

END Term Examination 2024

Name of the Program : B.Tech (CSE)

Semester : 4 (Fourth)

Name of the Course : Design & Analysis of Algorithms

Course Code : TCS-409

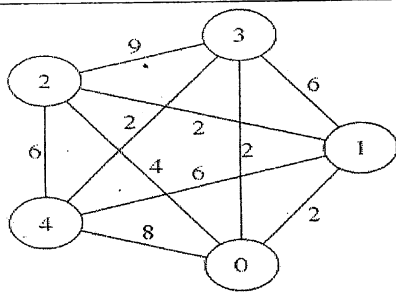
Time: 3 Hours

Maximum Marks: 100

Note:

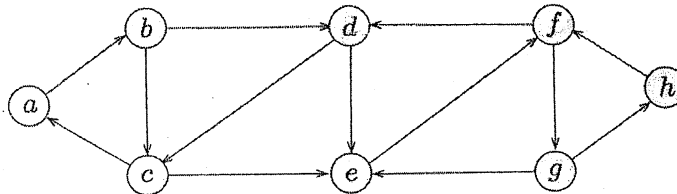
- (I) All Questions are compulsory
- (II) Answer any two sub questions among a, b and c in each question.
- (III) Total marks in each main question are twenty.
- (IV) Each question carries 10 marks

Q1	(20 marks)	
(a)	Solve the recurrence $T(n) = T(n/3) + T(2n/3) + n$ using recursion tree method.	CO1
(b)	Differentiate between Linear and Binary search. Write an efficient pseudo code for recursive binary search assuming that the given array elements are arranged in decreasing order.	
(c)	Define Master's Theorem and Apply on following recurrences: (i) $T(n) = 7 T(n/3) + n^2$ (ii) $T(n) = 3 T(n/3) + n/\log n$ (iii) $T(n) = 4 T(n/2) + n^{5/2}$	
Q2	(20 marks)	
(a)	What are major differences between Merge sort and Quick Sort? Write an algorithm for Randomized Quick Sort & Analyze its complexity.	CO2
(b)	Write an Algorithm for Insertion sort to sort an array in descending order and then apply it on the array $A[] = \{6, 1, 0, 4, 5, 2, 3\}$. Show the different steps involved.	
(c)	What do mean by external and stable sorting? Given an Array $A[] = \{2, 3, 2, 4, 6, 0, 3, 2, 4, 5\}$. Sort the array using counting sort algorithm.	
Q3	(20 marks)	
(a)	<p>Given a directed acyclic graph. Use any appropriate algorithm to sort the nodes in proper order (topological sort).</p> <pre> graph LR A((A)) --> B((B)) A --> D((D)) B --> C((C)) B --> H((H)) C --> F((F)) C --> G((G)) D --> E((E)) E --> H F --> G H --> G </pre>	CO3
(b)	What is a minimum spanning tree (MST)? What are the different methods to find the MST? Write any one algorithm to find the MST and apply it on the following graph.	



Given a directed graph. Apply an algorithm to find the strongly connected components.

(c)



Q4

(20 marks)

(a)

Differentiate between Dynamic and Greedy approach? Given $s1 = \text{"abccba"}$, $s2 = \text{"abddba"}$, find the longest common subsequence using dynamic approach.

(b)

A file contains the following characters with the frequencies as shown. If Huffman Coding is used for data compression, determine-

1. Huffman Code for each character
2. Average code length
3. Length of Huffman encoded message (in bits)

Character: A B C D E -
Probability: 0.5 0.35 0.5 0.1 0.4 0.2

CO4

(c)

Solve the following instance of 0-1 Knapsack problem using Dynamic programming:

$I1=(4,6)$, $I2=(2,4)$, $I3=(3,5)$, $I4=(1,3)$, $I5=(6,9)$ and $I6=(4,7)$ where $I=(w,v)$ represent item weight w and value v . consider knapsack capacity = 10.

Q5

(20 marks)

(a)

Define Class P and NP problems? Given a set $S = \{1,2,3,4,5,6\}$ and sum $X=8$. Obtain the subset sum using backtracking approach.

(b)

What do mean by hashing? What are different collision resolution techniques? Given key= $\{43,135,72,23,99,19,82,72\}$ use different collision resolution techniques to store the data. (use $h(K) = K \bmod 10$)

(c)

What do mean by string matching? What are different algorithms for string matching? Write an algorithm for Rabin Karp matching and apply on given string and pattern. Also find the number of spurious hits.

String = ABCDDACEBCDA, Pattern = CDA, $q=13$
(Assume that $A=1$, $B=2$ $E=5$)

CO5