Experiment 1.4

Aim: *Code to perform operation on singly and doubly Linked list*

Objectives: *To perform insertion and deletion on singly and doubly Linked list*

Input/Apparatus Used: *VS CODE*

Procedure/Algorithm:

Insertion at the Beginning:
1. Create a new node with the given value.
2. Set the new node's next pointer to the current head.
3. Update the head pointer to point to the new node.

Insertion at the End:
1. Create a new node with the given value.
2. If the list is empty, set the head pointer to the new node.
3. Otherwise, traverse the list until you reach the last node.
4. Set the last node's next pointer to the new node.

Deletion at the Beginning:
1. If the list is empty, return.
2. Store the head node in a temporary variable.
3. Update the head pointer to point to the next node.
4. Delete the temporary variable (old head).

Deletion at the End:
1. If the list is empty, return.
2. If there's only one node, delete the node and set the head pointer to null.
3. Traverse the list until you reach the second-to-last node.
4. Set the second-to-last node's next pointer to null.
5. Delete the last node.

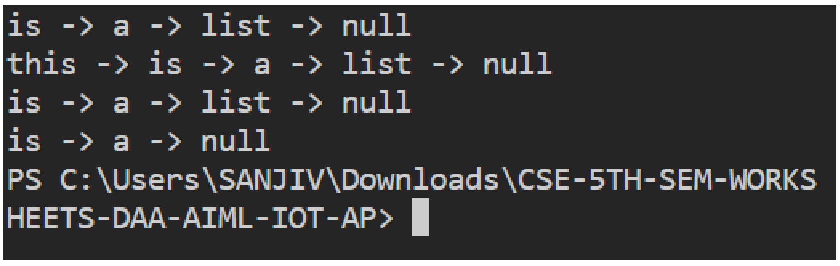
Code:

```
import java.util.*;
class LL {
  Node head;
  private int size;

  LL () {
     size = 0;
  }
  public class Node {
     String data;
     Node next;

     Node(String data) {
        this.data = data;
        this.next = null;
        size++;
     }
   }

  public void addFirst(String data) {
     Node newNode = new Node(data);
     newNode.next = head;
     head = newNode;
  }

  public void addLast(String data) {
     Node newNode = new Node(data);
     if(head == null) {
        head = newNode;
        return;
     }
```

```
        Node lastNode = head;
        while(lastNode.next != null) {
            lastNode = lastNode.next;
        }
        lastNode.next = newNode;
    }

    public void printList() {
        Node currNode = head;
        while(currNode != null) {
            System.out.print(currNode.data+" -> ");
            currNode = currNode.next;
        }
        System.out.println("null");
    }

    public void removeFirst() {
        if(head == null) {
            System.out.println("Empty List, nothing to delete");
            return;
        }
        head = this.head.next;
        size--;
    }



    public void removeLast() {
        if(head == null) {
            System.out.println("Empty List, nothing to delete");
            return;
        }
        size--;
        if(head.next == null) {
            head = null;
            return;
        }
        Node currNode = head;
        Node lastNode = head.next;
        while(lastNode.next != null) {
            currNode = currNode.next;
            lastNode = lastNode.next;
        }
        currNode.next = null;
    }
    public static void main(String args[]) {
        LL list = new LL();
        list.addLast("is");
        list.addLast("a");
        list.addLast("list");
        list.printList();

        list.addFirst("this");
        list.printList();

        list.removeFirst();
        list.printList();

        list.removeLast();
        list.printList();
    }
}
```

Course Name: DAA Lab **Course Code: 21ITH-311/21CSH-311**

Observations/Outcome :



```
is -> a -> list -> null
this -> is -> a -> list -> null
is -> a -> list -> null
is -> a -> null
PS C:\Users\SANJIV\Downloads\CSE-5TH-SEM-WORKS
HEETS-DAA-AIML-IOT-AP>
```

Time Complexity:

- *addFirst: 0(1)*
- *addLast: 0(N)*
- *removeFirst: 0(1)*
- *removeLast: 0(n)*