Task1:

Consider the Java implementation of the Singly Linked List (SLL) shared with you on Moodle:

a. Rewrite the methods for inserting in the middle of the list, deleting the tail, and deleting from the middle using a for loop instead of a while loop.
b. Run and test your code. Attach screenshots of modified code and output.

```java
class LinkedList {
  Node head;
```

```java
  // Create a node
  class Node {
    int data;
    Node next;
```

```java
    Node(int d) {
      data = d;
      next = null;
    }
  }
```

```java
  // Insert at the beginning
  public void insertAtBeginning(int new_data) {
    // insert the data
    Node new_node = new Node(new_data);
    new_node.next = head;
    head = new_node;
  }
```

```java
  // Insert after a node
  public void insertionAtMiddle(Node prev_node, int new_data) {
    if (prev_node == null) {
      System.out.println("The given previous node cannot be null");
      return;
    }
    Node new_node = new Node(new_data);
    new_node.next = prev_node.next;
    prev_node.next = new_node;
  }
  // Insert at the end
  public void insertAtEnd(int new_data) {
    Node new_node = new Node(new_data);
```

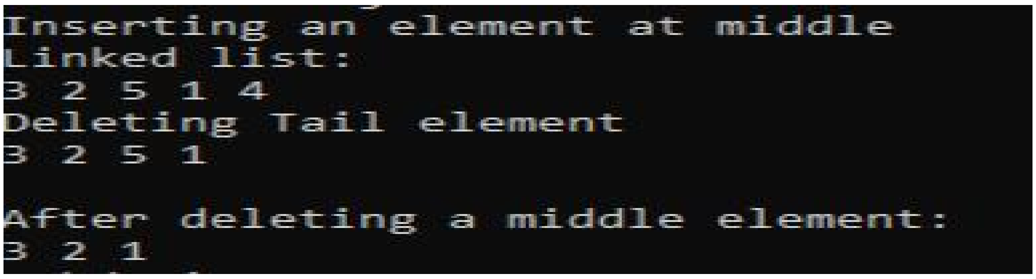
```java
    if (head == null) {
      head = new Node(new_data);
      return;
    }
    new_node.next = null;

    Node last = head;
    while (last.next != null)
      last = last.next;

    last.next = new_node;
    return;
  }

  // Delete a node
  void deleteNode(int position) {
    if (head == null)
      return;
    Node temp = head;
    if (position == 0) {
      head = temp.next;
      return;
    }
    // Find the key to be deleted
    for (int i = 0; temp != null && i < position - 1; i++)
      temp = temp.next;
    // If the key is not present
    if (temp == null || temp.next == null)
    {
       // System.out.println("the element at given position is
"+temp.data);
      return;
    }
    // Remove the node
    Node next = temp.next.next;
    temp.next = next;
  }
  // Print the linked list
  public void printList() {
    Node tnode = head;
    while (tnode != null) {
      System.out.print(tnode.data + " ");
      tnode = tnode.next;
    }
  }
  public static void main(String[] args) {
    LinkedList obj = new LinkedList();
    obj.insertAtEnd(1);
    obj.insertAtBeginning(2);
    obj.insertAtBeginning(3);
    obj.insertAtEnd(4);
    System.out.println("Inserting an element at middle");
    obj.insertionAtMiddle(obj.head.next, 5);
```

```java
    System.out.println("Linked list: ");
    obj.printList();
    System.out.println();
    System.out.println("Deleting Tail element");
    obj.deleteNode(4);
    obj.printList();
    System.out.println();
```

```java
    System.out.println("\nAfter deleting a middle element: ");
    obj.deleteNode(2);
    obj.printList();
```

```java
  }
}
```

Output



```
Inserting an element at middle
Linked list:
3 2 5 1 4
Deleting Tail element
3 2 5 1

After deleting a middle element:
3 2 1
```

TASK2:

Based on your understanding of the doubly linked list (DLL) concepts and algorithms, use the SLL Java implementation as a basis to create a Java program to implement a doubly linked list of Strings. Your program should contain the following methods:

a. Insert at the beginning of the DLL
b. Insert at the end of the DLL
c. Insert in the middle of the DLL
d. Delete the first node
e. Delete the last node
f. Delete the middle node
g. Display the list
h. Return the size of the DLL

Run and test your code. Attach screenshots of code alongside the output.

For both parts of this assignment, each pair group member is asked to specify which parts they have completed. Failure to do so will result in loss of marks. Your final deliverable should include:

