

C. U. SHAH UNIVERSITY

Summer Examination 2020

Subject Name : Design and Analysis of Algorithms

Subject Code : 4TE05DAA1

Branch: B.Tech (CE)

Semester: 5

Date: 02/03/2020

Time: 10:30 To 01:30

Marks: 70

Instructions:

- (1) Use of Programmable calculator & any other electronic instrument is prohibited.
- (2) Instructions written on main answer book are strictly to be obeyed.
- (3) Draw neat diagrams and figures (if necessary) at right places.
- (4) Assume suitable data if needed.

Q-1 Attempt the following questions: (14)

- a) What is algorithm?
- b) Arrange following rate of growth in increasing order.
 $2N, n \log n, n^2, 1, n, \log n, n!, n^3$
- c) Define Big 'Omega' notation.
- d) What is space complexity of an algorithm?
- e) Is $2^{n+1} = O(2^n)$? Explain
- f) Give recurrence equation for Merge Sort.
- g) Time complexity of matrix chain multiplication is:
i). $O(n^2)$ ii). $O(n)$ iii). $O(n \log n)$ iv). $O(n^3)$
- h) Time complexity of LCS is:
i). $O(m!)$ ii). $O(mn)$ iii). $O(n!)$ iv). $O(n^2)$
- i) _____ is a condition that is always true at a particular point in an algorithm.
i). assertion ii). constant iii). exception iv). invariant
- j) Data Structure used for the Merge Sort:
i). Two Pointers ii). Two pointers and N Extra Arrays
iii). $2N/2$ pointers and $N/2$ Extra Arrays iv). Two Pointers and an Extra Array
- k) In dynamic programming, the output to stage n become the input to:
i). stage n-1 ii). stage n+1 iii). stage n itself iv). stage n-2
- l) What do you mean by time complexity of an algorithm?
- m) What is a difference between an algorithm and a program?
- n) List out characteristics of an algorithm.

Attempt any four questions from Q-2 to Q-8

Q-2 Attempt all questions (14)

- (a) Write an algorithm for insertion sort. Also analyze the algorithm and compute its best case and worst case time complexity.
- (b) Explain master theorem and solve the following recurrence equation with master method:
 1. $T(n) = 9T(n/3) + n$
 2. $T(n) = 3T(n/4) + n \lg n$



- Q-3** **Attempt all questions** **(14)**
- (a) Write down an algorithm of quick sort. Analyze it for best case, worst case and average case. When it performs similar to selection sort?
- (b) What is an amortized analysis? Explain aggregate method of amortized analysis with suitable example.
- Q-4** **Attempt all questions** **(14)**
- (a) Differentiate among Greedy approach, Divide and Conquer Strategy, Dynamic Programming, Branch and Bound, and backtracking for designing of an algorithm.
- (b) Explain Floyd-Warshall's algorithm for finding out all pair shortest path in a given graph with suitable example.
- Q-5** **Attempt all questions** **(14)**
- (a) Find out optimal sequence for matrix chain multiplication using Dynamic Programming for matrices A1 [5 × 4], A2 [4 × 6], A3 [6 × 2], and A4 [2 × 7]. Also give the optimal parenthesization of matrices.
- (b) Explain Fractional Knapsack problem with suitable example.
- Q-6** **Attempt all questions** **(14)**
- (a) Solve the following 0/1 Knapsack Problem. There are five items whose weights and values are given in following arrays:
Weight W[] = { 1,2,5,6,7 }
Value V[] = { 1,6,18, 22, 28 }
Give equations and find out the optimal knapsack items where weight capacity of knapsack is **11** units.
- (b) Explain Backtracking Method. What is N-Queens Problem? Give solution of 4-Queens Problem using Backtracking Method.
- Q-7** **Attempt all questions** **(14)**
- (a) What is Minimum Spanning Tree? Explain Krushkal's algorithm for minimum spanning tree with suitable example.
- (b) Explain Making-Change problem using dynamic programming with suitable example.
- Q-8** **Attempt all questions** **(14)**
- (a) Explain spurious hits in Rabin-Karp string matching algorithm with example. Working modulo $q=13$, how many spurious hits does the Rabin-Karp matcher encounter in the text $T = 2359023141526739921$ when looking for the pattern $P = 31415$?
- (b) Define P, NP, NP-complete and NP-Hard problems. Give examples of each.

