Exam Date & Time: 21-Nov-2019 (09:00 AM - 12:00 PM)

MANIPAL INSTITUTE OF TECHNOLOGY
MANIPAL
(A constituent unit of MAHE, Manipal)

**III SEMESTER B.TECH(INFORMATION TECHNOLOGY/COMPUTER & COMMUNICATION ENGINEERING) END SEMESTER EXAMINATIONS, NOV 2019**

**DATA STRUCTURES [ICT 2153]**

**Marks: 50** **Duration: 180 mins.**

**Answer all the questions.**

**Instructions to Candiates: Answer ALL questions. Missing data may be suitably assumed**

1) A) Write a user defined function to sort the elements in increasing order using heap sort method. Also construct the max heap and sort the following list using heap sort method: 66, 33, 40, 20, 50, 88, 60, 11, 77, 30, 45, 65. (5)

B) Write a user defined function so that it takes two sparse matrices A and B as input represented in < row, col val> format. Add A and B by traversing them in the given representation. Display C which is the result of addition of A and B in < row, col, val> format. Also, display C in 2D matrix form. (3)

C) Write a function tc accept the first node address of Singly Linked List (SLL) as parameter and delete the nodes containing even numbers in SLL. (2)

2) A) Given a Doubly Linked List (DLL) containing 0s and 1s as data values, write a user defined function to find its decimal equivalent. For example, if list is $1 \leftrightarrow 1 \leftrightarrow 1 \leftrightarrow 1 \leftrightarrow 0 \leftrightarrow 0 \leftrightarrow 0 \leftrightarrow 1$ then the expected output is 121. Decimal value of an empty list is considered as 0. Also write a function to create another DLL, which contains nodes in the following format: < number of continuous occurrences of the digit, digit>. For the above example the content of newly created list should be $(4\,1) \leftrightarrow (3\,0) \leftrightarrow (1\,1)$ (5)

B) Explain different methods of Graph representation with an example for each. Also, write the function for Depth First Search traversal of a graph. (3)

C) What is the output of the following error-free C++ code: (2)

```
int main()
{ int arr[] = {10, 20, 30, 40, 50, 60};
int *ptr1 = arr;
int *ptr2 = arr+2;
cout< < *ptr1< < "\t";
cout< < *ptr2+2;
```

return(0); }

3) Write a C++ program to read students' name, roll no., marks in four subjects and maintain them in a sorted singly circular linked list according to roll number. Also, write a member function to delete student information with a specific roll number. (5)

A)

B) Construct a Binary search tree (BST) for the given sequence of input: 33,55,22,11,77, 99 88,100,120,89,90 . Also, show the memory representation of double threaded binary tree for the constructed BST. (3)

C) Consider a scenario where it is required to search for an element in an array of 1000 elements stored in sorted order. Which searching algorithm is suitable to perform the task efficiently? Write C++ implementation for the algorithm. (2)

4) Explain the algorithm for infix to prefix conversion. Give the functions necessary to convert infix to prefix. Trace the functions for the expression: A+B*(C/D)-G*H*J* (K+I). Show the contents of scanned symbol and stack contents clearly while tracing. (5)

A)

B) Write a function in C++ to perform non recursive postorder traversal of a binary tree. (3)

C) Write the required user defined functions for creation of an expression tree from postfix expression. (2)

5) Write a C++ program to implement multiple queues according to the following scenario. Create a singly linked list with N nodes, where every node in the list is the header node for N different singly linked list and each of that singly linked list is a queue. Header nodes must

A) store the queue number, address of the first node of the respective queue and address of the next header. In the queue, the nodes must store the information and the address of the next node in the respective queue. The figure Q5A shows visual representation of linked lists when N=2. (5)

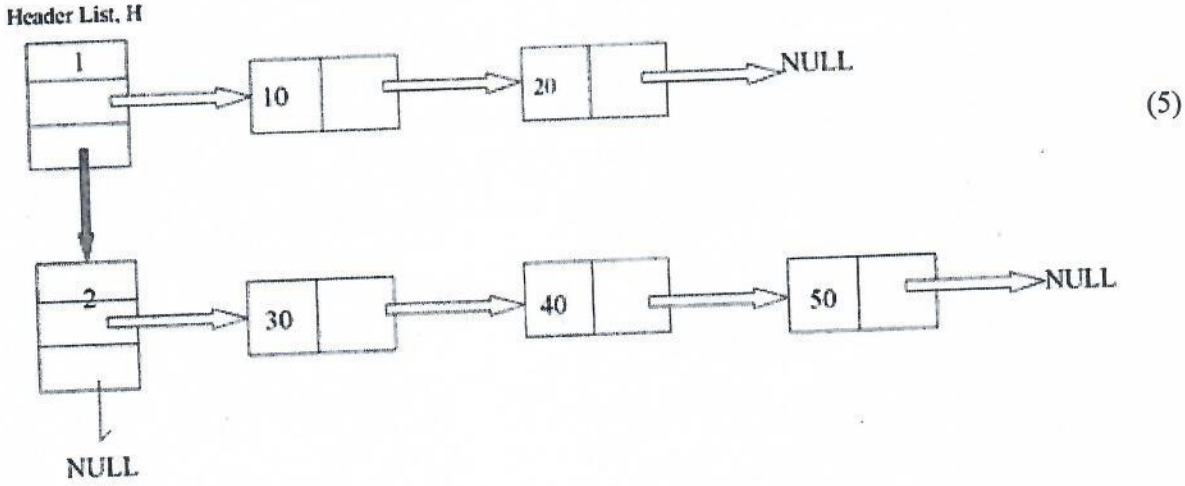


Figure: Q5A

B) Define a class **MagicSquare** that has a matrix as data member. Define member functions to read the matrix, display the matrix and to check if the read matrix is magic square or not. (3)

[Hint: Magic square is a matrix where the row sum, column sum, principal diagonal sum and the secondary diagonal sum are same]

C) Define time complexity? Explain and draw the step count table for the following code segment. (2)

```
void transpose(int a[][MAX_SIZE])
{ int i,j,temp;
for(i=0;i< MAX_SIZE-1;i++)
for(j=i+1;j< MAX_SIZE;j++)
swap(a[i][j],a[j][i],temp);}
```