Reg. No.											

MANIPAL INSTITUTE OF TECHNOLOGY

MANIPAL

(A constituent unit of MAHE, Manipal)

IV SEMESTER B.TECH. END SEMESTER EXAMINATIONS,

APRIL 2018

SUBJECT: OPEN ELECTIVE – I : FUNDAMENTALS OF DATA STRUCTURES AND ALGORITHMS (ICT 3283)

REVISED CREDIT SYSTEM
(30/04/2018)

Time: 3 Hours MAX. MARKS: 50

Instructions to Candidates:

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

1A. A computing device reads the following data from an input device in the sequence 60, 25, 75, 15, 50, 66, 33, 44. Considering the input is obtained one a time, create a binary search tree by inserting a node after getting each data. Write and trace the deletion algorithm to delete the node 25 from the tree. 5

1B. What is a sparse matrix? What are the different ways of representing sparse matrix? Explain with an example. 3

1C. If the depth of an almost complete binary tree is 8, what is the minimum and maximum number of nodes in the tree? 2

2A. Write a function to sort the elements using insertion sort. Sort the following array in ascending order using insertion sort.
9, 4, 7, 5, 13, 41, 19, 55, 58, 18, 15, 23
Show the contents of the array after every iteration of the sort (Iteration 0 is the input array). 5

2B. What is an expression tree? Write an expression tree for the following infix expression
(A+B)*C/D+E-A/C 3

2C. Data are pushed to (PUSH operation) and popped from (POP operation) a stack in the following order: The TOP operation returns the element at the top of the stack. Write the output of the following operations performed in sequence.

PUSH 5; TOP; PUSH 10; TOP; PUSH 15; PUSH 20; TOP; POP; POP; TOP; 2

3A. Write the structure definition to represent a term in the polynomial of the form:
$P(x)=a_n x^n + a_{n-1}x^{n-1} \ldots a_0$
Write the function *AddPoly* to add two polynomials *a* and *b* and generate a sum polynomial *c*. 5

3B. Evaluate the following expression using stack: 6*4-7/3+2. Show the contents of the stack. 3

3C. Discuss the time complexity of linear and binary search algorithms. 2

4A. Write functions to traverse a binary tree in preorder, inorder and postorder. Trace the functions to traverse the tree given in Figure Q.4A.

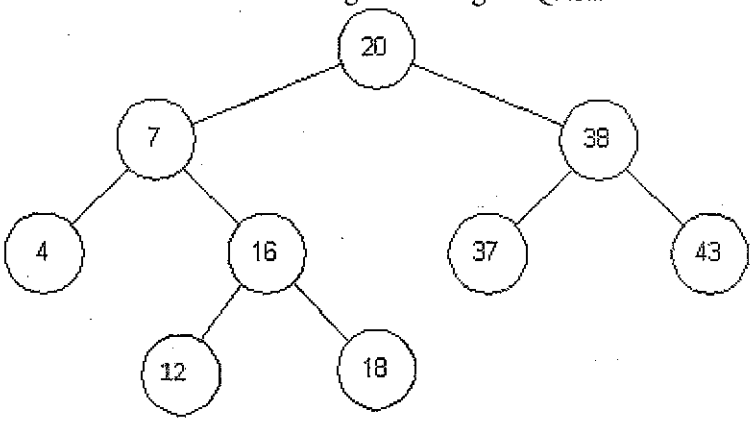

Figure Q.4A

5

4B. Consider the graph shown in Figure Q. 4B. If there is ever a decision to be made between multiple neighbor nodes in the BFS or DFS algorithms, assume we always choose the letter closest to the beginning of the alphabet first.

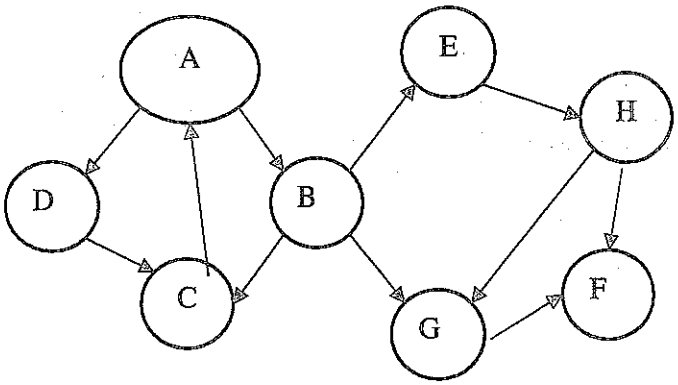

Figure Q.4B

3

In what order will the nodes be visited using BFS and DFS?

4C. Write a recursive function to find factorial of a number and compute the space complexity.

2

5A. Show that the following equalities are correct

i. $5n^2-6n=\Theta(n^2)$

ii. $n^3+10^6n=\Theta(n^3)$ 5

5B. What is the difference between linear queue and circular queue. Write the state of the circular queue with maximum size 5 after performing each of the following operations. Show the state of the queue after each insertion and deletion separately. Show the position of rear and front indices clearly.

add(10), add(20), add(30), delete(), delete(), add(40), add(50), delete() 3

5C. Given the following array elements, construct the max heap by inserting one element at a time. Show the different steps.

60, 15, 28, 70, 90, 37, 78, 56, 23, 80 2