

MCA
(SEM III) THEORY EXAMINATION 2022-23
DESIGN AND ANALYSIS OF ALGORITHMS

Time: 3 Hours**Total Marks: 70****Note:** Attempt all Sections. If require any missing data; then choose suitably.

SECTION A

1. Attempt all questions in brief. 2 x 7 = 14

- (a) Define algorithm. Describe it's various characteristics.
- (b) What is role of selecting pivot element in complexity of quick sort
- (c) Discuss the properties of binomial tree
- (d) Write a short note on asymptotic Notations.
- (e) Describe RB trees and its properties.
- (f) Write down bucket sort algorithm.
- (g) Discuss solution of 0/1 knapsack problem

SECTION B

2. Attempt any three of the following: 7 x 3 = 21

- (a) Write down merge sort algorithm
- (b) Define various asymptotic notations in detail
- (c) Explain the term "Time and Space Complexity Trade Offs"
- (d) Write short notes on the class P, class NP and class NPC
- (e) Differentiate backtracking approach in comparison of branch and bound technique.

SECTION C

3. Attempt any one part of the following: 7 x 1 = 7

- (a) Illustrate master theorem with all three cases. Apply Master theorem on following recurrence to get their solution.

$$T(n) = 4T\left(\frac{n}{2}\right) + \theta(n^3)$$

- (b) Write down counting sort algorithm and apply it on following data
 $A = \{ 2, 6, 3, 1, 4, 6, 2, 3, 6, 4, 2, 4, 8, 7, 3, 5, 1, 4, 5 \}$

4. Attempt any one part of the following: 7 x 1 = 7

- (a) Examine the height h of a red-black tree with n internal nodes is not greater than $2\log(n+1)$.
- (b) differentiate analysis of fibonacci heap, binomial heap and binary heap over different operations

5. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Give proper argument, how is Strassen's technique better than classical divide and conquer technique of matrix multiplication? Evaluate following matrix multiplication using Strassen's algorithm.

$$\begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix} \text{ and } \begin{bmatrix} 1 & 1 \\ 2 & 1 \end{bmatrix}$$

- (b) Write down prim's and krushkal's algorithm to find a minimum spanning tree and also analyses their complexities.

6. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Discuss the Matrix chain multiplication problem and write down its dynamic approach based algorithm
- (b) Demonstrate Floyd Warshall's algorithm to solve All Pairs Shortest Path problem with an example

7. Attempt any *one* part of the following:

7 x 1 = 7

- (a) Write KMP algorithm for string matching.
- (b) Discuss vertex cover problem and write down approximation algorithm to find out its solution

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