Programming in Java – Solution of assignments 2

Paolo Vercesi
ESTECO SpA

Assignment

```
public interface Collection {

    boolean isEmpty();

    int getSize();

    boolean contains(String string);

    String[] getValues();
}

public interface Stack extends Collection {

    void push(String string);

    String pop();

    String top();
}
```

```
public interface List extends Collection {

    void add(String string);

    String get(int index);

    void insertAt(int index, String string);

    void remove(int index);

    int indexOf(String string);

}
```

Implement the Stack and List interfaces. Minimize code duplication.

Hint: consider the usage of both inheritance and composition.

Collection interface with default methods

```java
public interface Collection {

    String[] getValues();

    default boolean isEmpty() {
        return getSize() == 0;
    }

    default int getSize() {
        return getValues().length;
    }

    default boolean contains(String value) {
        for (String datum : getValues()) {
            if (Objects.equals(datum, value)) {
                return true;
            }
        }
        return false;
    }
}
```

The getValues() method exposes a lot of information. We can implement all the other “optional” methods from getValues().

List and Stack interfaces with default methods

```java
public interface List extends Collection {

    void add(String value);

    default String get(int index) {
        return getValues()[index];
    }

    void insert(int index, String value);

    void remove(int index);

    default int indexOf(String value) {
        for (int i = 0; i < getSize(); i++) {
            if (Objects.equals(get(i), value)) {
                return i;
            }
        }
        return -1;
    }
}
```

```java
public interface Stack extends Collection {

    void push(String value);

    String pop();

    default String top() {
        return getValues()[getSize() - 1];
    }

}
```

We are able to implement many methods as queries on other methods. The getValues() method provide access to the full state of the collection.

```java
public class MyList implements List {

    private String[] data = new String[0];

    public String[] getValues() {
        return Arrays.copyOf(data, data.length);
    }

    public void add(String value) {
        String[] newData = new String[data.length + 1];
        System.arraycopy(data, 0, newData, 0, data.length);
        newData[newData.length - 1] = value;
        this.data = newData;
    }

    public void insert(int index, String value) {
        String[] newData = new String[data.length + 1];
        System.arraycopy(data, 0, newData, 0, index);
        newData[index] = value;
        System.arraycopy(data, index, newData, index + 1, data.length - index);
        this.data = newData;
    }

    public void remove(int index) {
        String[] newData = new String[data.length - 1];
        System.arraycopy(data, 0, newData, 0, index);
        System.arraycopy(data, index, newData, index, data.length - index - 1);
        this.data = newData;
    }
}
```

MyList

MyStack

```java
public class MyStack implements Stack {

    private String[] data = new String[0];

    public String[] getValues() {
        return Arrays.copyOf(data, data.length);
    }

    public void push(String value) {
        String[] newData = new String[data.length + 1];
        System.arraycopy(data, 0, newData, 0, data.length);
        newData[newData.length - 1] = value;
        this.data = newData;
    }

    public String pop() {
        String value = top();
        String[] newData = new String[data.length - 1];
        System.arraycopy(data, 0, newData, 0, newData.length);
        this.data = newData;
        return value;
    }
}
```

