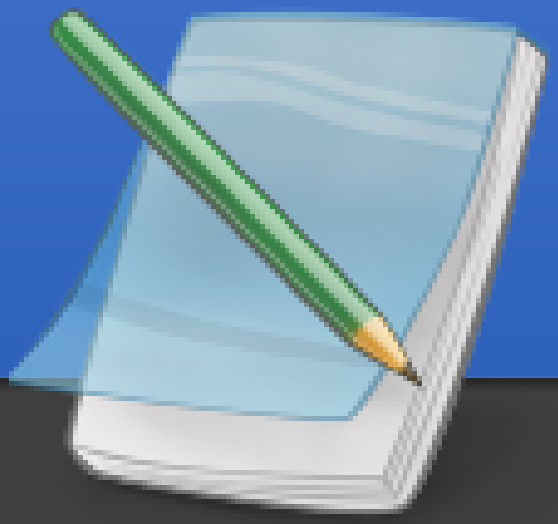
Lab 9
Java Exceptions

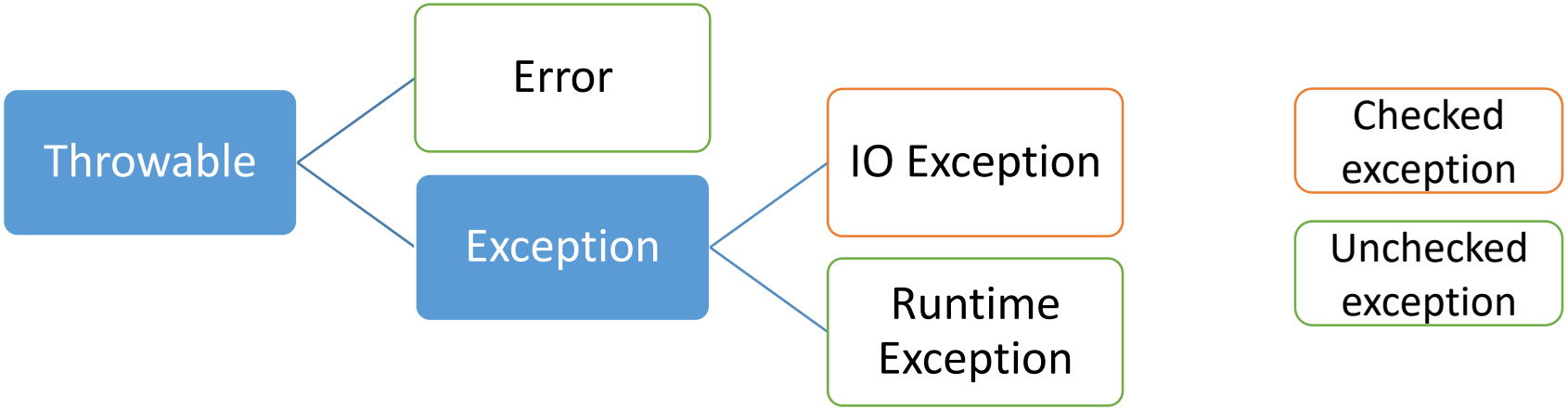
Goals

- In this lesson we will learn:
  - To use try, throw and catch to detect, indicate and handle exceptions, respectively.
  - To use the finally block to release resources.
  - How exceptions are arranged in an exception class hierarchy.
  - To declare new exception classes.

KEYNOTE



Exception Hierarchy



Some common built-in exception:

- **ArithmeticException** (e.g., divide by zero)
- **ClassCastException** (e.g., attempt to cast a String Object to Integer)
- **IndexOutOfBoundsException**
- **NullPointerException**
- **FileNotFoundException** (e.g., attempt to open a non-existent file for reading)

Catching Exceptions

- A **try/catch** block is placed around the code that might generate an exception
- A **finally** block of code that follows a **try** block, always executes, whether or not an exception has occurred.
- Example:

```
try {
   //Protected code
}catch(ExceptionType1 e1) {
   //Catch block
}catch(ExceptionType2 e2) {
   //Catch block
}catch(ExceptionType3 e3) {
   //Catch block
}finally {
   //The finally block always executes.
}
```

