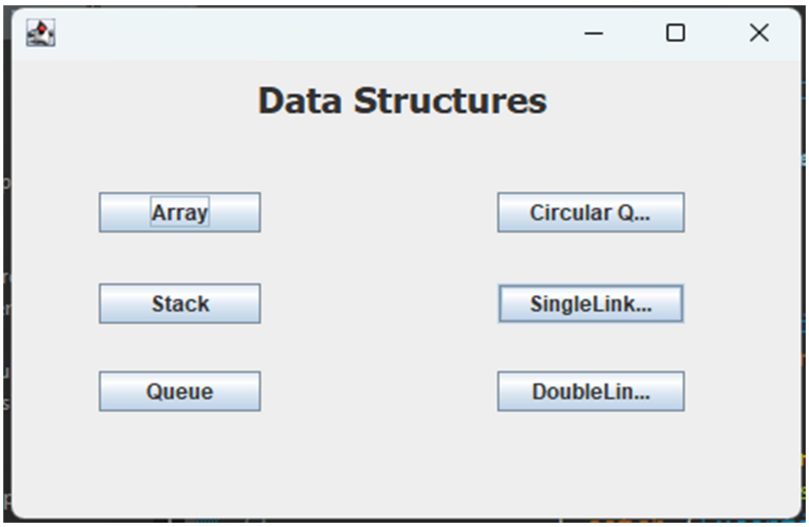
LinearDSA Java Application

This Java program creates a simple graphical user interface (GUI) using Swing to manage a collection of common linear data structures, including Queue, Circular Queue, Stack, Linked Lists, and Arrays.



Key Features:

1. **Frame Creation**:
   - The `LinearDSA` class extends `JFrame`, which is the main window of the application.
   - The frame's layout is set to `null`, allowing for manual placement of components like buttons and labels.
2. **Buttons**:
   - There are six buttons, each representing a different data structure: Queue, Circular Queue, Stack, Double Linked List, Single Linked List, and Array.
   - Each button is associated with an `ActionListener`, which defines the action to be taken when the button is clicked.
   - When a button is clicked, it calls the `close()` method to close the current window and then opens a new window related to the selected data structure.
3. **Closing the Window**:
   - The `close()` method simulates closing the current window. This is achieved using `WindowEvent` and `Toolkit.getDefaultToolkit().getSystemEventQueue().postEvent()`.
4. **Content Panel**:
   - The content panel (`contentPane`) holds all the components, and its layout is managed manually using `setLayout(null)`, which means no automatic layout manager is used. The components' positions are manually set using `setBounds(x, y, width, height)`.
5. **Label**:
   - A `JLabel` titled "Data Structures" is added at the top with a bold font to give the GUI a title.

Example Flow:

- When the application starts, a window with a title "Data Structures" appears, showing buttons for the six data structures.
- When a user clicks a button (e.g., "Queue"), the current window closes and the program opens a new window related to the Queue data structure.

Recommendations for Improvement:

1. **Modularize the Data Structure Classes**: Instead of directly creating `Array` objects for each data structure type, it's better to create specific classes for each data structure (e.g., `QueueFrame`, `StackFrame`), which would then handle the visualization and functionality of that data structure.
2. **Improve Layout Management**: Instead of using `setLayout(null)`, which can be error-prone, consider using layout managers like `GridLayout`, `FlowLayout`, or `BorderLayout` for better automatic placement and resizing of components.
3. **Window Resizing**: The fixed window size (`450x300`) could cause issues with window resizing or varying screen sizes. You might want to make the window resizable or adjust components dynamically based on window size.
4. **Close Operation Enhancement**: The `close()` method could be enhanced by using `setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE)` if the program should terminate when the window is closed.

Key Components of the Program:

1. **Main Frame (`LinearDSA`):**
   - The main window of the application extends `JFrame` and provides the interface for users to interact with.
   - The frame contains a `JPanel` which holds all UI components like buttons and labels. This panel uses a null layout, meaning components are positioned manually using `setBounds(x, y, width, height)`.
2. **Buttons:**
   - The GUI includes six buttons, each representing a different linear data structure:
     - **Queue**
     - **Circular Queue**
     - **Stack**
     - **Double Linked List**
     - **Single Linked List**
     - **Array**
   - Each button is associated with an `ActionListener` that triggers the opening of a new window corresponding to the selected data structure. For example, clicking the "Queue" button opens a new window for interacting with a queue.
3. **Window Closing Mechanism:**

    - The application includes a `close()` method that closes the current window when a button is pressed. This method uses `WindowEvent` and `Toolkit` to post a closing event to the system event queue.
4. **Title Label:**
    - A `JLabel` titled "Data Structures" is added at the top of the frame. It uses a bold font to make the label prominent and acts as a title for the window.
5. **Data Structure Classes:**
    - The `Array` class (and other data structure classes like `Stack`, `Queue`, etc.) are assumed to exist and provide the core functionality for managing the respective data structures. These classes are instantiated with specific parameters (like `"Queue"` for a queue) when a user selects a data structure from the main window.

