? Demonstrate working of Quick Sort algorithm by sorting the following data : 10

5 2 10 15 1 12 9

(b) What are various Asymptotic Notations ? Explain each with an example. 10

5. (a) Write short notes on any *two* of the following : 5+5

(i) Vertex cover problem

(ii) Colouring problem

(iii) Knapsack problem

(iv) Post correspondence problem

(b) Differentiate between any *two* of the following : 5+5

(i) Turing Acceptable Language and Turing Decidable Language

(ii) NP-complete problem and NP-hard problem

(iii) Context Free Grammar and Context Sensitive Grammar

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