The throws/throw Keywords

- If a method does not handle a *checked exception*, the method must declare it using the **throws** keyword.
- You can **throw** an exception, either a newly instantiated one or an exception that you just caught, by using the **throw** keyword
- Example:

```
import java.io.*;
public class className
{
   public void deposit(double amount) throws RemoteException
   {
      // Method implementation
      throw new RemoteException();
   }
   //Remainder of class definition
}
```

Declaring you own Exception

- Keep the following points in mind when writing your own exception classes:
  - All exceptions must be a child of **Throwable**.
  - If you want to write a checked exception, extend the **Exception** class.
  - If you want to write a runtime exception, extend the **RuntimeException** class.

```
public class MyException extends Exception
{
   private double field1;
   public MyException (double input)
   {
      this.field1 = input;
   }
   public double getField1 ()
   {
      return field1;
   }
}
```

Exceptions Methods

Method	Description
String getMessage()	Returns a detailed message about the exception that has occurred. This message is initialized in the Throwable constructor.
synchronized Throwable getCause()	Returns the cause of the exception as represented by a Throwable object.
String toString()	Returns the name of the class concatenated with the result of getMessage()
void printStackTrace()	Prints the result of toString() along with the stack trace to System.err, the error output stream.

When to throw an exception

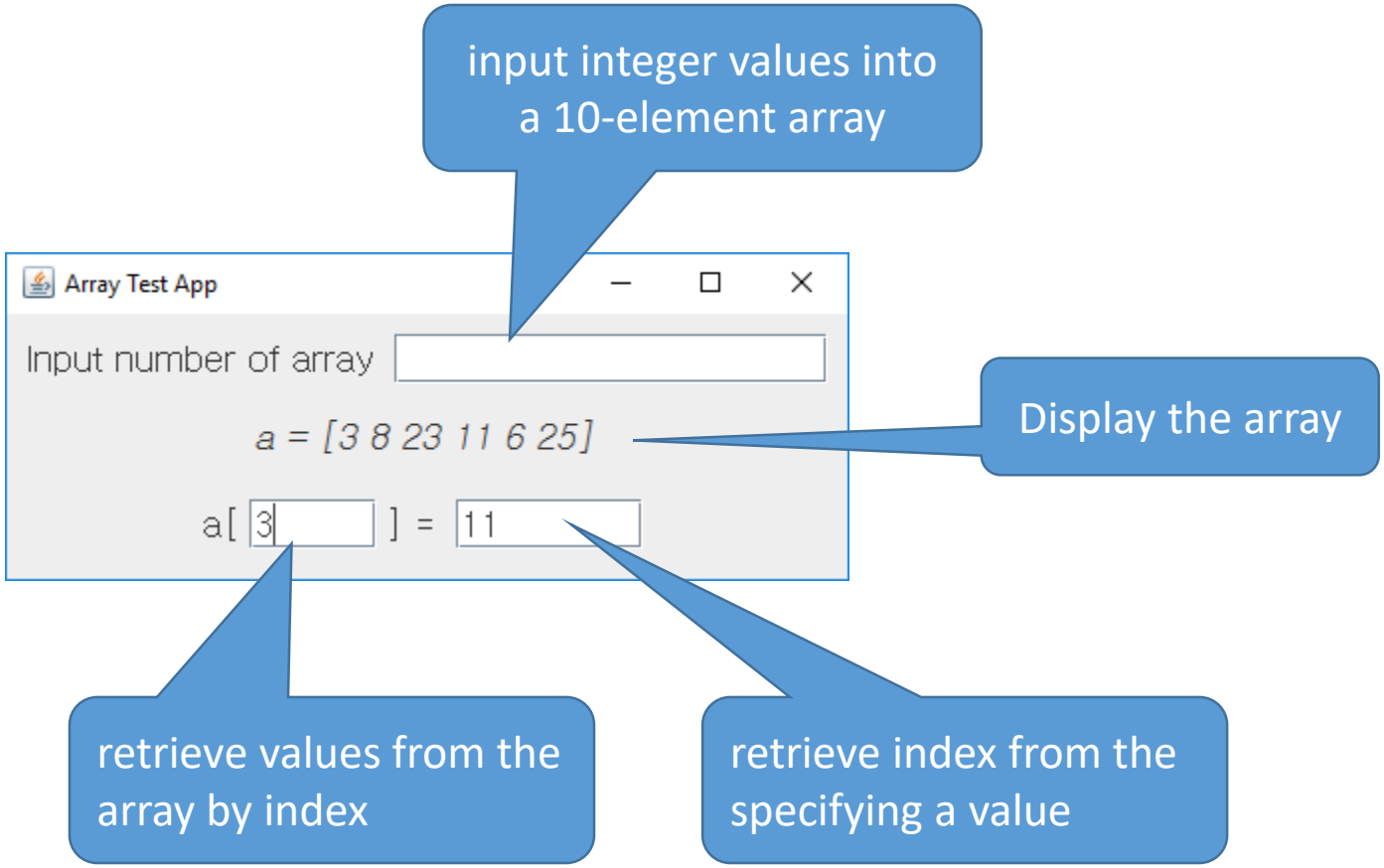
- “An exception is thrown when a fundamental assumption of the current code block is found to be false.”
- “The other side of this equation is: if you find your functions throwing exceptions frequently, then you probably need to refine their assumptions.”