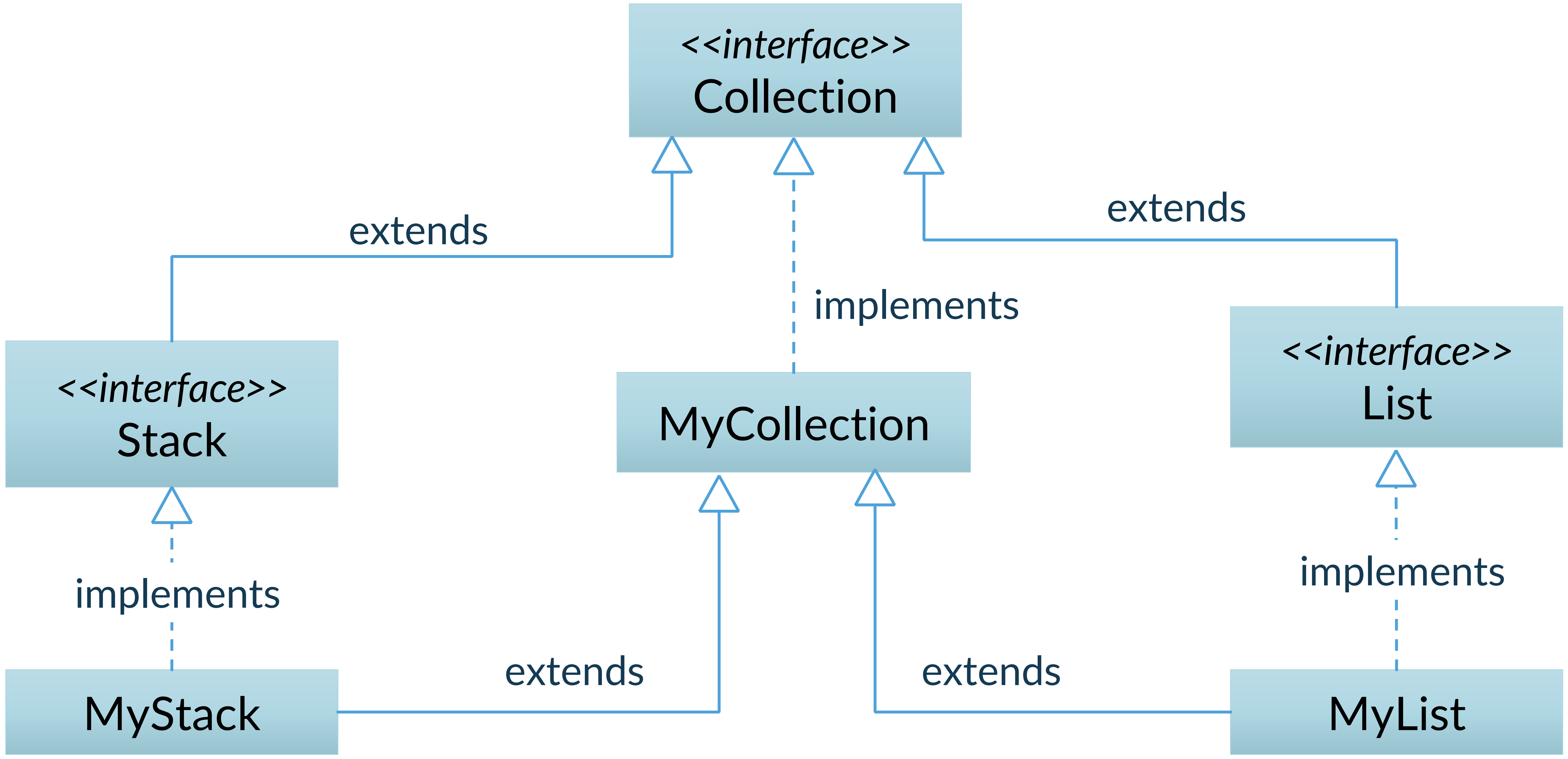
Comparison of MyList and MyStack

- Object state is represented in the same way
```
private String[] data = new String[0];
```

- Same implementation of
```
public String[] getValues()
```

- Same implementation of
```
public void push(String value)
public void add(String value)
```

Inheritance 1



Inheritance 1 - MyCollection

```java
class MyCollection implements Collection {

    private String[] data = new String[0];

    public String[] getValues() {
        return Arrays.copyOf(data, data.length);
    }

    public int getSize() {
        return data.length;
    }

    void add(String value) {
        String[] newData = new String[data.length + 1];
        System.arraycopy(data, 0, newData, 0, data.length);
        newData[newData.length - 1] = value;
        this.data = newData;
    }

    void remove(int index) {
        String[] newData = new String[data.length - 1];
        System.arraycopy(data, 0, newData, 0, index);
        System.arraycopy(data, index, newData, index, data.length - index - 1);
        this.data = newData;
    }

    void insert(int index, String value) {
        String[] newData = new String[data.length + 1];
        System.arraycopy(data, 0, newData, 0, index);
        newData[index] = value;
        System.arraycopy(data, index, newData, index + 1, data.length - index);
        this.data = newData;
    }
}
```

