(Please write your Exam Roll No.) *Exam Roll No. .....*

END TERM EXAMINATION

FIFTH SEMESTER [B.TECH] FEBRUARY 2023

Paper Code: ETCS301 ***Subject: Algorithms Design and Analysis***

Time: 3 Hours ***Maximum Marks: 75***

Note: Attempt any five questions in all including Q.No.1 which is compulsory.

Q1 Attempt all questions: **(5x5=25)**

a) Define time complexity and space complexity. Write an algorithm for adding n natural numbers and find the space required by that algorithm.

b) Define Big 'Oh' notation. Formulate the order of growth. Compare the order of growth n! and 2n.Differentiate between Best, average and worst case efficiency.

c) Differentiate divide and conquer and dynamic programming.

d) Explain dynamic programming method of problem solving. What type of problems can be solved by dynamic programming?

e) Determine an LCS of <1, 0, 0, 1, 0, 1, 0, 1> and <0, 1, 0, 1, 1, 0, 1, 1, 0>

Q2 **(4+4+4.5)**

a) Discuss the concepts of asymptotic notations and its properties.

b) Analyze the order of growth.
F(n) = 2n2 + 5 and g(n) = 7n. Use the Ω (g(n)) notation.

c) Evaluate the recurrence relations.
(i). x (n) = x (n-1) + 5 for n>1.
(ii). X (n) = x(n/3) +1 for n >1,x(1) =1. (Solve for n = 3k)

Q3 **(4+4+4.5)**

a) Which sorting algorithm is best if the list is already sorted? Why?

b) Prove that the average running time of Quick Sort is O(nlog(n)) where n is the number of elements.

c) What are stable algorithms? Which sorting algorithm is stable? Give one example and explain.

Q4 **(4+4+4.5)**

a) Implement UNION using linked list representation of disjoint sets.

b) Explain the characteristics of problems that can be solved using dynamic programming.

c) Give a control abstraction for Divide and Conquer method. Explain with an example.

P.T.O.

Q5 **(4+4+4.5)**

a) Explain the effect of negative weight edges and negative weight cycles on shortest paths.

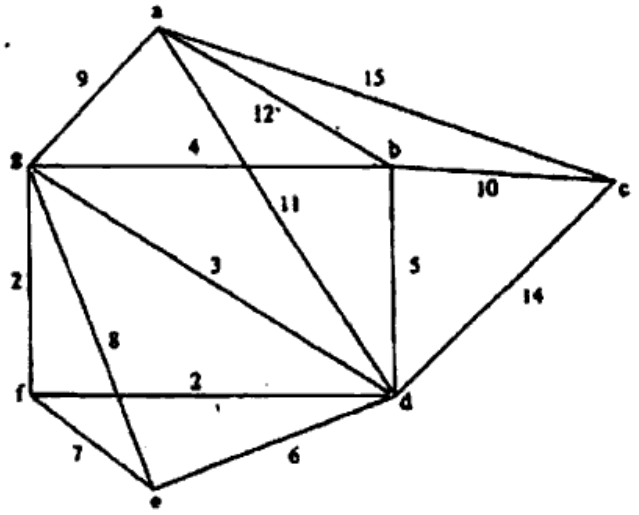
b) Define strongly connected components. How DFS can be used to find strongly connected components?

c) Find an optimal paranthesization of a matrix-chain product whose sequence of dimensions is 4x10, 10x3, 3x12, 12x20

Q6 **(6+6.5)**

a) Write Dijkstra's Single Source Shortest path algorithm. Analyze the complexity.

b) Find minimum spanning tree for the following graph using Prims algorithm and discuss complexity.



Q7 **(6+6.5)**

a) Explain Rabin-karp string matching algorithm in brief.

b) Find longest common subsequence of following two strings X and Y using any algorithm :
X = 'aabdbacdcba'
Y = 'aabddcbac'

Q8 **(4+4+4.5)**

a) Differentiate between P, NP, NP-completeness and NP – Hard problems.

b) How a problem is identified as NP complete problem? Give atleast five problems that can be classified as NP complete problems.

c) With examples explain polynomial time reducibility.

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