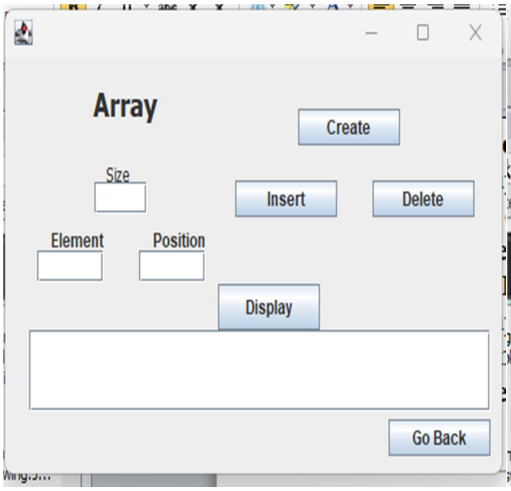
Application Flow:

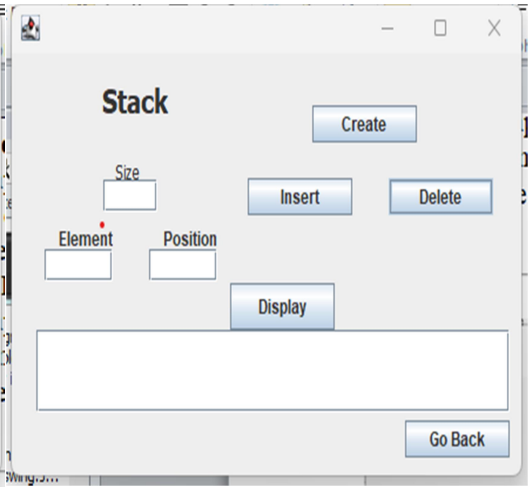
1. **Launch Application:**
    - The application is launched by invoking the `LinearDSA` class in the `main()` method.
    - The main window appears with the title "Data Structures" and six buttons.
2. **User Interaction:**
    - Users click a button corresponding to the desired data structure (e.g., "Queue").
    - The program closes the current window and opens a new window related to the selected data structure. This new window is expected to allow further operations on the chosen data structure (e.g., adding/removing elements from a queue).
3. **Window Closing:**
    - The `close()` method ensures that the main window closes before transitioning to the new data structure window. It uses a `WindowEvent` to trigger the closing of the window.

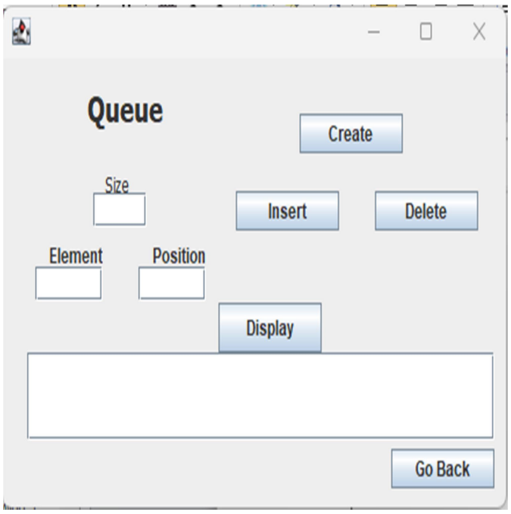
Example: Queue Button Interaction

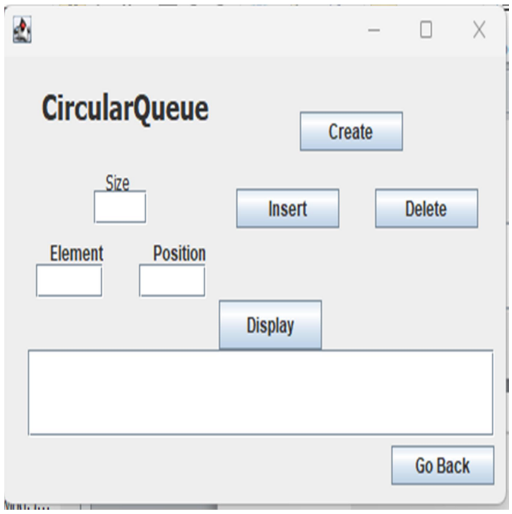
When the user clicks the **Queue** button:

