Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

A Constituent Institution of Manipal University

I SEMESTER M.TECH. (CSE/CSIS)

END SEMESTER EXAMINATIONS, NOV/DEC 2017

SUBJECT: ADVANCED DATA STRUCTURES AND ALGORITHMS [CSE5101]

REVISED CREDIT SYSTEM (16/11/2017)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

- Answer **ALL** questions.
- Missing data may be suitable assumed.

1A. Prove that O(1) is the amortized cost for n increment operations, which add 1 to the k-bit binary number present in the binary counter. **3**

1B. List all the properties of the Binomial heap and also analyze the complexity of Binomial heap union. **2**

1C. Write an algorithm for splitting a full node in a B-tree and also analyze its complexity. Use the same procedure for inserting the following keys in order to the B-tree with minimum degree 3 given in Fig.Q1C (i) H (ii) I (iii) W **5**

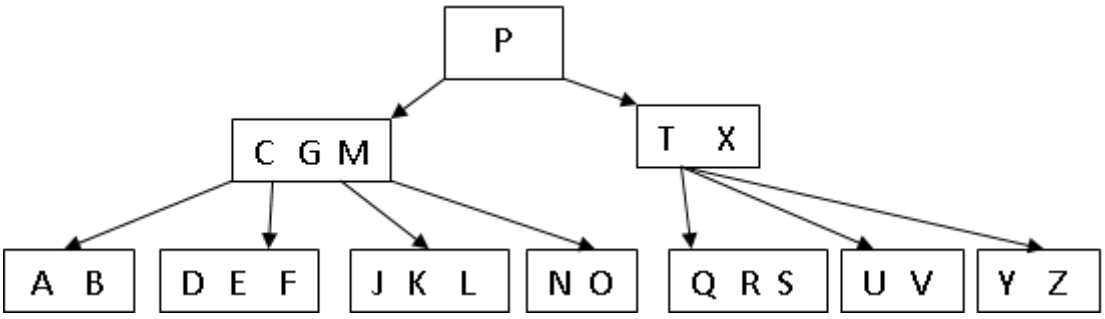


Fig Q1C

2A. Write an algorithm for inserting a node to a Fibonacci heap and also find its amortized cost. **2**

2B. Extract the third minimum from the Binomial heap given in Fig Q2B by indicating all the steps. **5**

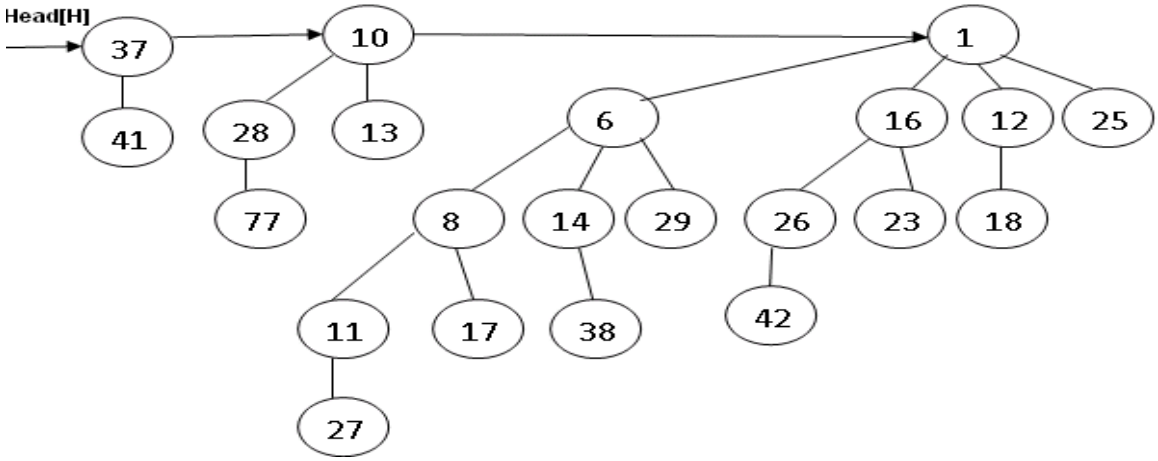
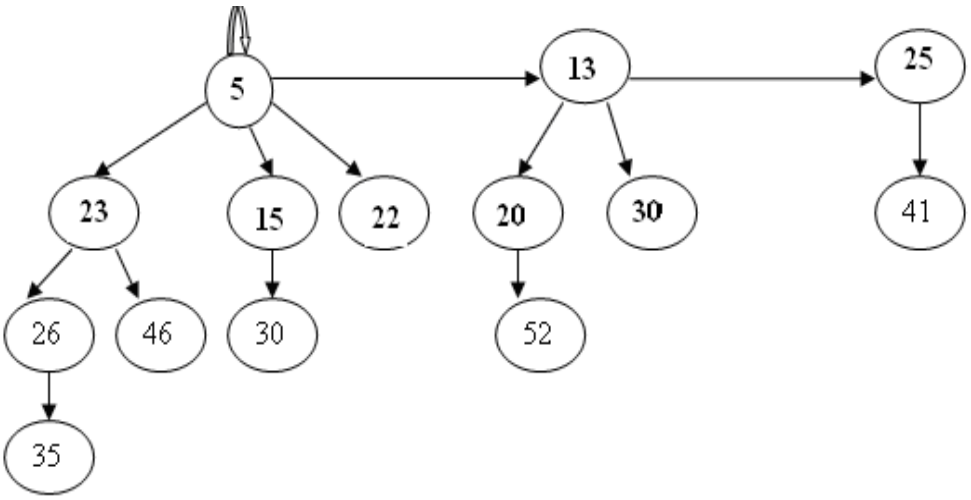


