Registration No.: | | | | | | | | | | |

Total Number of Pages: 02 **Course: M.Sc.I**

Sub_Code: FBEF511

5th Semester Regular Examination: 2024-25
SUBJECT: Design & Analysis of Algorithms
BRANCH(S): M.Sc.I(MC)
Time: 3 Hours
Max Marks: 70
Q.Code: R337
Answer Question No.1 (Part-I) which is compulsory, any five from rest (Part-II)
The figures in the right-hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) What is heap?
b) Define Brute force strategy.
c) What is principle of optimality?
d) Compare Dynamic programming and divide and conquer.
e) Differentiate between Traveling Salesman Problem (TSP) and Dijkstra's Algorithm.
f) Prove that if NP ≠ co-NP, then P ≠ NP.
g) State the Subset Sum problem.
h) What is meant by all pairs shortest path problem?
i) Sort the given set of elements using merge sort 12, 24, 8, 71, 4, 23, 6, 89, 56.
j) What is the running time of Quick sort when all elements of array A have the same value?

Part-II

Long Answer Type Questions (Answer Any five)

Q2 **a)** Determine an LCS of <1, 0,0,1,0,1,0,1> and <0,1, 0,1,1,0,1,1,0>. **(5)**

b) Explain the general principle of Greedy method and list the applications of Greedy method. **(5)**

Q3 **a)** What is the time complexity of the following C function. **(5)**

```
int recursive (int n){
  if (n == 1)
    return (1);

  else

    return (recursive (n-1) + recursive (n-
1));

}
```

b) Show that the solution to T(n) = 2T(n/2) + n is O(n lg n) using substitution method. **(5)**

Q4 **a)** Show the result of running Quick sorting technique on the sequence 38, 27, 43, 3, 9, 82, 10. **(5)**

b) Explain the methodology of Dynamic programming. List the applications of Dynamic programming. **(5)**

Q5 **a)** Write the Binary search algorithm and analyze for its best, worst, and average case time complexity. **(5)**

b) Suppose we are sorting an array of seven integers using heapsort, and we have just finished some heapify (either maxheapify or minheapify) operations. The array now looks like this: 16 14 15 10 12 27 28 **(5)**

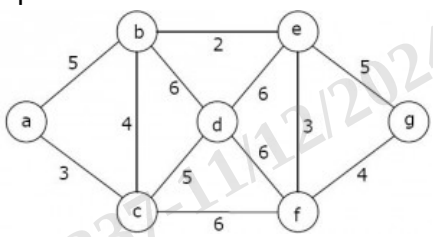
How many heapify operations have been performed on root of heap?

Q6 **a)** State the concept of branch and bound method and list its applications. **(5)**

b) What are the factors that influence the efficiency of the backtracking algorithm? **(5)**

Q7 **a)** Solve the recurrence relation: T(n) = T(n/2) + T(n/4) + T(n/8) + n **(5)**

b) Consider the following graph: **(5)**



Construct a minimum spanning tree using Prim's algorithm? Discuss the time complexity and space complexity of this algorithm.

Q8 **a)** Discuss the NP class, NP- Hard, and NP- complete problems with suitable examples. How can we show that a problem is NP complete? **(5)**

b) Write pseudo code to create a Huffman tree given a set of characters with frequency. Suppose the letters a, b, c, d, e, f have probabilities 1/2, 1/4, 1/8, 1/16, 1/32, 1/32 respectively. What is the average length of Huffman codes? **(5)**