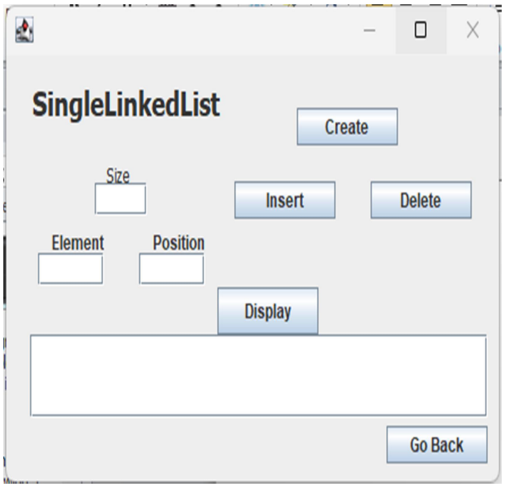
- The `close()` method is called to close the current window.
- A new `Array` object is created with the string `"Queue"` as an argument (`new Array("Queue")`).
- The `Array` window is then made visible, showing the interface for interacting with a queue (the specifics of which are assumed to be implemented within the `Array` class).

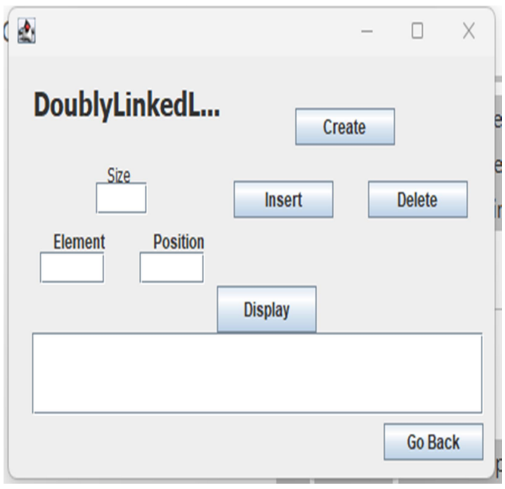

Array
Create
Size
Insert
Delete
Element
Position
Display
Go Back


Stack
Create
Size
Insert
Delete
Element
Position
Display
Go Back


Queue
Create
Size
Insert
Delete
Element
Position
Display
Go Back


CircularQueue
Create
Size
Insert
Delete
Element
Position
Display
Go Back


SingleLinkedList
Create
Size
Insert
Delete
Element
Position
Display
Go Back


DoublyLinkedL...
Create
Size
Insert
Delete
Element
Position
Display
Go Back

Overview:

The `LinearDSA` Java application is a graphical user interface (GUI) built using the Swing framework. It provides a user-friendly interface to interact with and visualize several linear data structures, including arrays, stacks, queues, circular queues, and linked lists (both singly and doubly linked). The application allows users to select a data structure, after which a new window corresponding to the selected data structure opens for further interaction.

The `DSA` Java application provides a user interface for managing linear data structures such as arrays or lists. Using Java Swing, this GUI allows users to create, insert, delete, and display elements within a specific data structure. The program dynamically updates the data structure based on user input and provides feedback through dialog boxes.

Key Components of the Program:

1. **Frame (`DSA`):**
    - This class creates the main window (frame) using `JFrame` where users interact with different operations on a linear data structure (e.g., array).
    - The window includes buttons, text fields, and labels for user interaction.
2. **User Interface (UI) Components:**
    - **Text Fields:**
        - `txt1`: Input field for the size of the data structure.
        - `txt2`: Input field for the element to be inserted or deleted.
        - `txt3`: Input field for the position at which the element should be inserted or deleted.
        - `txt4`: Output field that displays the current elements of the data structure after any operation (display).
    - **Buttons:**
        - **Go Back**: Returns to the previous main frame (`LinearDSA`).
        - **Create**: Initializes the data structure with a specified size.
        - **Insert**: Inserts an element at a specific position in the data structure.
        - **Delete**: Deletes an element from a specified position.
        - **Display**: Shows the current contents of the data structure in `txt4`.
3. **Action Listeners:**
    - Each button has an `ActionListener` attached to it, performing actions like creating a data structure, inserting/deleting elements, or displaying the current state of the structure.
4. **Data Structure Operations:**
    - **Create:** The `create` method initializes the data structure with the given size.
    - **Insert:** Inserts a value at a given position in the data structure, using 1-based indexing (position - 1).
    - **Delete:** Deletes an element from a specified position in the data structure.
    - **Display:** Displays the current elements in the data structure in `txt4`.
5. **Dialog Boxes:**
    - **JOptionPane:** Used for showing success or error messages, such as when an element is inserted, deleted, or when the data structure is created.

