Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

I SEMESTER M.TECH. (SOFTWARE ENGINEERING)

END SEMESTER EXAMINATIONS, NOVEMBER 2018

SUBJECT: ADVANCED DATA STRUCTURES AND ALGORITHMS [ICT 5121]

REVISED CREDIT SYSTEM

(20/11/2018)

Time: 3 Hours

MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** the questions.
- Missing data, if any, may be suitably assumed.

1A. Construct the optimal binary search tree for the words given in Table Q.1A using Dynamic Programming approach. The probabilities of occurrence of each word is given. **5**

Table Q.1A

Word	Probability
a	0.22
am	0.18
and	0.20
egg	0.05
if	0.25
the	0.02
two	0.08

1B. Consider the dataset given below and sort the elements using shell sort. Show all the steps clearly. (Assume the data initially to be split into 4 columns). **3**

16	4	3	13	5	6	8	9	10	11	12	17	15	18	19	7	1	2	14	20

1C. Write the recurrence relation and hence derive the time complexity of the following C function. **2**

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

2A. Show the result of inserting 8, 11, 16, 24, 6, 4, 7, 15, 13, 9, 17, 4, 21, 23, 12, one at a time into an initially empty binary min heap. Determine the time complexity of insertion. **5**

2B. Construct a red-black tree by *inserting* the keys in the following sequence into an initially empty red-black tree: 13, 10, 8, 3, 4 and 9. Show each step. **3**

2C. For the AVL tree given in Fig.Q.2C, show the resultant AVL tree after the element 35 is removed. Show the steps clearly. **2**

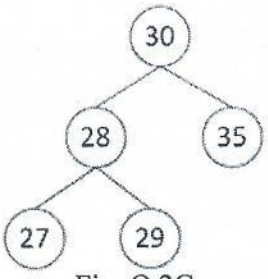

Fig. Q.2C

3A. Consider the set of initially unrelated elements 0,1,2,3,4,5,6,7,8,9,10,11,12. **5**

i. Draw the final forest of up-trees that results from the following sequence of operations on union-by-size. Break ties by keeping the first argument as the root.
Union(0,2), union(3,4), Union(9,7), Union(9,3), Union(6,8), Union(6,0), Union(12,6), Union(1,11), Union(9,6).

ii. Draw the new forest of up-trees that results from doing a Find(4) with path compression on the forest of up-trees from (i).

3B. Given the B-tree in Fig.Q.3B of order m = 5, show each corresponding B-tree after insertion of 17, 6, 21, 67, in this order. Use commas (,) to separate the data in a node. **3**

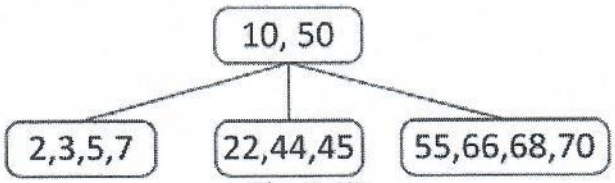

Fig. Q.3B

3C. Discuss how Strassen's matrix multiplication is faster than the normal Divide and Conquer strategy matrix multiplication. Justify in terms of complexity. **2**

4A. Draw the leftist heap that results from inserting: 77, 22,9,68, 16, 34,13, 8 in that order into an initially empty leftist heap. **5**

4B. Consider the Fibonacci heap given in Fig.Q.4B(* denotes marked nodes): **3**

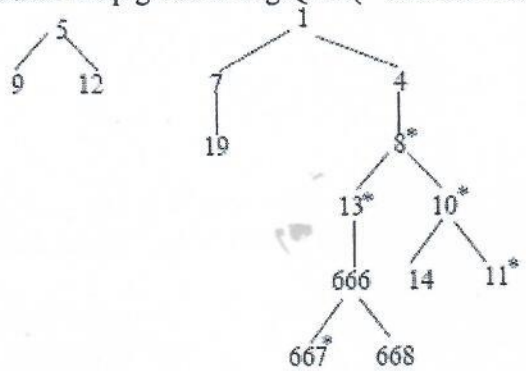

Fig. Q.4B

i. Show the result of del min operation .

ii. Show the result of decreasing key from 666 to 466. Show the marked nodes.

4C. Discuss the differences between Kruskal's and Prim's algorithm to find the minimum spanning tree. Which is advantageous and why? **2**

5A. Compute the maximum flow from the source to the sink in the network of Fig.Q.5A using Ford-Fulkerson algorithm. **5**

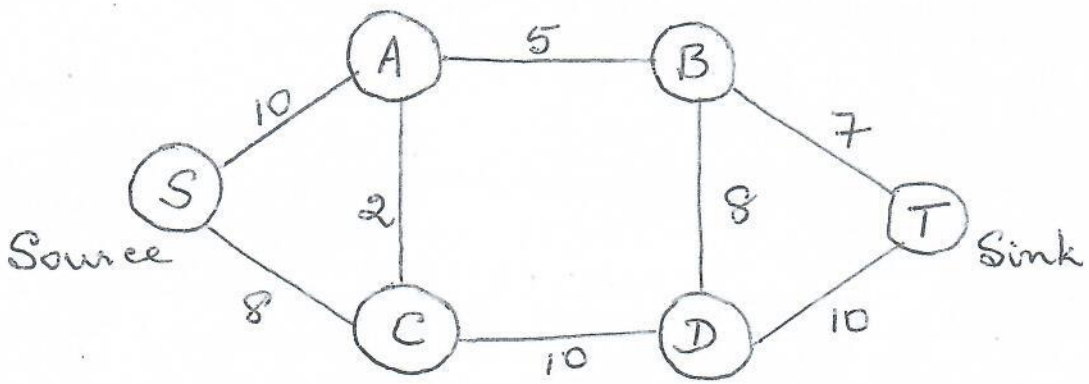

Fig. Q. 5A

5B. Describe the following with suitable examples. **3**

i. NP hard and NP complete problems.

ii. Randomized Algorithms.

5C. Find the Depth First Spanning Tree for the graph shown in Fig.Q.5C. **2**

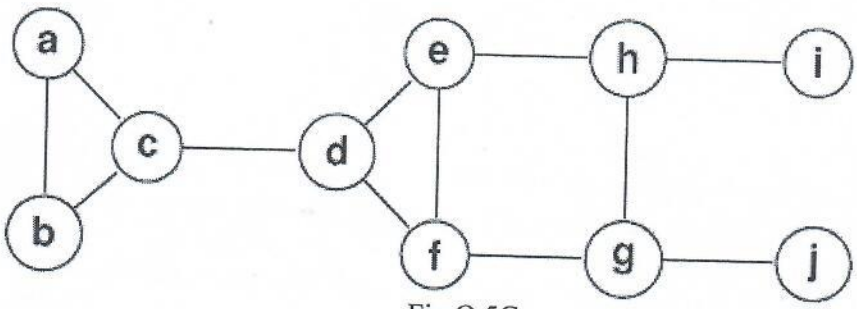

Fig.Q.5C