Methods that are not part of the Collection interface are package protected

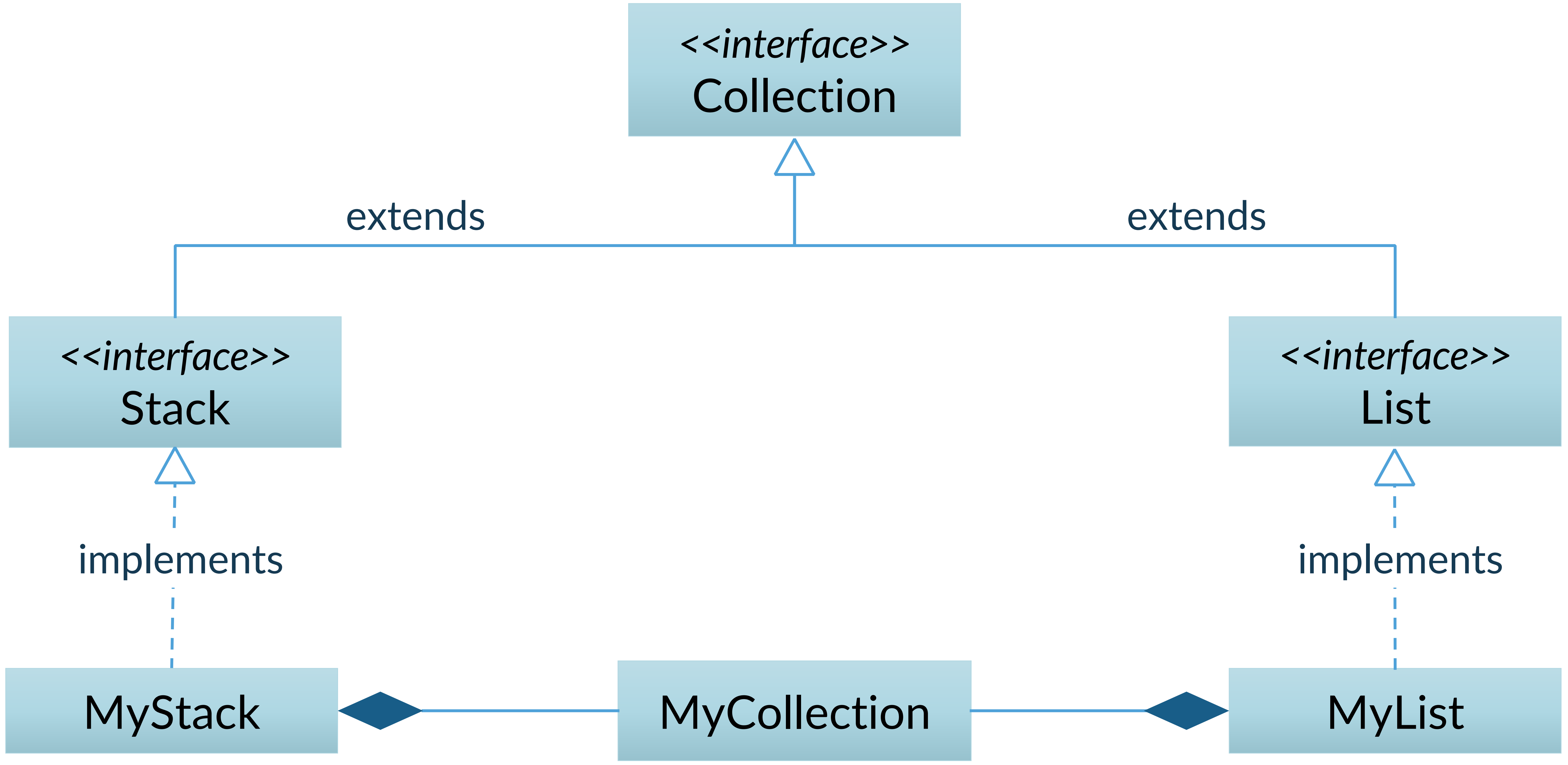
Inheritance 1 - MyStack

```
public class MyStack extends MyCollection implements Stack {

    @Override
    public void push(String value) {
        super.add(value);
    }

    @Override
    public String pop() {
        String value = top();
        remove(getSize()-1);
        return value;
    }

}
```

Inheritance 1 - MyList

```
public class MyList extends MyCollection implements List {

    @Override
    public void add(String value) {
        super.add(value);
    }

    @Override
    public void insert(int index, String value) {
        super.insert(index, value);
    }

    @Override
    public void remove(int index) {
        super.remove(index);
    }
}
```

Composition



Composition - MyCollection

```java
class MyCollection {

    private String[] data = new String[0];

    String[] getValues() {
        return Arrays.copyOf(data, data.length);
    }

    int getSize() {
        return data.length;
    }

    void add(String value) {
        String[] newData = new String[data.length + 1];
        System.arraycopy(data, 0, newData, 0, data.length);
        newData[newData.length - 1] = value;
        this.data = newData;
    }

    void remove(int index) {
        String[] newData = new String[data.length - 1];
        System.arraycopy(data, 0, newData, 0, index);
        System.arraycopy(data, index, newData, index, data.length - index - 1);
        this.data = newData;
    }

    void insert(int index, String value) {
        String[] newData = new String[data.length + 1];
        System.arraycopy(data, 0, newData, 0, index);
        newData[index] = value;
        System.arraycopy(data, index, newData, index + 1, data.length - index);
        this.data = newData;
    }
}
```