Flow of Operations:

1. **Launch Application:**
   - The `main()` method initializes and displays the `DSA` frame.
2. **Creating a Data Structure:**
   - The user enters the desired size of the data structure in `txt1` and clicks the **Create** button.
   - The `create` method initializes the data structure, and a success message is shown.
3. **Inserting Elements:**
   - The user provides a value and a position (using `txt2` and `txt3`), then clicks the **Insert** button.
   - The `insert` method places the value at the specified position and a confirmation message appears.
4. **Deleting Elements:**
   - The user provides the position of the element to be deleted in `txt3` and clicks the **Delete** button.
   - The `delete` method removes the element from the given position and displays a confirmation message.
5. **Displaying the Data Structure:**
   - The user clicks the **Display** button to view the current elements in the data structure, which are displayed in `txt4`.

Key Methods:

- **create(int size):** Initializes the data structure with a given size.
- **insert(String type, int value, int position):** Inserts an element at the specified position.
- **delete(String type, int position):** Deletes the element at the specified position.
- **display(String type):** Returns a string representing the current state of the data structure.

Additional Features:

- **Back Button:** The "Go Back" button closes the current window and opens the main menu (the `LinearDSA` frame).

Conclusion:

The `LinearDSA Jframe` application provides a simple interface for users to explore different linear data structures. While the current implementation serves as a basic starting point, it could be significantly improved with enhanced modularity, better layout management, and the addition of functionality for each data structure.

The `DSA Jframe` is a user-friendly interface that allows users to manage linear data structures through a simple set of operations like creating, inserting, deleting, and displaying elements. While functional, there are opportunities for enhancement, such as improving error handling and offering more dynamic data structure management.

Code:

LinearDSA Frame Code:

```
import java.awt.EventQueue;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.border.EmptyBorder;
import javax.swing.JLabel;
import javax.swing.JButton;
import javax.swing.JToggleButton;
import javax.swing.JTextField;
import javax.swing.SwingConstants;
import java.awt.event.ActionListener;
import java.awt.event.WindowEvent;
import java.awt.event.ActionEvent;
import java.awt.Font;
import java.awt.Toolkit;
import java.beans.PropertyChangeListener;
import java.beans.PropertyChangeEvent;
public class LinearDSA extends JFrame {
	private static final long serialVersionUID = 1L;
	public static void main(String[] args) {
		EventQueue.invokeLater(new Runnable() {
			public void run() {
				try {
					LinearDSA frame = new LinearDSA();
					frame.setVisible(true);
				} catch (Exception e) {
					e.printStackTrace();
				}
			}
		});
	}
```

```
public void close() {
		WindowEvent closeWindow = new WindowEvent(this,
		WindowEvent.WINDOW_CLOSING);
		Toolkit.getDefaultToolkit().getSystemEventQueue().postEvent(closeWindow);
}
public LinearDSA() {
		setDefaultCloseOperation(JFrame.DISPOSE_ON_CLOSE);
		setBounds(100, 100, 450, 300);
		JPanel contentPane = new JPanel();
		contentPane.addPropertyChangeListener(new PropertyChangeListener() {
			public void propertyChange(PropertyChangeEvent evt) {
			}
		});
		contentPane.setBorder(new EmptyBorder(5, 5, 5, 5));

		setContentPane(contentPane);
		contentPane.setLayout(null);
		JButton btnNewButton = new JButton("Queue");
		btnNewButton.addActionListener(new ActionListener() {
			public void actionPerformed(ActionEvent e) {
				close();
				DSA array = new DSA("Queue");
				array.setVisible(true);
			}
		});
		btnNewButton.setBounds(48, 177, 89, 23);
		contentPane.add(btnNewButton);
		JButton btnNewButton_1 = new JButton("Circular Queue");
		btnNewButton_1.addActionListener(new ActionListener() {
			public void actionPerformed(ActionEvent e) {
				close();
				DSA array = new DSA("CircularQueue");
				array.setVisible(true);
			}
		});
		btnNewButton_1.setBounds(267, 75, 103, 23);
		contentPane.add(btnNewButton_1);
```

```
JButton btnNewButton_2 = new JButton("Stack");
btnNewButton_2.addActionListener(new ActionListener() {
	public void actionPerformed(ActionEvent e) {
		close();
		DSA array = new DSA("Stack");
		array.setVisible(true);
	}
});
btnNewButton_2.setBounds(48, 127, 89, 23);
contentPane.add(btnNewButton_2);
JButton btnNewButton_3 = new JButton("DoubleLinkedList");
btnNewButton_3.addActionListener(new ActionListener() {
	public void actionPerformed(ActionEvent e) {
		close();
		DSA array = new DSA("DoublyLinkedList");
		array.setVisible(true);
	}
});
btnNewButton_3.setBounds(267, 177, 103, 23);
contentPane.add(btnNewButton_3);
JButton btnNewButton_4 = new JButton("Array");
btnNewButton_4.addActionListener(new ActionListener() {
	public void actionPerformed(ActionEvent e) {
		close();
		DSA array = new DSA("Array");
		array.setVisible(true);
	}
});
btnNewButton_4.setBounds(48, 75, 89, 23);
contentPane.add(btnNewButton_4);

JButton btnNewButton_5 = new JButton("SingleLinkedList");
btnNewButton_5.addActionListener(new ActionListener() {
	public void actionPerformed(ActionEvent e) {
		close();
		DSA array = new DSA("SingleLinkedList");
```

```
                    array.setVisible(true);
                }
            });
            btnNewButton_5.setBounds(267, 127, 103, 23);
            contentPane.add(btnNewButton_5);
            JLabel lblNewLabel = new JLabel("Data Structures");
            lblNewLabel.setFont(new Font("Tahoma", Font.BOLD, 20));
            lblNewLabel.setBounds(135, 11, 166, 23);
            contentPane.add(lblNewLabel);
    }
     }
```

