

JK Lakshmipat University Jaipur
INSTITUTE OF ENGINEERING AND TECHNOLOGY

End Term Examination, December 2024

B. Tech. (CSE), Semester V, 2024-2025

Roll No.....

CS1105: Design and Analysis of algorithms

Time: 2 hours

Max. Marks: 30

Instructions to students:

1. Do not write anything other than your roll number on the question paper.
 2. Show steps and give proper explanation wherever required.
-

Q. 1.1 Find the time complexity of the following C-function ($n > 0$)

2.0
(CO1)

```
int recursive (int n)
{
    if(n==1) return (1);
    else return(recursive(n-1) + recursive(n-1));
}
```

Q. 1.2 A sorting algorithm takes 1 second to sort 1000 items on your local machine. How long will it take to sort 10,000 items.

2.0
(CO1)

- a) if you believe that the algorithm takes time proportional to n^2 , and
- (b) if you believe that the algorithm takes time roughly proportional to $n \log_2 n$

Q. 2.1 Suppose a Photocopier shopkeeper Mr. Ramesh has the following scheduling problem-

5.0
(CO2)

He has a single Photocopy machine and every morning he gets a set of jobs from n customers. Assume customer i 's job J_i takes t_i time to complete and weight w_i denotes the cost of the job J_i . If according to the schedule Job J_i is completed at time C_i after the start, then it means that C_i denotes the finish time of job J_i . Mr Ramesh wants to order the jobs such that the weighted sum of the completion time is minimum i.e. $\sum_{i=1,n} w_i C_i$ is minimum. Design an efficient algorithm to solve the problem. Apply your algorithm to the following data and tell in which order Mr. Ramesh should schedule the given 5 jobs.

Job	Time taken	Weight
J1	10	50
J2	5	15
J3	3	48
J4	15	90

Show whether your algorithm will give optimal solution or not

Q. 2.2 Obtain a set of optimal Huffman codes for the message if it has 6

2.0

alphabets {a, b, c, d, e, f,} and the frequencies of alphabets in the message are 20, 12, 7, 15, 16}

(CO2)

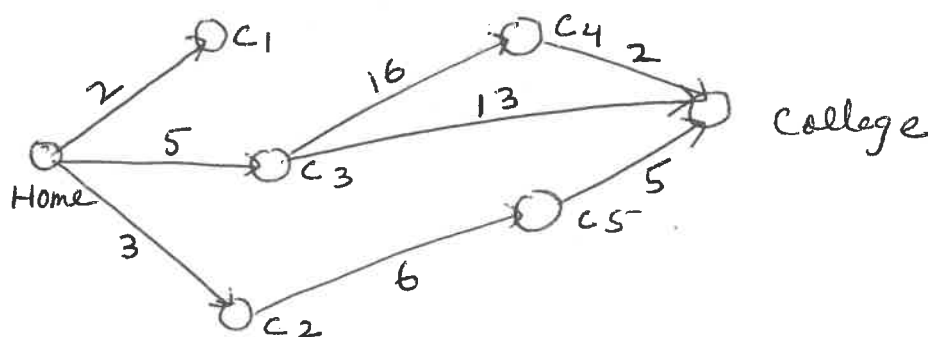
Q. 3.1 You are given a one-dimensional array that may contain both positive and negative integers. Write a pseudocode to find the sum of the contiguous subarray of numbers that has the largest sum using divide and conquer algorithm. Show how your algorithm will work for the array [1, -2, 5, -1, 4, 4, -1, -2, 8] 4.0 (CO3)

Q.3.2 For any two problems given below, define the problem clearly, explain the complexity if these problems are solved using brute force method. 4.0 (CO5)

- Weighted interval scheduling
- 0/1 knapsack problem
- Matrix chain multiplication

Q.3.3 Define the classes of problems P, NP, NP-complete. 3.0 (CO7)

Q. 4.1 For the given graph, find the cheapest path from Home to College using Dijkstra algorithm. Show the steps clearly. 3.0 (CO4)

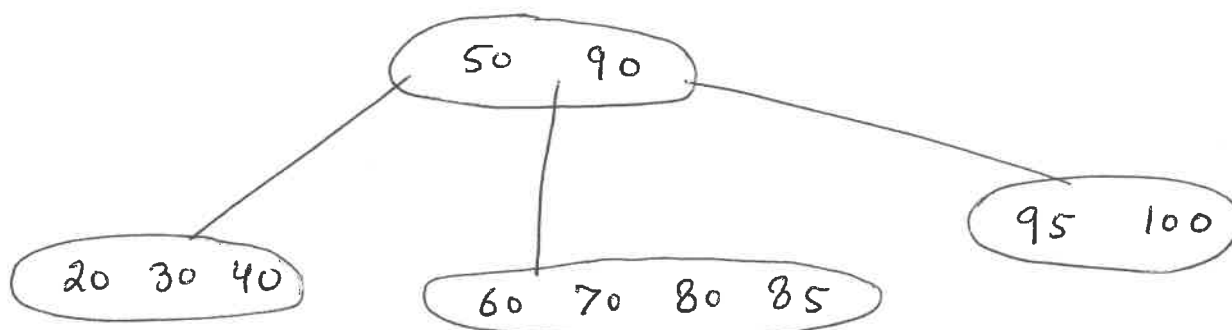


Q. 4.2 Suppose you are given a pointer to a root node of a B-Tree of order 5 of height 1 that contains 3 key values, and all its leaf nodes have 4 key values. Write a function to insert a new key K in this B-tree. **You do not have to write a general function for inserting a node in a B-tree.** Structure of the B-tree node is as follows: 3.0 (CO2)

Struct Breenode

```
{int counter; int data[4]; struct Breenode * child[5]; struct Breenode *father;}
```

Q 4.3 Delete the keys 50 and 100 from the given B-tree of order 5 one after another. 2.0 (CO2)



All the Best