Registration No.: | | | | | | | | | | |

Total Number of Pages: 02

Integrated Dual Degree (B.Tech and M.Tech)
RME4G003/ REC4G002/ RME4G003/ RPL4G003/ RMN4G003/ RML4G003/ RMM4G003/ RMF4G003/ RAU4G003/ RAE4G003

4th Semester Regular/Back Examination: 2023-24
SUBJECT: Data Structure
BRANCH(S): MECH, ECE, ETC, ME, ECE, PLASTIC, MINING, MINERAL, METTA, MME, MANUTECH, AUTO, AERO
Time: 3 Hour
Max Marks: 100
Q.Code: P163

Answer Question No.1 (Part-1) which is compulsory, any eight from Part-II and any two from Part-III.
The figures in the right hand margin indicate marks.

Part-I

Q1 **Answer the following questions:** **(2 x 10)**

a) Explain abstract data types (ADT) with suitable examples.
b) Write the limitations of array implementation of simple queue. How it can be avoided?
c) List out some advantages and disadvantages of linked list over array data structure.
d) Consider a linear queue implemented using 1-D array. Initially the value of FRONT and REAR is initialized to -1. Perform suitable insertions and deletions so that you can get the following FRONT and REAR values.
I) FRONT = 3 and REAR = 9.
II) FRONT = 4, REAR = 4.
Demonstrate each operation through the queue with suitable diagrams.
e) Define a complete binary tree and strictly binary tree with suitable example.
f) Write the limitations of array implementation of simple queue. How it can be avoided?
g) Differentiate between strongly connected graph and weakly connected graph.
h) Explain with suitable example how a graph can be represented using an array in computer's memory.
i) Differentiate between linear probing and quadratic probing technique to resolve collision in hashing.
j) Sort the given elements in ascending order using bubble sort, showing each pass.
2, 1, 4, 0, 7, 3

Part-II

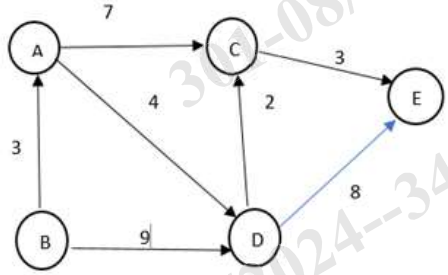
Q2 **Only Focused-Short Answer Type Questions- (Answer Any Eight out of Twelve)** **(6 × 8)**

a) Discuss the algorithm for insertion, deletion, and display operation in a circular queue.
b) Develop a C-function to merge two single lists having the following elements. Start holds the address of first node of List 1 and head holds the address of first node of List 2.
List 1: 10 → 15 → 22 → 46 → 17 → 39
List 2: 23 → 12 → 42 → 36 → 41

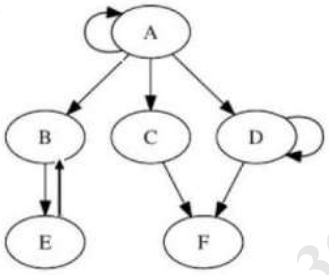
c) Construct an AVL tree from the list of given elements:
55, 66, 77, 15, 11, 33, 22, 35, 25, 44, 88.

d) Discuss height and depth of a binary tree. Construct a binary search tree from these numbers: 90, 36, 58, 96, 32, 92, 12, 93, 24, 97, 38, 60, and 98

e) Discuss the data structures used for Depth First Search (DFS) and Breadth First Search (BFS) algorithm in a Graph. Construct the spanning tree using the Depth First Search for the following graph, starting from node B.



f) Define path matrix. Represent the following graph in memory using array and linked list representation.



g) List out the properties of Max-Heap and Min-Heap. Sort the following list of numbers in descending order using Heap sort.

77, 85, 5, 7, 10, 72, 50, 21

h) Let A is the array of the following elements A = {2, 4, 6, 8, 9, 10, 12, 13}. Search the element 12 using binary search technique. Write its time complexity.

i) Discuss the advantage and average efficiency of quick sort. Apply Quick sort on the following data and show the contents of the array every pass:
48, 7, 26, 4, 13, 23, 98, 57, 10, 5, 32

j) From the following inorder and postorder traversal, Construct the binary tree and show the steps of tree construction.

Postorder: 12, 30, 40, 37, 25, 60, 70, 62, 87, 75, 50

Inorder: 12, 25, 30, 37, 40, 50, 60, 62, 70, 75, 87

k) Consider the following sequence of operations on an empty queue.
Enqueue (21); enqueue (24); dequeue (); enqueue (28); enqueue (32); q = dequeue (); then compute the value of q? Find the position of front and rear by assuming the queue as both linear and circular.

l) Given N set of integers. Write a program in C to arrange them in descending order using insertion sort techniques.

Part-III

Only Long Answer Type Questions (Answer Any Two out of Four)

Q3 **a)** Use linked list to represent the following polynomial P (x, y, z) = $2xy^2z^3 + 3x^2yz^2 + 4xy^3z + 5x2y^2 + 8xy^2z^5 + 19$ **(4x4)**

b) Describe the data structure used to represent a general tree.

c) Define circular queue. Sketch to explain the placement of FORNT and REAR pointers when Queue is Full and Queue Containing single element.

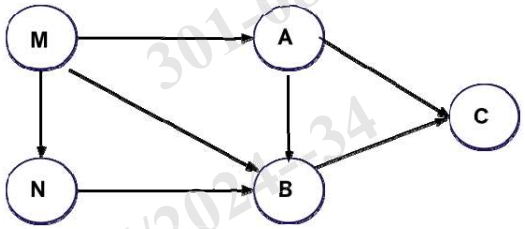
d) Convert the following infix expression to post fix expression using STACK

C – D + (E – F) + F/(H + W)*A

Q4 Discuss the concept of collision in Hashing technique. List out different collision resolution techniques. Consider a list of size 20 (m = 20). Insert the following list of keys given below into the Hash table and resolve collision using Linear Probing, quadratic probing, and rehashing method by taking the hash function key % 10. **(16)**

96, 48, 63, 29, 87, 77, 48, 66, 69, 93, 61

Q5 **a)** What do you mean by graph traversal? What are the data structures used for graph traversal? Write the algorithm for BFS and Perform the Breadth First Search of the graph given below where M is the starting node. **(8)**



b) Write the algorithm of merge sort and explain the working of merge sort with a suitable example. **(8)**

Q6 **a)** Discuss height and depth of a binary tree. Construct a binary search tree from these numbers: 90, 36, 58, 96, 32, 92, 12, 93, 24, 97, 38, 60, and 98. Delete the root node from this tree. **(8)**

b) Sort the following array of elements using selection sort. **(8)**
96, 48, 63, 29, 87, 77, 48, 66, 69, 93, 61