Fig Q2B

2C. Superimpose a binary tree of constant height for the universal set u = 16 with $\sqrt{\mathbf{u}}$ bits on top of a bit vector representing the set [4, 5 , 6, 8, 13, 14, 15]. Give the method for finding (i) minimum (ii) predecessor and successor of 13. **3**

3A. Decrease the keys of the nodes with values **3**
(i) 46 to 16 (ii) 35 to 2 in order from the following Fibonacci Heap by Indicating all the steps involved in this process. **Note**: Node with the value 26 is colored.



3B. Suppose that algorithm for finding CONNECTED_COMPOONENTS is run on the undirected graph G=(V,E), where V ={ a, b, c ,d, e, f, g, h, i, j, k} and the edges of E are processed in the following order (d, i), (f, k), (g, i), (b, g), (a, h), (i, j), (d. k), (b, j), (d, f) , (g, j), (a, e), (i, d). List the vertices in each connected component for every iteration of the algorithm. **3**

3C. What do you mean by topological sorting? Use this concept to find the shortest paths tree from S to all other vertices of the graph whose adjacency matrix is given in the Table Q3C. **4**

Table Q3C

Adjacency Matrix	**S**	**A**	**B**	**C**	**D**
S	**0**	**2**	∞	**5**	**7**
A	∞	**0**	**1**	**2**	∞
B	∞	∞	**0**	∞	**4**
C	∞	∞	**9**	**0**	**2**
D	∞	∞	∞	∞	**0**

4A. Execute Belmann Ford's algorithm on the graph whose adjacency matrix is given in Table Q4A.(S is the source vertex) **3**

Table Q4A

Adjacency Matrix	**S**	**A**	**B**	**C**	**D**
S	**0**	**6**	∞	∞	**7**
A	∞	**0**	**5**	**-4**	**8**
B	∞	**-2**	**0**	∞	∞
C	**2**	∞	**7**	**0**	∞
D	∞	∞	**- 3**	**9**	**0**

4B. If the adjacency matrix of a graph is given in the Table,Q4B. Use Floyd Warshall's Algorithm to find all pairs shortest paths by considering intermediate vertices from the set {1, 2}. **4**

Table Q4B

Vertices	**1**	**2**	**3**	**4**	**5**
1	0	3	8	∞	- 4
2	∞	0	∞	1	7
3	∞	4	0	∞	∞
4	2	∞	-5	0	∞
5	∞	∞	∞	6	0

4C. Execute Transitive closure algorithm up to k=2 on the graph whose initial values for k=0 is given in the Table Q4C. **3**

Table Q4C

1	0	0	0
0	1	1	1
0	1	1	0
1	0	1	1

5A. Discuss the structure of proto van Emde Boas tree and draw the same for the universal size=16 for the dynamic set{1,6, 8,9,13,15} **5**

5B. What is static threading and what are its problems? How Dynamic threading is useful . **3**

5C Discuss the concept of network flow and what are the conditions the network flow must satisfy? **2**

****