Reg. No.									

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

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

END SEMESTER EXAMINATIONS, NOV/DEC 2016

SUBJECT: FUNDAMENTALS OF ALGORITHM ANALYSIS AND DESIGN (ICT 351)

(REVISED CREDIT SYSTEM)

(24/11/2016)

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

Instructions to candidates:

- Answer **ANY FIVE FULL** questions
- Missing data may be suitably assumed.

1A. Write Strassen's algorithm to multiply matrices using Divide and Conquer strategy and apply the same to multiply the matrices A and B. 5

$$A=\begin{bmatrix} 5 & -7 & 6 & 2 \\ 8 & 1 & -3 & 4 \\ -5 & 3 & 2 & 1 \\ 2 & 5 & 6 & -7 \end{bmatrix} \quad B=\begin{bmatrix} 1 & 2 & -3 & 5 \\ 6 & 8 & -10 & 7 \\ 9 & -7 & 6 & 5 \\ -8 & 3 & 2 & 1 \end{bmatrix}$$

1B. Given 7 tasks and their start and finish time as shown in Table Q.1B, assume infinite supply of machines. Find out optimal number of machines required to complete the tasks using Greedy technique such that, no machine is assigned two overlapping tasks. 3

1C. What is an Abstract Data Type (ADT)? Write and ADT for directed weighted graph. 2

2A. Given 5 matrices and their orders as r=30,35,15,5,10,20. Find the optimal sequence of multiplying these matrices using Dynamic programming. 5

2B. In a professional network each person is represented by a node. Two nodes are connected if they communicate with each other. Write an algorithm to find out how many mutually exclusive groups are present in the network. Group is a set of nodes that are connected. 3

2C. Show the relation between NP, P, NP-complete problems with their definitions. 2

3A. Find the topological sequence for the graph given in Figure Q.3A using Greedy algorithm. Write the greedy criterion and show all the steps clearly. 5

3B. Write an algorithm for finding minimum and maximum elements in a given array using divide and conquer algorithm. Using recurrence relation find the time complexity for the same. 3

3C. Compare Divide and Conquer algorithm design technique with Dynamic programming technique. 2

4A. Find MaxClique for the graph given in Figure Q.4A using Branch and Bound technique. 5

4B. Analyse the best, worst and average time complexities for a given code below using operation count method. Also analyze the space complexity. 3

```
void insert( int a[], int &n, int x)
{
int i;
for(i=n-1; i >=0 && x < a[i]; i--)
        a[i+1] = a[i];
a[i+1]=x;
n++;
}
```

4C. How is the solution space searched in Backtracking and Branch and Bound algorithm techniques? 2

5A. Find the least cost tour for traveling salesperson using Backtracking for the graph shown in Figure Q.5A . 5

5B. For what input sizes algorithm 1 is faster than algorithm 2 (in worst case) if time for algorithm 1 is represented using f(n)= $5n^2 + 2n$ steps in worst case , and algorithm 2 is represented as g(n)=50n+5 steps in the worst case. Also represent f(n) and g(n) using Asymptotic notations with respect to n^2. 3

5C. Prove that Bipartite cover problem is an optimization problem. 2

6A. Write Dijkstra's algorithm to find single source shortest path and apply it on the graph shown in Figure Q.6A. 5

6B. Write an algorithm to find the recursive sum of n elements of an array and find the time complexity. 3

6C. Define path, simple path and spanning tree with an example. 2

Table Q.1B

task	a	b	c	d	e	f	g
start	0	3	4	9	7	1	6
finish	2	7	7	11	10	5	8

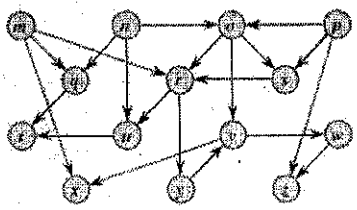

Figure Q.3A

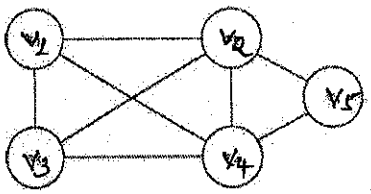

Figure Q.4A

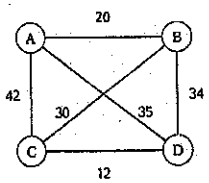

Figure Q.5A

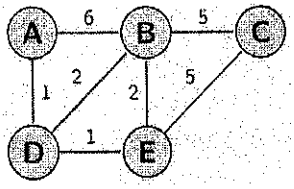

Figure Q.6A