DSA Frame Code:

```
import java.awt.EventQueue;
import java.awt.Toolkit;
import javax.swing.JFrame;
import javax.swing.JPanel;
import javax.swing.border.EmptyBorder;
import javax.swing.JButton;
import java.awt.event.ActionListener;
import java.awt.event.WindowEvent;
import java.awt.event.ActionEvent;
import javax.swing.JLabel;
import javax.swing.JOptionPane;
import javax.swing.JTextField;
import java.awt.Font;
import javax.swing.SwingConstants;
import com.miniproject.linearDS.copy2.LinearDS;
public class DSA extends JFrame {

    private static final long serialVersionUID = 1L;
```

```
	private JPanel contentPane;
	private JTextField txt1;
	private JTextField txt2;
	private JTextField txt3;
	private JTextField txt4;
	public static void main(String[] args) {
		EventQueue.invokeLater(new Runnable() {
			public void run() {
				try {
					DSA frame = new DSA("");
					frame.setVisible(true);
				} catch (Exception e) {
					e.printStackTrace();
				}
			}
		});
	}
	public void close() {
		WindowEvent closeWindow = new WindowEvent(this,
WindowEvent.WINDOW_CLOSING);
		Toolkit.getDefaultToolkit().getSystemEventQueue().postEvent(closeWindow);
	}

	/**
	 * Create the frame.
	 */
	public DSA(String s) {
		setDefaultCloseOperation(JFrame.DISPOSE_ON_CLOSE);
```

```
setBounds(100, 100, 450, 300);
contentPane = new JPanel();
contentPane.setBorder(new EmptyBorder(5, 5, 5, 5));

setContentPane(contentPane);
contentPane.setLayout(null);
LinearDS structures = new LinearDS();

JButton btnNewButton = new JButton("Go Back");
btnNewButton.addActionListener(new ActionListener() {
	public void actionPerformed(ActionEvent e) {
		close();
		LinearDSA mainFrame = new LinearDSA();
		mainFrame.setVisible(true);
	}
});
btnNewButton.setBounds(335, 227, 89, 23);
contentPane.add(btnNewButton);

JButton btnNewButton_1 = new JButton("Display");
btnNewButton_1.addActionListener(new ActionListener() {
	public void actionPerformed(ActionEvent e) {
		txt4.setText(structures.display(s));

	}
});
btnNewButton_1.setBounds(186, 142, 89, 29);
contentPane.add(btnNewButton_1);
```

```
JLabel lblNewLabel = new JLabel("Size");
lblNewLabel.setFont(new Font("Tahoma", Font.PLAIN, 12));
lblNewLabel.setBounds(88, 66, 36, 14);
contentPane.add(lblNewLabel);

txt1 = new JTextField();
txt1.setBounds(78, 78, 46, 20);
contentPane.add(txt1);
txt1.setColumns(10);

JButton btnNewButton_2 = new JButton("Create");
btnNewButton_2.addActionListener(new ActionListener() {
        public void actionPerformed(ActionEvent e) {
                int num1 = Integer.parseInt(txt1.getText());
                structures.create(num1);
                JOptionPane.showMessageDialog(null, s + "Created");
        }
});
btnNewButton_2.setBounds(256, 32, 89, 23);
contentPane.add(btnNewButton_2);

txt2 = new JTextField();
txt2.setBounds(28, 121, 58, 20);
contentPane.add(txt2);
txt2.setColumns(10);

txt3 = new JTextField();
```

```
		txt3.setBounds(117, 121, 58, 20);
		contentPane.add(txt3);
		txt3.setColumns(10);

		JButton btnNewButton_3 = new JButton("Insert");
		btnNewButton_3.addActionListener(new ActionListener() {
			public void actionPerformed(ActionEvent e) {
				int value = Integer.parseInt(txt2.getText());
				int position = Integer.parseInt(txt3.getText());
				structures.insert(s, value, position-1);
				JOptionPane.showMessageDialog(null,"In "+ s + " Inserted Value:"
+ value + " at postion:" + position);
			}
		});
		btnNewButton_3.setBounds(201, 77, 89, 23);
		contentPane.add(btnNewButton_3);

		JButton btnNewButton_4 = new JButton("Delete");
		btnNewButton_4.addActionListener(new ActionListener() {
			public void actionPerformed(ActionEvent e) {
				int position = Integer.parseInt(txt3.getText());
				structures.delete(s, position-1);
				JOptionPane.showMessageDialog(null,"In "+ s + " Deleted at
postion:" + position);
			}
		});
		btnNewButton_4.setBounds(321, 77, 89, 23);
		contentPane.add(btnNewButton_4);
```

```
        txt4 = new JTextField();
        txt4.setBounds(21, 171, 403, 51);
        contentPane.add(txt4);
        txt4.setColumns(10);

        JLabel lblNewLabel_1 = new JLabel("Element");
        lblNewLabel_1.setBounds(40, 107, 46, 14);
        contentPane.add(lblNewLabel_1);

        JLabel lblNewLabel_3 = new JLabel("Position");
        lblNewLabel_3.setBounds(129, 107, 46, 14);
        contentPane.add(lblNewLabel_3);

        JLabel lblNewLabel_2 = new JLabel(s);
        lblNewLabel_2.setFont(new Font("Tahoma", Font.BOLD, 20));
        lblNewLabel_2.setHorizontalAlignment(SwingConstants.CENTER);
        lblNewLabel_2.setBounds(21, 11, 169, 36);
        contentPane.add(lblNewLabel_2);

    }
}
```

