Department of Computer Science

Data Structures and Algorithms Group Assignment

Due Date:14 October 2024

Group Members

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Section A

Pseudocode for Phonebook Application

```
START

  Initialize an empty list called contacts

  Create the GUI with the following components:
    - Text fields for name, phone, address, email
    - Combo box for gender selection (Male, Female)
    - Text area to display contacts
    - Buttons: Insert, Search, Delete, Update, Display All, Sort

  Display the GUI

  WHILE the application is running:

    IF Insert button is clicked:
      Get name, phone, address, gender, and email from input fields
      IF name and phone are not empty AND gender is valid (Male/Female):
        Create a new Contact object with the input values
        Add the Contact to the contacts list
        Display "Contact added" message in the text area
        Clear all input fields
      ELSE:
```

Show error message "Name and Phone cannot be empty, and Gender must be Male or Female"

IF Search button is clicked:

Prompt the user to enter a name to search

Search the contacts list for a Contact whose name matches (case-insensitive)

IF a matching contact is found:

Display the contact's details in the text area

ELSE:

Display "Contact not found" message in the text area

IF Delete button is clicked:

Prompt the user to enter a name to delete

Search and remove any contact from the contacts list whose name matches (case-insensitive)

IF a contact is removed:

Display "Contact deleted" message in the text area

ELSE:

Display "Contact not found" message in the text area

IF Update button is clicked:

Prompt the user to enter a name to update

Search the contacts list for a Contact whose name matches (case-insensitive)

IF a matching contact is found:

Prompt the user for new phone, address, gender, and email

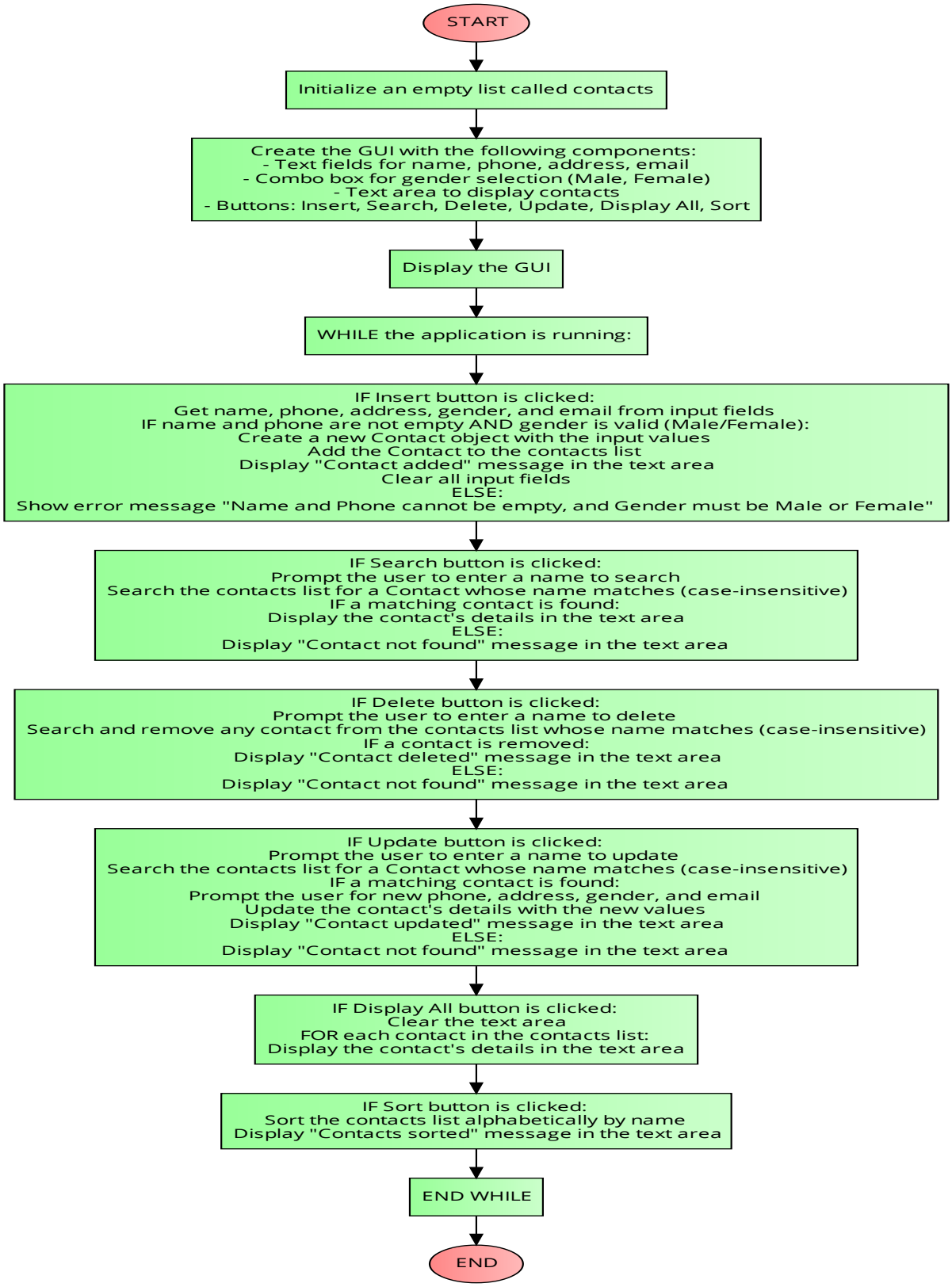
Update the contact's details with the new values

