Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

V SEMESTER B.TECH. (COMPUTER AND COMMUNICATION ENGINEERING)

MAKEUP EXAMINATIONS, DECEMBER 2017/ JANUARY 2018

SUBJECT: FUNDAMENTALS OF ALGORITHM ANALYSIS AND DESIGN (ICT 3151)

(REVISED CREDIT SYSTEM)

(19 /12/2017)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates:

- Answer ALL the questions
- Missing data may be suitably assumed.

1A. Consider q=5 and r=(5,4,6,2,7,3) and obtain the optimal order of matrix multiplication using dynamic programming approach. Write the recurrence relation and show each step clearly with traceback. 5

1B. Analyze the space and time complexity for the Algorithm shown in Figure Q.1B and represent the complexities in terms of asymptotic notations. 3

```
void Transpose(int **a, int rows)
{
     for(int i=0;i<rows;i++)
        for(int j=i+1;j<rows;j++)
          {
             swap(a[i][j],a[j][i])
          }
}
```

Figure Q.1B

1C. Show the relation between P, NP-hard and NP-complete class of problems with definitions. 2

2A. Consider an instance of 0/1 knapsack with 5 objects, having weights=[11, 12, 8, 7, 9], profits=[23, 24, 15, 13, 16] and a capacity of 26. Find the optimal packing of the knapsack using Backtracking technique. 5

2B. Write a pseudocode to find the sum of the elements of an array using divide and conquer technique. Write the recurrence relation and compute the time complexity. 3

2C. What are the properties of an algorithm? What are the two methods of performance analysis of an algorithm? 2

3A. Using FIFO branch and bound technique find the optimal loading of the containers for the instance n=4 W=[2,6,4,10] and capacity of the ship c as 20. 5

3B. Write an algorithm for sequential search. Analyze the best, average and worst case complexity. 3

3C. Write an algorithm to find the sum of two matrices. Also analyze the space complexity and time complexity using global variable count method. 2

4A. Multiply the given matrices A and B using Strassen's method. What are the constraints of this method? Analyze the time complexity of Strassen's divide and conquer algorithm for multiplying matrices. 5

$$A = \begin{bmatrix} 2 & 3 \\ 6 & 1 \end{bmatrix} \quad B = \begin{bmatrix} 5 & 1 \\ 2 & 4 \end{bmatrix}$$

4B. Identify two sets of Bipartite graph shown in Figure Q. 4B. Find the minimal cover using Greedy technique. 3

4C. Prove that the following equalities are correct 2
i) $\frac{1}{2}n(n-1) \in \theta(n^2)$.
ii) $n^3 + 10^6 n^2 = \theta(n^3)$

5A. Write an algorithm to find the minimum cost spanning tree using Prims method. Apply Prim's algorithm for the graph shown in Figure Q.5A. considering starting vertex as 'a'. Also analyze the time complexity. 5

5B. Write an algorithm to find the path between two vertices. Find the path from vertex 'a' to vertex 'e' for the graph shown in Q.5A. 3

5C. Solve the recurrence relation $T(n) = 4T(n/2)+n^3$ and T(1)=1 using substitution method. 2

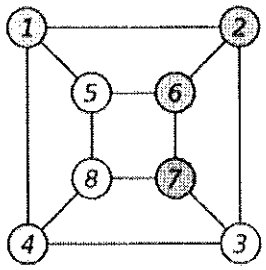

Figure Q.4B

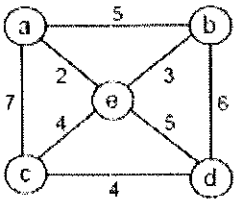

Figure Q.5A