- This file updated with screenshots of operational code with output for both parts. Your file should also contain an account of each member's contribution. Please save the file as a PDF. Word documents will not be considered a submission.
- Java files for both parts.

```java
import java.util.*;
import java.io.*;
class node{
  int num;
  node next;
  node prev;

  public node(int num)
  {
    this.num=num;
    next=null;
    prev=null;
    //size=0;
  }
}
class list{

  //int size=0;
 node head=null;
 node tail=null;
  boolean isEmpty()
  {
    if(head==null)
    {
      return true;
    }
    else
    return false;
  }

  void insertAtBeginning(node n)
  {
     if(isEmpty())
     {
         head=n;
     }
else{
    n.next=head;
    head.prev=n;
    head=n;
}
  }
  /*void insertAtBeginning(String name)
  {
node n=new node(name);
    {
     if(isEmpty())
     {
         head=n;
     }
else{
    n.next=head;
    head.prev=n;
    head=n;
}
  }
  }*/
void insertAtEnd(node n)
{
 if(isEmpty()){
 head=n;
 //size++;
 }
 else{
  node curr=head;
while(curr.next!=null)
{
  curr=curr.next;
```

```
}
curr.next=n;
n.prev=curr;
 }
```

```java
}
void display()
{
  node curr=head;
  while(curr!=null)
  {
    System.out.print(curr.num+" ");
    curr=curr.next;
  }
  System.out.println();
 // System.out.print(curr.data);
}
```

```java
void size()
{
  int count=0;A
  node curr=head;
  while(curr!=null)
  {
    ++count;
    curr=curr.next;
  }

  System.out.println("The Size of this Linked List is "+ count);
 // System.out.print(curr.data);
}
```

```java
void insertAtMid(node n,int num)
{
  if(isEmpty())
  System.out.println("list is empty");
  else{
        node curr=head;
        node back=null;
        while(curr.num!=num)
        {
            back=curr;
            curr=curr.next;
        }
    node  temp=back.next;
      back.next=n;
      curr.prev=back;
      n.next=temp;
      curr.prev=n;
//      size++;
```

```java
  }
}
 public void deleteFromStart() {
        //Checks whether list is empty
        if(head == null) {
            return;
        }
        else {
            //Checks whether the list contains only one element
            if(head != tail) {
                //head will point to next node in the list
                head = head.next;
                //Previous node to current head will be made null
                head.prev = null;
            }
            else {
                head = tail = null;
            }
        }
    }
```

```
 public void deleteFromLast() {
     node curr=head;
        //Checks whether list is empty
        if(head == null) {
            return;
        }
        else {
            //Checks whether the list contains only one element
            while(curr.next.next != null)
                //head will point to next node in the list
                curr = curr.next;
                //Previous node to current head will be made null



               node t=curr.next.next;
              // t.prev=null;
               curr.next=null;

        }
    }
```

```
    public void deleteFromMid(int value){
    node curr=head;

node temp=null;
    while(curr.num!=value)
    {
      temp=curr;
      curr=curr.next;
    }
```

```
    temp.next=curr.next;
    curr.next.prev=temp;
    //curr.next=null;
    //curr.prev=null;
```

```
    }
```

```
public static void main(String[] args)
{
  node node1 =new node(1);
  node node2 =new node(2);
  node node3 =new node(3);
  node node4 =new node(4);
  node node5 =new node(5);
  node node6 =new node(6);
```

```
  list obj=new list();
 // obj.insert(node1);
  obj.insertAtEnd(node2);
   obj.insertAtEnd(node3);
    obj.insertAtEnd(node4);
    System.out.println("the linked list is: ");
    obj.display();
  System.out.println();
  System.out.println("Insertion at the Tail:");
obj.insertAtEnd(node5);
     obj.display();
     System.out.println();
      System.out.println("Insertion at the Mid:");
     obj.insertAtMid(node6,3);
     obj.display();
     System.out.println();
      System.out.println("Insertion at the Beginning:");
     obj.insertAtBeginning(node1);
     obj.display();
```

```
     //Deletion
```

```
obj.deleteFromStart();
System.out.println("After deleting node from start");
obj.display();
```

```
  System.out.println();
```

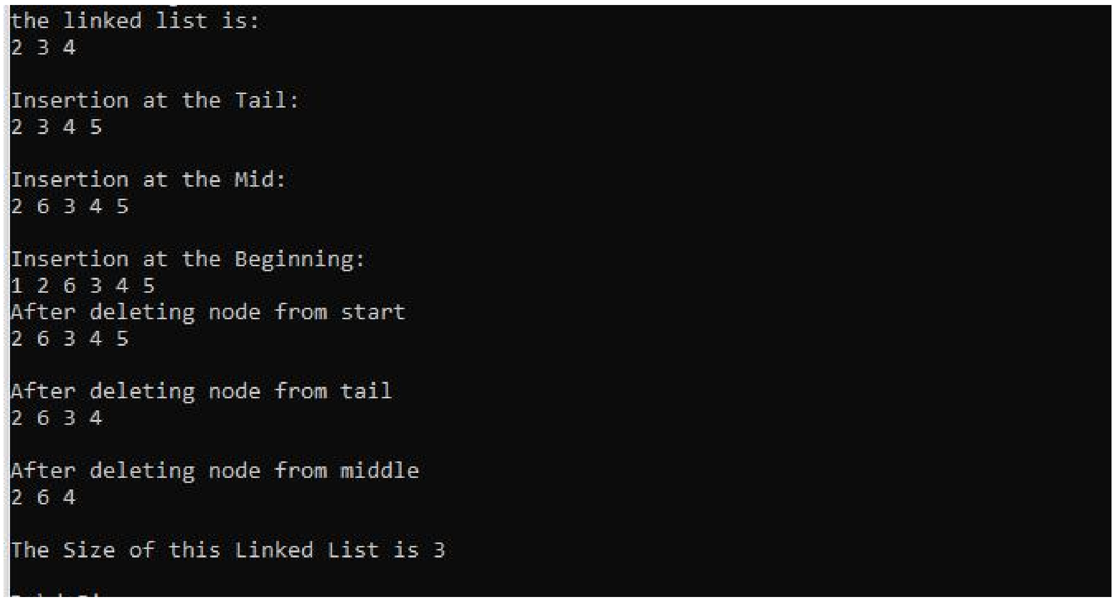
```
obj.deleteFromLast();
System.out.println("After deleting node from tail");
obj.display();
```

```
  System.out.println();
```

```
obj.deleteFromMid(3);
System.out.println("After deleting node from middle");
obj.display();
```

```
  System.out.println();
  obj.size();
}
}
```

OUTPUT:



```
the linked list is:
2 3 4

Insertion at the Tail:
2 3 4 5

Insertion at the Mid:
2 6 3 4 5

Insertion at the Beginning:
1 2 6 3 4 5
After deleting node from start
2 6 3 4 5

After deleting node from tail
2 6 3 4

After deleting node from middle
2 6 4

The Size of this Linked List is 3
```