Display "Contact updated" message in the text area

ELSE:

```
            Display "Contact not found" message in the text area

        IF Display All button is clicked:
            Clear the text area
            FOR each contact in the contacts list:
                Display the contact's details in the text area

        IF Sort button is clicked:
            Sort the contacts list alphabetically by name
            Display "Contacts sorted" message in the text area

    END WHILE

END
```

Flowchart


START
Initialize an empty list called contacts
Create the GUI with the following components:
- Text fields for name, phone, address, email
- Combo box for gender selection (Male, Female)
- Text area to display contacts
- Buttons: Insert, Search, Delete, Update, Display All, Sort
Display the GUI
WHILE the application is running:
IF Insert button is clicked:
Get name, phone, address, gender, and email from input fields
IF name and phone are not empty AND gender is valid (Male/Female):
Create a new Contact object with the input values
Add the Contact to the contacts list
Display "Contact added" message in the text area
Clear all input fields
ELSE:
Show error message "Name and Phone cannot be empty, and Gender must be Male or Female"
IF Search button is clicked:
Prompt the user to enter a name to search
Search the contacts list for a Contact whose name matches (case-insensitive)
IF a matching contact is found:
Display the contact's details in the text area
ELSE:
Display "Contact not found" message in the text area
IF Delete button is clicked:
Prompt the user to enter a name to delete
Search and remove any contact from the contacts list whose name matches (case-insensitive)
IF a contact is removed:
Display "Contact deleted" message in the text area
ELSE:
Display "Contact not found" message in the text area
IF Update button is clicked:
Prompt the user to enter a name to update
Search the contacts list for a Contact whose name matches (case-insensitive)
IF a matching contact is found:
Prompt the user for new phone, address, gender, and email
Update the contact's details with the new values
Display "Contact updated" message in the text area
ELSE:
Display "Contact not found" message in the text area
IF Display All button is clicked:
Clear the text area
FOR each contact in the contacts list:
Display the contact's details in the text area
IF Sort button is clicked:
Sort the contacts list alphabetically by name
Display "Contacts sorted" message in the text area
END WHILE
END

Section B

Functionality, Services, and Requirements (FSR) for the Phonebook Application

S No.	Module Name	Description/Role
1	Contact Class	Represents a contact with name, phone number, address, gender, and email attributes.
2	Phonebook Class	Manages the list of contacts, providing methods for adding, searching, updating, and deleting contacts.
2.1	insertContact	Adds a new contact to the phonebook.
2.2	searchContact	Finds and returns a contact by name.
2.3	deleteContact	Removes a contact by name from the list.
2.4	updateContact	Updates the details of an existing contact.
2.5	sortContact	Sorts contacts alphabetically by name.
3	GUI (Main Window)	Provides a graphical interface for interacting with the phonebook.
3.1	Buttons	Buttons for inserting, searching, displaying, deleting, updating, and sorting contacts.
4	Action Listeners	Handles the button click events and triggers the corresponding phonebook actions.

The code

Package declaration and import statements

```
package phonebooksystem;

import javax.swing.*;
import java.awt.*;
import java.awt.event.*;
import java.util.ArrayList;
import java.util.Collections;
import java.util.Comparator;
```

Class Definition

The contacts class represents a contact in the phonebook application

```
// Class to represent a contact
class Contact {
    String name;
    String phoneNumber;
    String address;
    String gender;
    String email;
```

Constructor

The constructor initializes the contact details.

```

    // Constructor to initialize contact details
    Contact(String name, String phoneNumber, String address, String gender, String email) {
        this.name = name;
        this.phoneNumber = phoneNumber;
        this.address = address;
        this.gender = gender;
        this.email = email;
    }

```

Overridden `toString` Method

The `toString` method returns a formatted string with the contact details

```java
    // Override toString method to display contact details
    @Override
    public String toString() {
        return String.format("Name: %s, Phone: %s, Address: %s, Gender: %s, Email: %s",
                name, phoneNumber, address, gender, email);
    }
}
```

Class Definition

The `PhoneBook` class is the main class for the phonebook application, which includes a graphical user interface (GUI).