Implementation of Linear Data Structures:

```
package com.miniproject.linearDS.copy2;
import java.util.*;
public class LinearDS {
    Stack<Integer> stack = new Stack<>();
    Queue<Integer> queue = new LinkedList<>();
    CircularQueue<Integer> cQueue = new CircularQueue<>();
```

```
    LinkedList<Integer> lList = new LinkedList<>();
    LinkedList<Integer> sList = new LinkedList<>();
    public

     static int[] a;
    public void create(int size) {
         a = new int[size];
    }

   public void insert(String s, int value, int position) {
    a[position] = value;
    switch (s) {
         case "Stack":
               stack.push(a[position]);
               break;
         case "Queue":
               queue.add(a[position]);
               break;
         case "CircularQueue":
               cQueue.add(value, position);
               break;
         case "SingleLinkedList":
               sList.add(value);
               break;
         case "DoublyLinkedList":
               lList.add(value);;
               break;
         case "Array":
               a[position] = value;
               break;
         default:
               System.out.println("Invalid input");
               break;
         }

    }
    public void delete(String s, int position) {

      switch (s) {
         case "Stack":
               stack.remove(position);
               break;
         case "Queue":
               queue.remove(position);
               break;
         case "CircularQueue":
               cQueue.remove(position);
               break;
         case "SingleLinkedList":
```

```
                sList.remove(position);
                break;
            case "DoublyLinkedList":
                lList.remove(position);
                break;
            case "Array":
                a[position] = 0;
                break;
            default:
                System.out.println("Invalid input");
                break;
            }

    }
    public String  display(String s) {
        String dis = "";
        switch (s) {
        case "Stack":
            for(int p : stack)
                dis += p + " ";
            return dis;
        case "Queue":
            for(int p : queue)
                dis += p + " ";
            return dis;
        case "CircularQueue":
            return cQueue.display();
        case "SingleLinkedList":
            for(int p : sList)
                dis += p + " ";
            return dis;
        case "DoublyLinkedList":
            for(int p : lList)
                dis += p + " ";
            return dis;
        case "Array":
            for(int p : a)
                dis += p + " ";
            return dis;
        default:
            return "Invalid input";
        }



    }
}
```

Circular Queue Implementation:

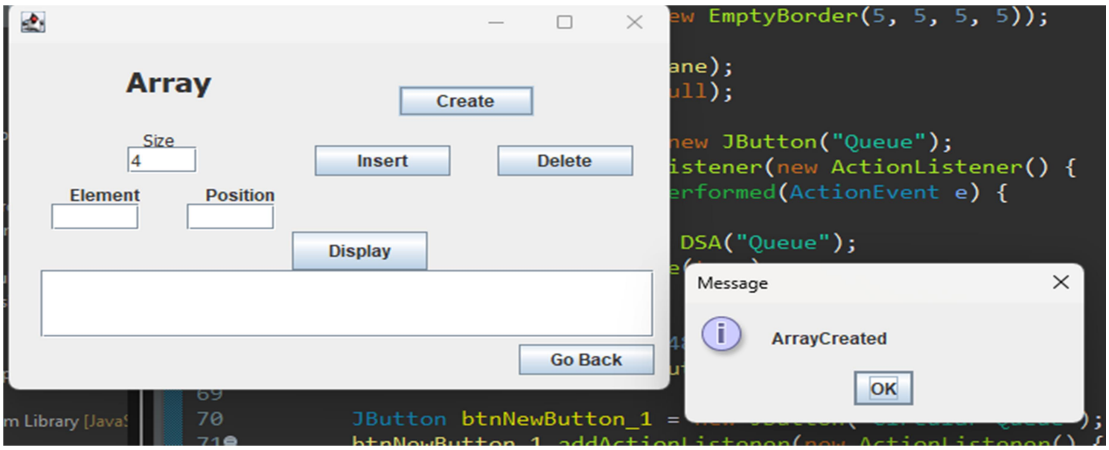
```
package com.miniproject.linearDS.copy2;
class Node {
    int data;
    Node next;

    // Constructor to create a new node
    public Node(int data) {
        this.data = data;
        this.next = null;
    }
}

public class CircularQueue<Integer> {

     Node front, rear;

    // Constructor to initialize the queue
    public CircularQueue() {
        front = rear = null;
    }

    // Check if the queue is empty
    public boolean isEmpty() {
        return front == null;
    }

    // Enqueue operation at specific position
    public void add(int data, int position) {
        Node newNode = new Node(data);

        // If the queue is empty, set the new node as both front and
rear
        if (isEmpty()) {
            front = rear = newNode;
            rear.next = front;  // Circular link
        } else if (position == 0) {
            // Insert at the front of the queue (before front)
            newNode.next = front;
            rear.next = newNode;
            front = newNode;
        } else {
            Node current = front;
            int count = 0;
            // Traverse the queue to the position
            while (current != rear && count < position - 1) {
                current = current.next;
                count++;
```

```
            }
            // Insert the node at the specific position
            newNode.next = current.next;
            current.next = newNode;
            // If inserted at the rear
            if (current == rear) {
                rear = newNode;
            }
        }
    }

    // Dequeue operation from a specific position
    public int remove(int position) {
        if (isEmpty()) {
            System.out.println("Queue is empty!");
            return -1;
        }

        if (position == 0) {
            // Dequeue the front
            return removeFirst();
        }

        Node current = front;
        int count = 0;
        // Traverse the queue to the position
        while (current != rear && count < position - 1) {
            current = current.next;
            count++;
        }

        // If current is rear, we are removing the rear node
        if (current == rear) {
            return removeLast();
        }

        // Remove the node at the position
        Node temp = current.next;
        current.next = temp.next;
        return temp.data;
    }

    // Dequeue operation from the front (helper method)
    private int removeFirst() {
        if (front == rear) {
            int data = front.data;
            front = rear = null;
            return data;
        } else {
```