http://stackoverflow.com/questions/77127/when-to-throw-an-exception

PRACTICE

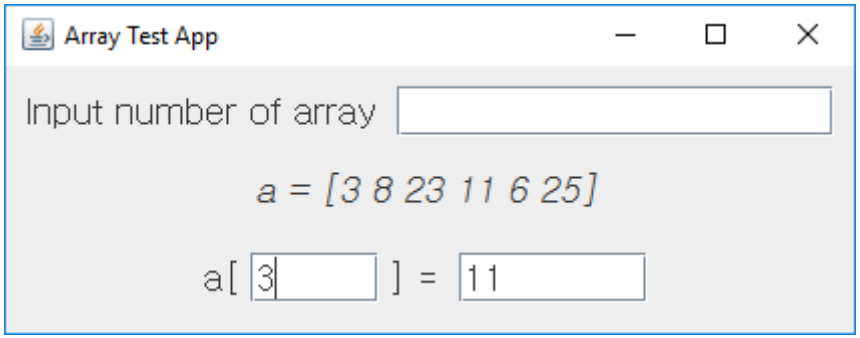
Practice makes perfect

1. Problem

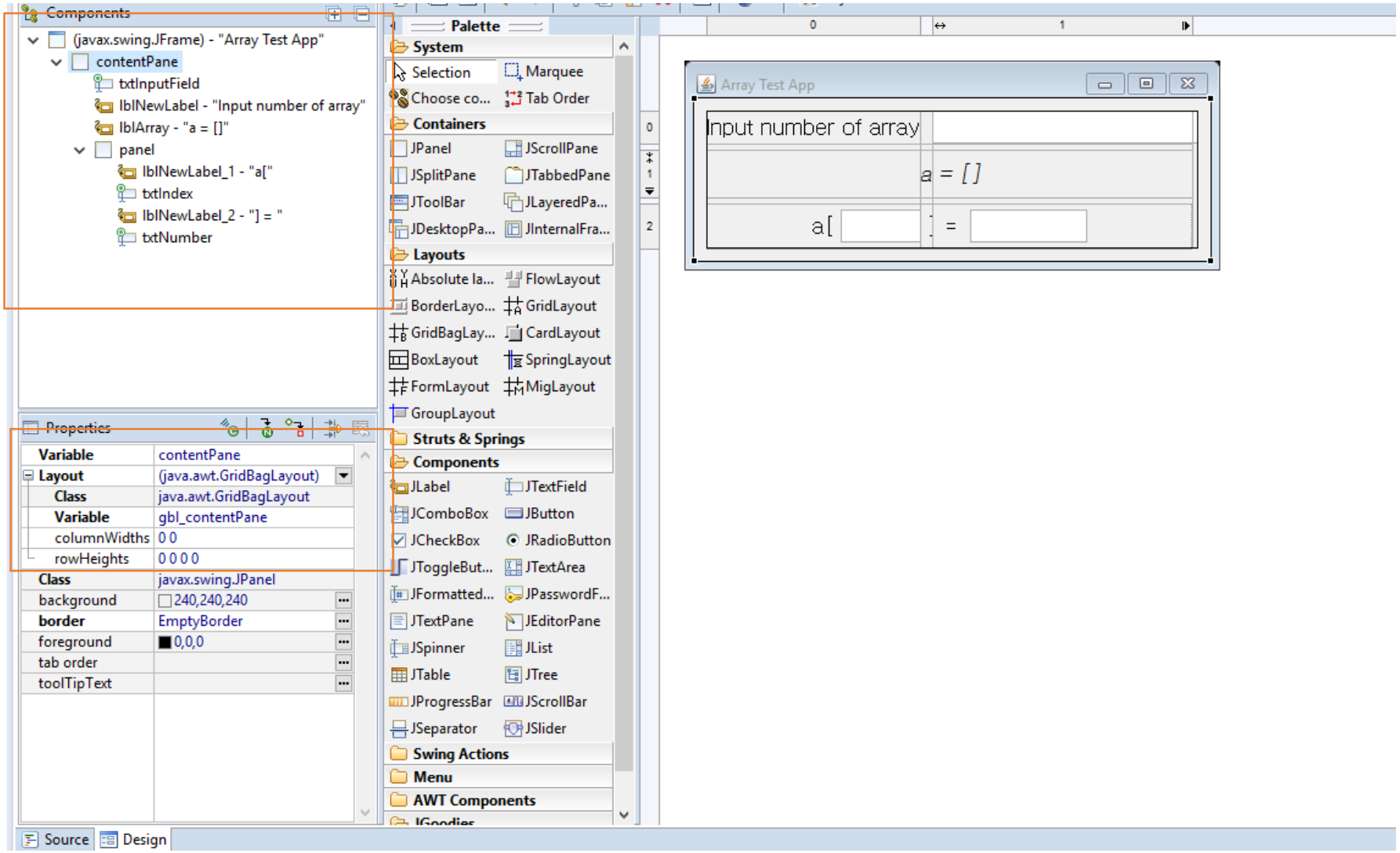

input integer values into a 10-element array
Array Test App
Input number of array
a = [3 8 23 11 6 25]
a[3] = 11
Display the array
retrieve values from the array by index
retrieve index from the specifying a value

2. Design - MVC pattern

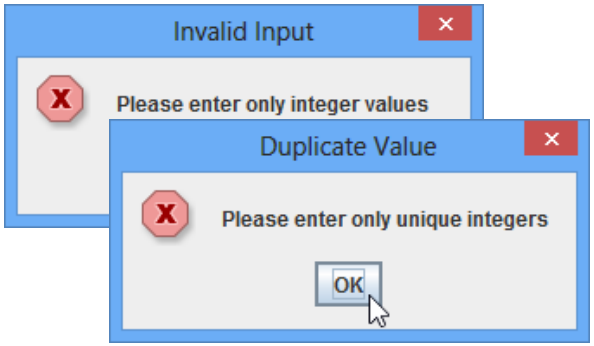
- Model:
  - int index = 0;
  - int array[] = new int[10];
- View:
  - JLabel lblArray and other 3 labels
- Controller:
  - JTextField txtInputField;
  - JTextField txtNumber;
  - JTextField txtIndex;