Member Variables

- `private ArrayList<Contact> contacts`: A list to store contact objects.
- `private JFrame frame`: The main frame for the GUI.
- `private JTextArea displayArea`: A text area to display contact information.
- `private JTextField nameField, phoneField, addressField, emailField`: Text fields for user input.
- `private JComboBox<String> genderComboBox`: A combo box for gender selection.

```java
// Main class for the phonebook application with GUI
public class Phonebook {
    private ArrayList<Contact> contacts; // List to store contacts
    private JFrame frame;
    private JTextArea displayArea;
    private JTextField nameField, phoneField, addressField, emailField;
    private JComboBox<String> genderComboBox; // Combo box for gender selection
```

Constructor

The constructor initializes the phonebook and GUI components.

```java
    // Constructor to initialize the phonebook and GUI components
    public Phonebook() {
        contacts = new ArrayList<>();
        createGUI();
    }
```

Method to Create the GUI

The `createGUI` method sets up the main frame and its components.

```java

    // Method to create the GUI
    private void createGUI() {
        frame = new JFrame("Phonebook");
        frame.setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        frame.setSize(600, 400);
        frame.setLayout(new GridBagLayout());
        frame.getContentPane().setBackground(new Color(230, 240, 250));

        GridBagConstraints gbc = new GridBagConstraints();
        gbc.fill = GridBagConstraints.HORIZONTAL;
        gbc.insets = new Insets(5, 5, 5, 5);

        // Title Label
        JLabel titleLabel = new JLabel("Phonebook Application");
        titleLabel.setFont(new Font("Arial", Font.BOLD, 20));
        gbc.gridx = 0;
        gbc.gridy = 0;
        gbc.gridwidth = 2;
        frame.add(titleLabel, gbc);

        // Input fields for contact details
        gbc.gridwidth = 1;
        gbc.gridy = 1;
        frame.add(new JLabel("Name:"), gbc);
        nameField = new JTextField(15);
        gbc.gridx = 1;
        frame.add(nameField, gbc);

        gbc.gridx = 0;
        gbc.gridy = 2;
        frame.add(new JLabel("Phone:"), gbc);
        phoneField = new JTextField(15);
        gbc.gridx = 1;
        frame.add(phoneField, gbc);

```

```java
        gbc.gridx = 0;
        gbc.gridy = 3;
        frame.add(new JLabel("Address:"), gbc);
        addressField = new JTextField(15);
        gbc.gridx = 1;
        frame.add(addressField, gbc);

        gbc.gridx = 0;
        gbc.gridy = 4;
        frame.add(new JLabel("Gender:"), gbc);
        // Combo box for gender selection
        String[] genders = {"Male", "Female"};
        genderComboBox = new JComboBox<>(genders);
        gbc.gridx = 1;
        frame.add(genderComboBox, gbc);

        gbc.gridx = 0;
        gbc.gridy = 5;
        frame.add(new JLabel("Email:"), gbc);
        emailField = new JTextField(15);
        gbc.gridx = 1;
        frame.add(emailField, gbc);

        // Text area to display contacts
        displayArea = new JTextArea(10, 40);
        displayArea.setEditable(false);
        displayArea.setBackground(new Color(240, 255, 255));
        JScrollPane scrollPane = new JScrollPane(displayArea);
        gbc.gridx = 0;
        gbc.gridy = 6;
        gbc.gridwidth = 2;
        frame.add(scrollPane, gbc);
```

Button Panel Creation

The button panel is created to hold various buttons for the phonebook application.

Button Panel Initialization

```java
        // Panel for buttons
        JPanel buttonPanel = new JPanel();
        buttonPanel.setLayout(new FlowLayout());
```

Button Creation

Several buttons are created for different actions:

```java
JButton insertButton = new JButton("Insert");
JButton searchButton = new JButton("Search");
JButton deleteButton = new JButton("Delete");
JButton updateButton = new JButton("Update");
JButton displayButton = new JButton("Display All");
JButton sortButton = new JButton("Sort");

// Add buttons to the panel
buttonPanel.add(insertButton);
buttonPanel.add(searchButton);
buttonPanel.add(deleteButton);
buttonPanel.add(updateButton);
buttonPanel.add(displayButton);
buttonPanel.add(sortButton);
```

Action listeners are added to each button to define their behavior when clicked:

```java
        // Button actions
        insertButton.addActionListener(e -> insertContact());
        searchButton.addActionListener(e -> searchContact());
        deleteButton.addActionListener(e -> deleteContact());
        updateButton.addActionListener(e -> updateContact());
        displayButton.addActionListener(e -> displayContacts());
        sortButton.addActionListener(e -> sortContacts());

        frame.setVisible(true);
    }
```

Method to Insert a New Contact

```java
    // Method to insert a new contact
    private void insertContact() {
        String name = nameField.getText().trim();
        String phone = phoneField.getText().trim();
        String address = addressField.getText().trim();
        String gender = (String) genderComboBox.getSelectedItem(); // Get selected gender
        String email = emailField.getText().trim();

        if (!name.isEmpty() && !phone.isEmpty() && (gender.equals("Male") || gender.equals("Female"))) {
            contacts.add(new Contact(name, phone, address, gender, email));
            displayArea.append("Contact added: " + name + "\n");
            clearFields();
        } else {
            JOptionPane.showMessageDialog(frame, "Name and Phone cannot be empty, and Gender must be Male or Female.");
        }
    }
```

