Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

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

END SEMESTER EXAMINATIONS, NOVEMBER 2017

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

(REVISED CREDIT SYSTEM)

(15/11/2017)

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

Instructions to candidates:

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

1A. Write the dynamic programming recurrence relation and find optimal packing for the following instance of the knapsack problem: Capacity=5, W=[2,1,3,2] and P=[12,10,20,15]. Write the time complexity for the same and justify it. 5

1B. Consider the algorithm given in Figure Q.1B 3

```
ALGORITHM find(A,n)
//Input: An array A[0 .. n - 1] of real numbers
if n = 1 return A[0]
else temp = find(A,n-1)
if temp <= A[n-1] return temp
else return A[n-1]
```

Figure Q.1B

i). What does the above algorithm compute? What is the space complexity of the algorithm?

ii). Set up a recurrence relation for the algorithm's basic operation count and solve it.

1C. Prove that any algorithm to search an element 'K' in an array of 'n' entries must do at least $[log_{10}(n+1)]$ comparisons for some input. 2

2A. Find the minimum cost tour for traveling sales person, starting with node 1 for the graph given in Figure Q.2A using Backtracking method. 5

2B. Using Dijkstras algorithm find all shortest paths with path length by considering vertex 'a' as source for the graph shown in Figure Q.2B. 3

2C. Analyze the time complexity of the algorithm given in Figure Q.2C. 2

```
void fun()
{
int i, j;
for (i=1; i<=n; i++)
for (j=1; j<=log(i); j++)
printf("MIT");
}
```

Figure Q.2C

3A. With neat diagram explain the algorithmic problem solving approach. 5

3B. Explain linked list representation of a graph with an example. State an example where adjacency list representation is better than the array representation to reduce the time requirement. 3

3C. Is the following statement true or false: "If cost of every edge is increased by one, shortest path remains same." Justify the answer. 2

4A. Write greedy criterion and pseudocode for finding topological sequence using greedy technique. Also find the topological sequence for the graph shown in Figure Q.4A. 5

4B. What is a NP complete problem? Show the relation between P, NP, NP-complete and NP-hard class of problems when $P \neq NP$ and $P = NP$. 3

4C. Assume that the function M is defined for all powers of 2 and is described by the recurrence equation $M(n) = n - 1 + 2M(\frac{n}{2})$ and base case M(1)=0. If n is a power of 2, what is the asymptotic order of M(n)? 2

5A. Find Clique of maximum size for the graph given in Figure Q.5A using max profit/least cost approach of branch and bound method. 5

5B. Analyze the best case and worst case time complexities of the quick-sort algorithm and sort the list E,N,T,R,E,P,R,E,N,E,U,R in alphabetical order using the same. 3

5C. Both Backtracking and Branch and bound methods search for an optimal solution in a solution space consisting of all solutions. What are the differences between these techniques? 2

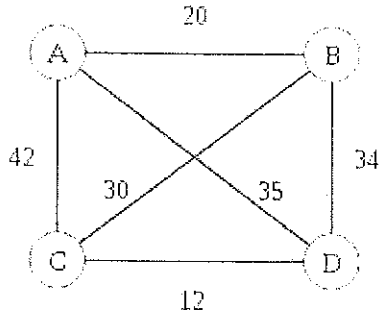

Figure Q.2A

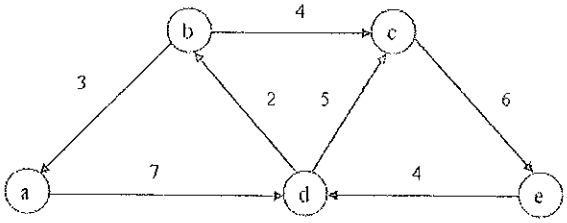

Figure Q.2B

Figure Q.4A

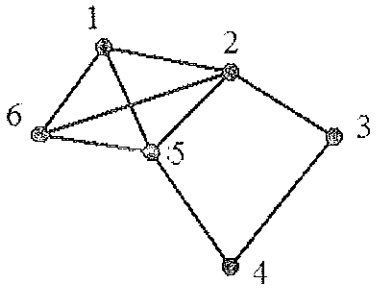

Figure Q.5A

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