Information Technology, Noida,
Enrolment No.....

End Semester Examination, Odd 2021

B.Tech. III Sem,

Course Title: Data Structures

Course Code:15B11CI311

Maximum Time: 2 Hrs

Maximum Marks: 35

After pursuing the course, the student will be able to:

CO 1 : Explain abstract data types, memory allocation schemes, and need of linear and non-linear data structures
CO 2 : Apply and implement various linear data structures, like array, linked list, stack, and queue in different problems and applications.
CO 3 : Analyze the performance of various sorting and searching techniques
CO 4 : Demonstrate and implement various operations like search, traverse, insertion, deletion, etc. on different non-linear data structures
CO 5 : Apply appropriate data structure to design an efficient solution for given and identified problem.

Q1. [Marks 4] [CO 2] Given a positive number n, write code to efficiently generate binary numbers between 1 and n using the queue data structure in linear time. You may use STL library.

For example, for n = 16, the binary numbers are:

1 10 11 100 101 110 111 1000 1001 1010 1011 1100 1101 1110 1111 10000

Q2. [Marks 6] [CO 5] Consider there are 10 seats available in an auditorium numbered from 0 to 9. The organizing committee has distributed the tickets with ticket numbers 10,77,55,14,20,19,30,99,18 and 24. Each person carrying the ticket gets the seat only when it is not already occupied. Seats are allocated by the member of the organizing committee present in the auditorium in the above sequence based on the following formula

Seat number = Ticket number % Total available seats.

In case, if obtained seat number is already occupied then the immediate next seat needs to be given to the same person only when it is not occupied. Note that in case any seat is occupied, person needs to go to the member again for finding out the new seat number. Identify the appropriate data structure which can find the following:

a) Count of number of times a person with ticket number 99 needs to communicate to the member for finding out his/her seat.

b) Total communications made between persons and the member of the organizing committee.

Q3. [Marks 4] [CO 3] ERP department of an Institute X manage data (name, enrolmentNo, totalMarks) of N students in sorted order of their enrolment numbers. Management of the Institute decide to facilitate K students who have the highest total Marks. Write a most efficient sorting algorithm with respect to time complexity to identify those K students when

a) K << N

b) K = N

Q4. [Marks 5] [CO 4] Create a Red-Black tree by inserting following sequence of integers:

8, 18, 5, 15, 17, 25, 40, and 80.

Q5. [Marks 6] [CO 4] On an initially empty binomial heap, carry out the following sequence of operations: insert(27), insert(17), insert(19), insert(20), insert(24), insert(12), insert(11), insert(10), insert(14), insert(18), deletemin, decreasekey (19, 7) and delete(18). After each operation, draw the resulting structure of the binomial heap.

Q6. [Marks 4] [CO 4] Like B+ tree the leaf nodes of a B tree (traditional B tree) are connected to form the linked list at leafnode. Call this variant of B tree as "BTreeModified". In comparison with the traditional B tree, Comment on whether this variant of B tree ("BTreeModified") improve the search capability or not. Your comment should be justified with proper reasoning.

Q7. [Marks 6] [CO 4] A graph with V = {1, 2, 3, 4} and E = {a,b,c,d,e,f} is described by G = {a {1,2}, b {1,2}, c {1,4}, d {2,3}, e {3,4}, f {3,4} }. It has weights on its edges given by w = {(a , 3), (b, 2), (c,1), (d, 2), (e, 4), (f ,2)} What is the weight of the minimum spanning trees of it and how many such trees are there? Draw all such tress.

**********All the Best**********