The `insertContact` method adds a new contact to the list if the required fields are not empty and the gender is valid.

```java
// Method to insert a new contact
private void insertContact() {
    String name = nameField.getText().trim();
    String phone = phoneField.getText().trim();
    String address = addressField.getText().trim();
    String gender = (String) genderComboBox.getSelectedItem(); // Get selected gender
    String email = emailField.getText().trim();

    if (!name.isEmpty() && !phone.isEmpty() && (gender.equals("Male") || gender.equals("Female"))) {
        contacts.add(new Contact(name, phone, address, gender, email));
        displayArea.append("Contact added: " + name + "\n");
        clearFields();
    } else {
        JOptionPane.showMessageDialog(frame, "Name and Phone cannot be empty, and Gender must be Male or Female.");
    }
}
```

Method to Search for a Contact by Name

The `searchContact` method searches for a contact by name and displays the result.

```java
// Method to search for a contact by name
private void searchContact() {
    String name = JOptionPane.showInputDialog("Enter Name to Search:");
    Contact contact = contacts.stream()
            .filter(c -> c.name.equalsIgnoreCase(name))
            .findFirst().orElse(null);

    if (contact != null) {
        displayArea.append("Contact found: " + contact + "\n");
    } else {
        displayArea.append("Contact not found.\n");
    }
}
```

Method to Delete a Contact by Name

```java
// Method to delete a contact by name
private void deleteContact() {
    String name = JOptionPane.showInputDialog("Enter Name to Delete:");
    boolean removed = contacts.removeIf(c -> c.name.equalsIgnoreCase(name));

    if (removed) {
        displayArea.append("Contact deleted: " + name + "\n");
    } else {
        displayArea.append("Contact not found.\n");
    }
}
```

Methodto Update an Existing Contact's Information

The `updateContact` method updates the information of an existing contact.

```java
    // Method to update an existing contact's information
    private void updateContact() {
        String name = JOptionPane.showInputDialog("Enter Name to Update:");
        Contact contact = contacts.stream()
                .filter(c -> c.name.equalsIgnoreCase(name))
                .findFirst().orElse(null);

        if (contact != null) {
            String newPhone = JOptionPane.showInputDialog("Enter New Phone Number:", contact.phoneNumber);
            String newAddress = JOptionPane.showInputDialog("Enter New Address:", contact.address);
            String newGender = (String) JOptionPane.showInputDialog(frame, "Select New Gender:", "Update Gender",
                    JOptionPane.QUESTION_MESSAGE, null, new String[]{"Male", "Female"}, contact.gender);
            String newEmail = JOptionPane.showInputDialog("Enter New Email:", contact.email);

            contact.phoneNumber = newPhone;
            contact.address = newAddress;
            contact.gender = newGender;
            contact.email = newEmail;
            displayArea.append("Contact updated: " + contact + "\n");
        } else {
            displayArea.append("Contact not found.\n");
        }
    }
```

Method to Display All Contacts

The `displayContacts` method displays all contacts in the list.

```java
    // Method to display all contacts
    private void displayContacts() {
        displayArea.setText(""); // Clear display area
        for (Contact contact : contacts) {
            displayArea.append(contact + "\n");
        }
    }
```

Method to Sort Contacts Alphabetically by Name

The `sortContacts` method sorts the contacts alphabetically by name.

```java
    // Method to sort contacts alphabetically by name
    private void sortContacts() {
        Collections.sort(contacts, Comparator.comparing(c -> c.name));
        displayArea.append("Contacts sorted.\n");
    }
```