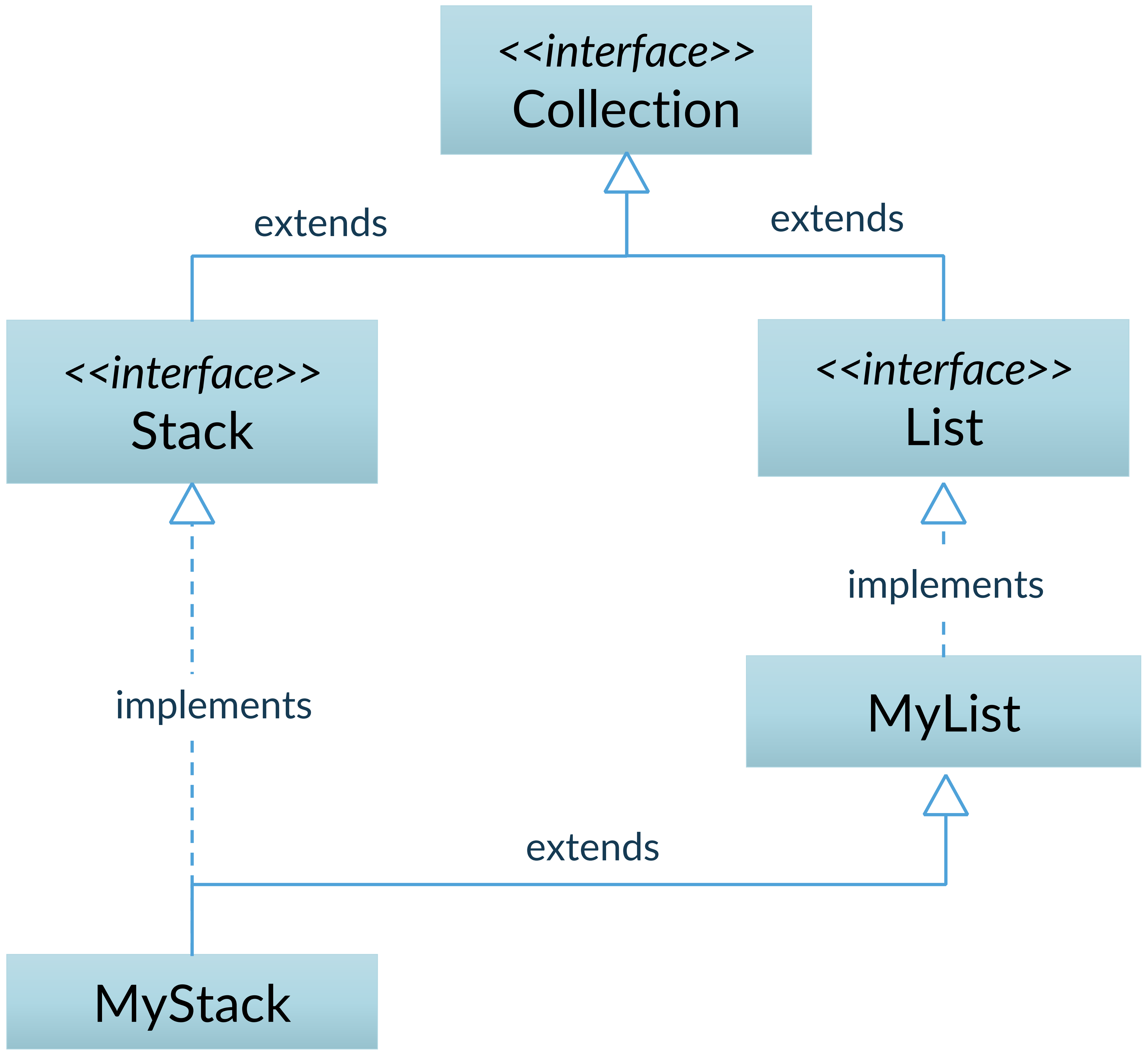
Composition - MyList

```java
public class MyList implements List {

    private final MyCollection collection = new MyCollection();

    @Override
    public String[] getValues() {
        return collection.getValues();
    }

    @Override
    public void add(String value) {
        collection.add(value);
    }

    @Override
    public void insert(int index, String value) {
        collection.insert(index, value);
    }

    @Override
    public void remove(int index) {
        collection.remove(index);
    }
}
```

Composition - MyStack

```java
public class MyStack implements Stack {

    private final MyCollection collection = new MyCollection();

    @Override
    public String[] getValues() {
        return collection.getValues();
    }

    @Override
    public void push(String value) {
        collection.add(value);
    }

    @Override
    public String pop() {
        String value = top();
        collection.remove(collection.getSize()-1);
        return value;
    }

}
```

Inheritance 2



ESTECO

Thank you!

esteco.com