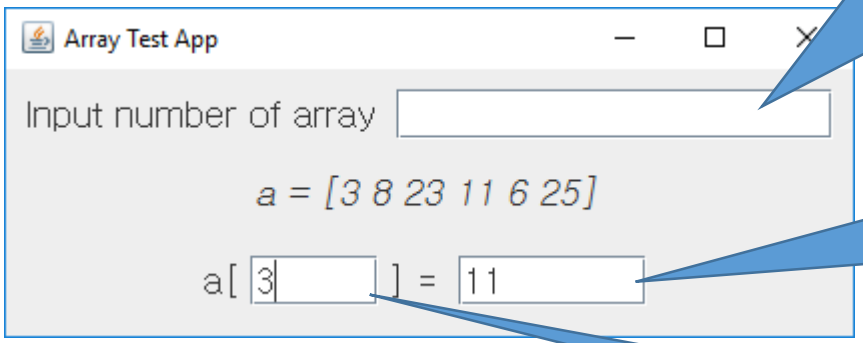
3. Implements
Create the components



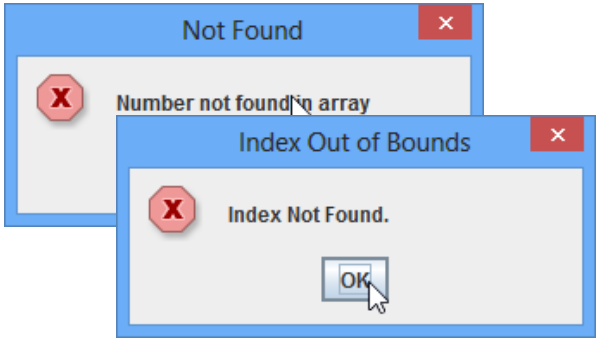
3. Implements
Define the exceptions



Write catch handlers that catch:
- NumberFormatException
- ArrayIndexOutOfBoundsException
- DuplicateValueException (user define)



Write catch handlers that catch:
- NumberFormatException
- NumberNotFoundException(user define)



Write catch handlers that catch:
- NumberFormatException
- ArrayIndexOutOfBoundsException

3. Implements
Add action listener for txtInput

- Create try block and catch the exception

```
txtInputField.addActionListener(new ActionListener() {
   public void actionPerformed(ActionEvent e) {
       /*
        * Create a try block in which the application reads the number
        * entered in the txtInputField and assigns it to the array.
        */

       /* Write catch handlers that catch 3 types of exceptions that
        * the previous try block might throw (NumberFormatException,
        * ArrayIndexOutOfBoundsException and DuplicateValueException)
        * and display appropriate messages in error message dialogs
        * using JOptionPane.showMessageDialog() method
        */
   }
});
```

3. Implements
Add action listener for txtNumber

- Create try block and catch the exception

```
txtNumber.addActionListener(new ActionListener() {
   public void actionPerformed(ActionEvent e) {
       /*
        * Create a try block to reads from txtNumber
        * the number the user wants to find in the array,
        * then searches the current array contents for the number.
        * If the number is found, the outputField should display
        * all the indices in which the number was found.
        * If the number is not found, a NumberNotFoundException
        * should be thrown.
        */

       /*
        * Write catch handlers that catch the two types
        * of exceptions that the try block might throw
        * (NumberFormatException and NumberNotFoundException),
        * and display appropriate messages in error
        * message dialogs.
        */
   }
});
```

3. Implements
Add action listener for txtIndex

- Create try block and catch the exception

```
txtIndex.addActionListener(new ActionListener() {
   public void actionPerformed(ActionEvent e) {
       /*
        * Create a try block to reads from txtIndex the index of the array,
        * then displays the value at that index in the txtNumber.
        * If the index input by the user is not a number a
        * NumberFormatException should be thrown.
        * If the number input by the user is outside the array
        * bounds or represents an element in which the application has
        * not stored a value, an ArrayIndexOutOfBoundsException should
        * be thrown.
        */

       /*
        * Write catch handlers that catch the two types of exceptions
        * the try block might throw (NumberFormatException and
        * ArrayIndexOutOfBoundsException), and display appropriate
        * messages in error message dialogs.
        */
   }
});
```

QUIZ

Find the 4 errors in this code

```
1. import java.io.IOException;
2. public class SpecialIOException throws IOException {
3.   public SpecialIOException() {
4.       super("Special IO Exception Occurred");
5.     }
6.     public SpecialIOException(String message) {
7.       this(message);
8.     }
9. } // end class SpecialIOException

10. public class DebugException {
11.  public static void main(String args[]) {
12.      try {
13.          throw new SpecialIOException();
14.      } catch (Exception exception) {
15.          System.err.println(exception.toString());
16.      } catch (IOException ioException) {
17.          System.err.println(ioException.toString());
18.      } catch (SpecialIOException specialIOException) {
19.          specialIOException.toString();
20.      }
21.  }
22. } // end class DebugException
```