Method to Clear Input Fields

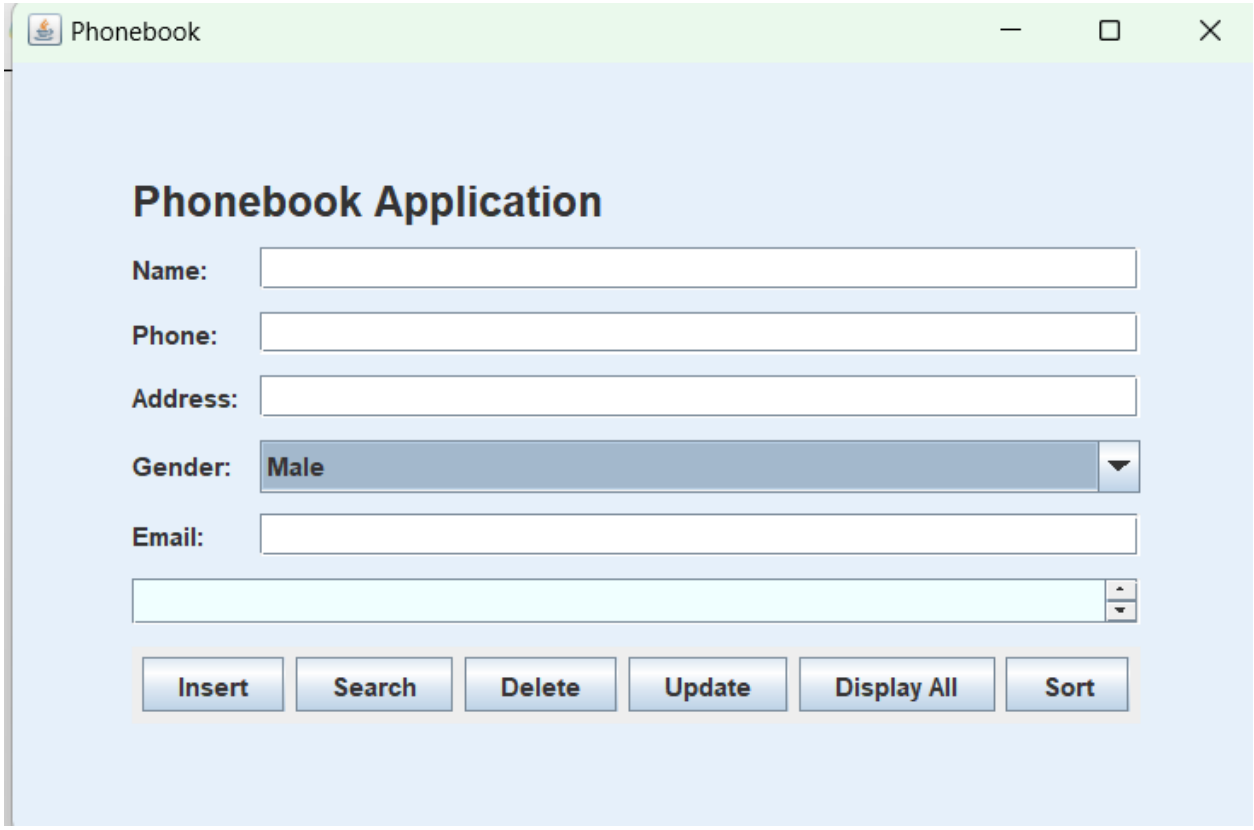
The `clearFields` method clears all the input fields in the form.

```java
    // Method to clear input fields
    private void clearFields() {
        nameField.setText("");
        phoneField.setText("");
        addressField.setText("");
        genderComboBox.setSelectedIndex(0); // Reset gender selection
        emailField.setText("");
    }
```

Main Method to Run the Application

The `main` method is the entry point of the application. It uses `SwingUtilities.invokeLater` to ensure that the GUI creation and updates are performed on the Event Dispatch Thread.

```
    // Main method to run the application
    public static void main(String[] args) {
        SwingUtilities.invokeLater(Phonebook::new);
    }
}
```



Application Title

The title of the application window is **"Phonebook Application"**.

Input Fields

The application contains several input fields for entering contact information:

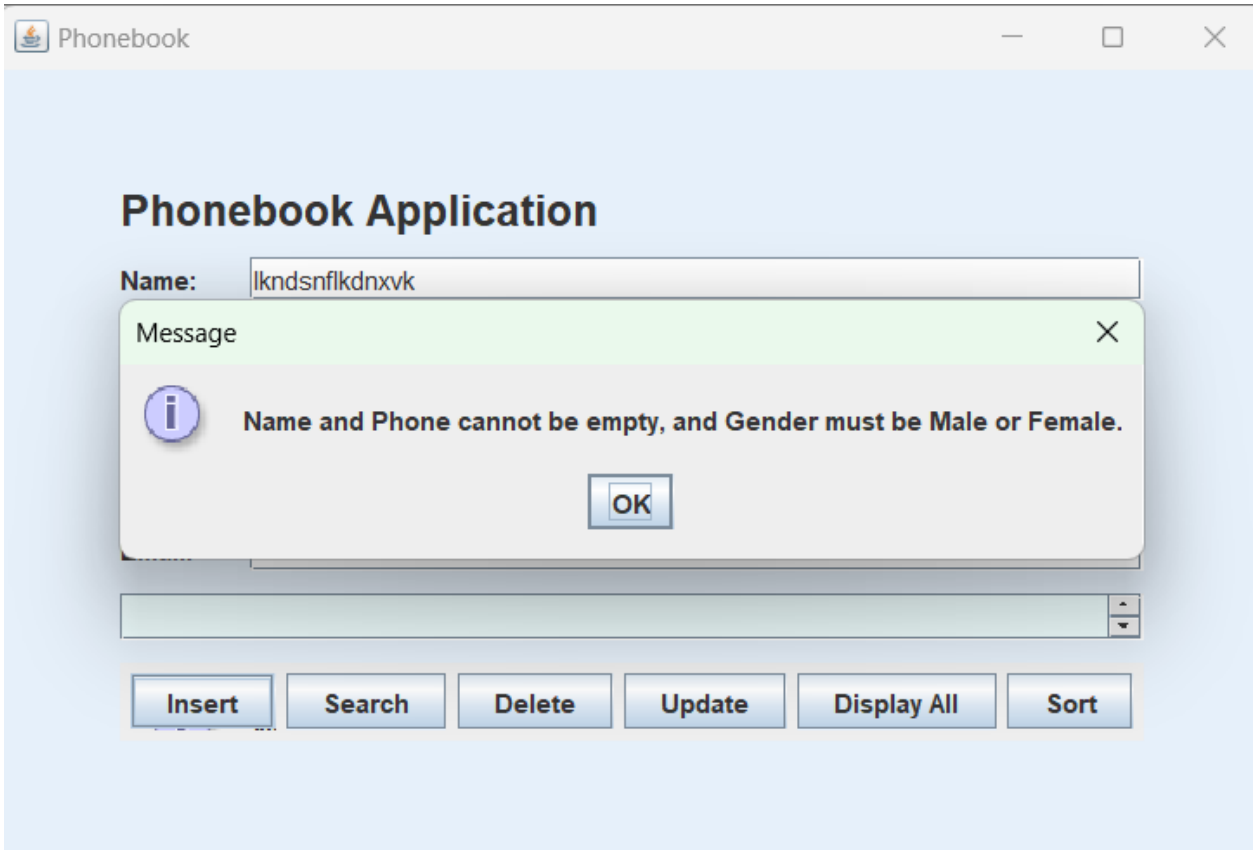
- **Name**: A text field for entering the contact's name.

- **Phone**: A text field for entering the contact's phone number.
- **Address**: A text field for entering the contact's address.
- **Gender**: A dropdown menu for selecting the contact's gender (e.g., Male, Female).
- **Email**: A text field for entering the contact's email address.

Buttons

The application includes several buttons for performing different actions:

- **Insert**: Adds a new contact to the phonebook.
- **Search**: Searches for a contact by name.
- **Delete**: Deletes a contact by name.
- **Update**: Updates the information of an existing contact.
- **Display All**: Displays all contacts in the phonebook.
- **Sort**: Sorts the contacts alphabetically by name.



Error Message

Application Title

The title of the application window is **"Phonebook Application"**.

Error Message Dialog

A dialog box titled **"Message"** appears within the application window. This dialog box contains an informational icon and the following text:

```
Name and Phone cannot be empty, and Gender must be Male or Female.
```

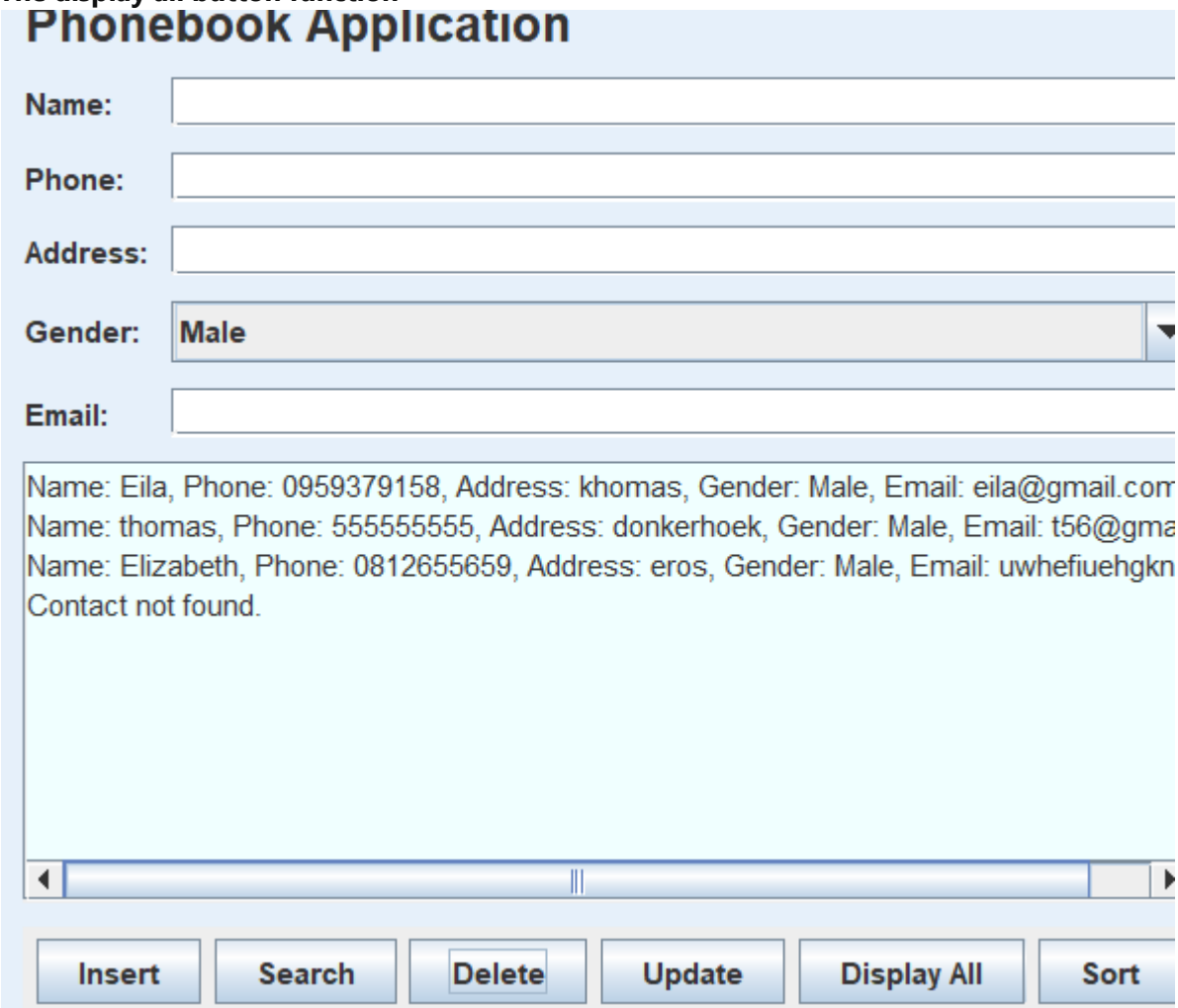
OK Button

Below the error message, there is an **"OK"** button that the user can click to close the dialog box.

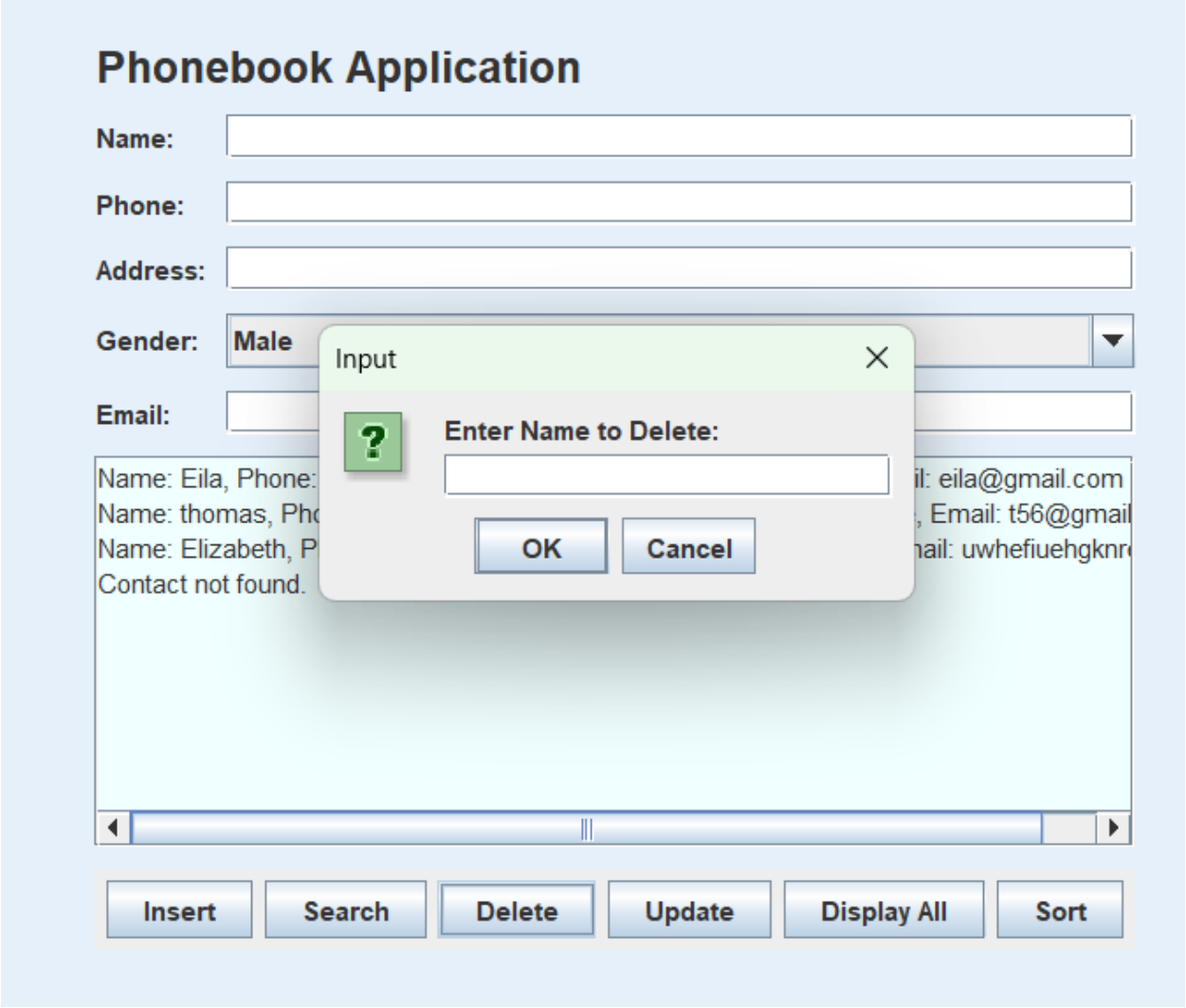
Context of the Error Message

This error message is likely triggered when the user attempts to insert a new contact without providing a name or phone number, or if the gender field is not set to either "Male" or "Female". This validation ensures that essential contact information is provided and that the gender field contains a valid value.

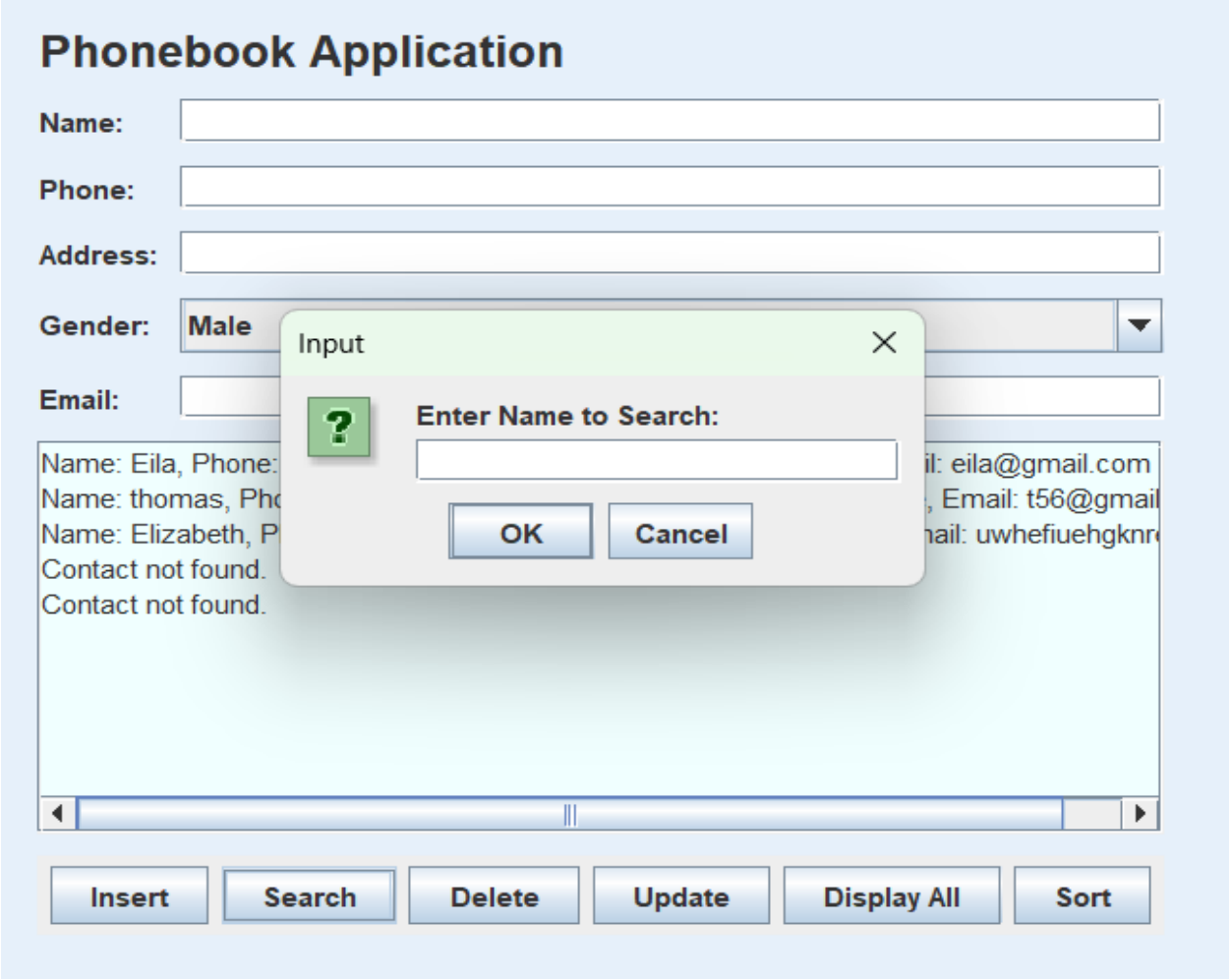
The display all button function



The delete button



The search button



The update button