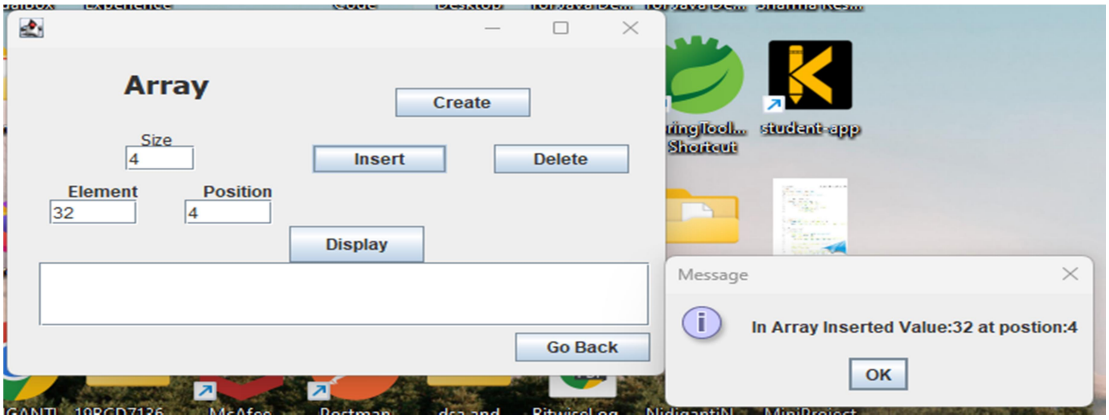
```
            int data = front.data;
            front = front.next;
            rear.next = front;  // Maintain circular link
            return data;
        }
    }

    // Dequeue operation from the rear (helper method)
    private int removeLast() {
        if (front == rear) {
            int data = rear.data;
            front = rear = null;
            return data;
        }

        Node current = front;
        while (current.next != rear) {
            current = current.next;
        }

        int data = rear.data;
        rear = current;
        rear.next = front;  // Maintain circular link
        return data;
    }

    // Display the queue elements
    public String display() {
      String s = "";
        if (isEmpty()) {
            System.out.println("Queue is empty!");
            return "";
        }

        Node current = front;
        while (current != rear) {
            s += current.data + " ";
            current = current.next;
        }
        s += current.data;
        return s;
    }
}
```

Output:

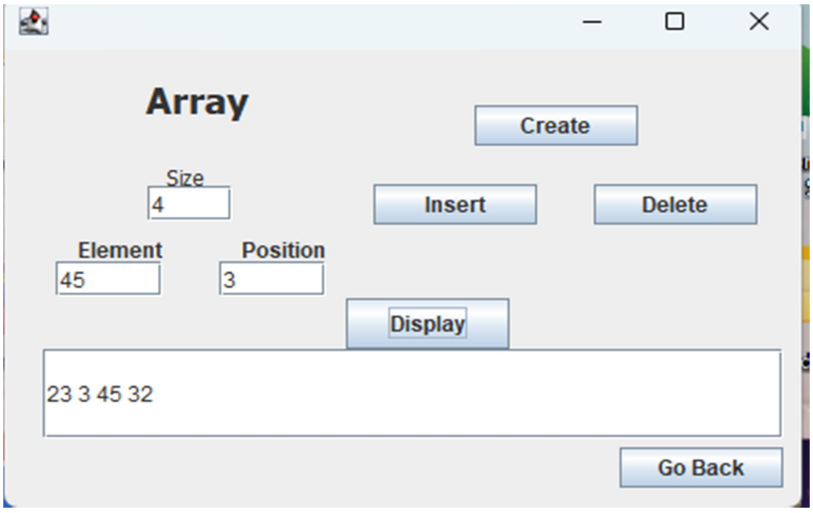
Creating Array:



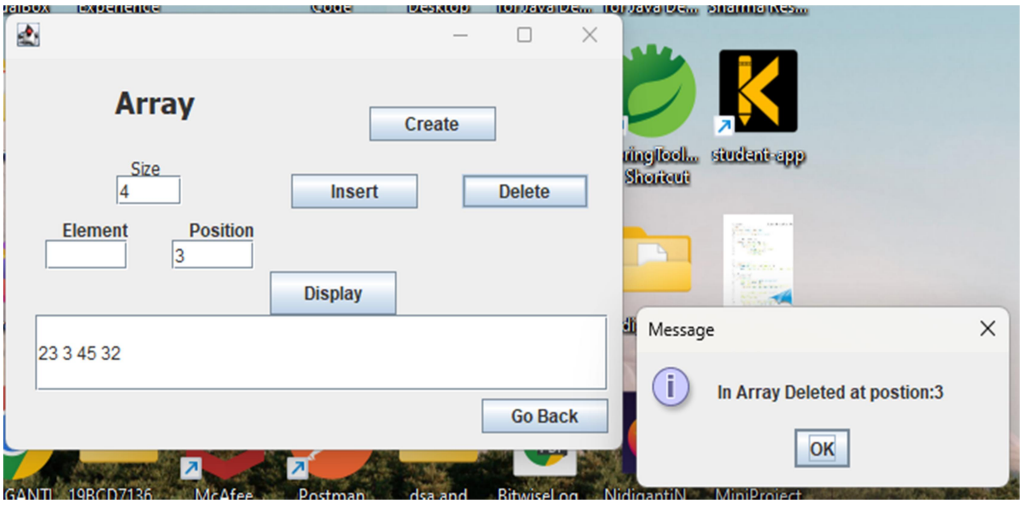
Insertion of values at specific position:



Displaying the elements before Deletion:



Deletion based on the Index value:



Displaying of Elements after deletion: