Java, Swing, and Eclipse: The Calculator Lab.

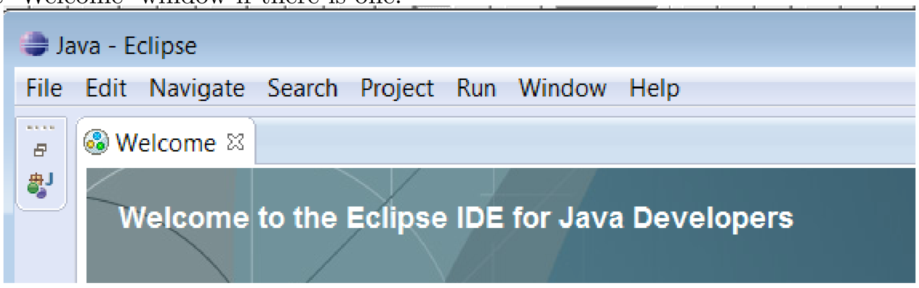
ENGI 5895. Winter 2014

January 13, 2014

1 A very simple application

(Some images were prepared with an earlier version of Eclipse and may not look exactly as they would with the version you are using.)

1. Start Eclipse
   - If you get a 'workspace not available message,' click OK
   - Set the workspace to somewhere on the H: drive. (Or if you are using your own computer, wherever you like.)
   - Note the workspace directory – you will need to find it later.
   - Click Ok.
   - Close the 'Welcome' window if there is one.

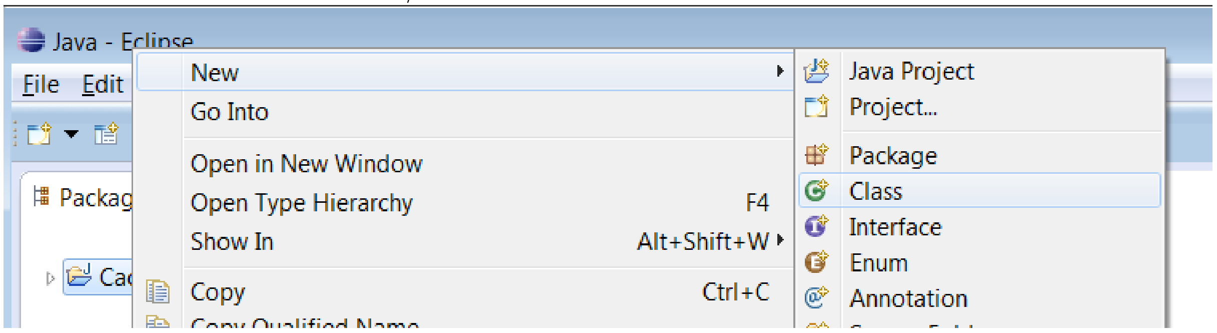

Java - Eclipse
File Edit Navigate Search Project Run Window Help
Welcome
Welcome to the Eclipse IDE for Java Developers

2. Create a new project (see Fig 1)
   - On the Menu select "File / New / Project ...".
   - Select "Java Project" and click "Next".
   - Set "Project Name" to "Calculator"
   - Set the execution environement to JavaSE-1.7.
   - Select "Create separate folders for source and class files"
   - Click Finish.
   - (If you get a message to the effect that EGit can't be found, just click OK. If there is a further complaint, click OK again.

- In the “Package Explorer” view (on the left of the window) you should see your project.”

3. Create a class (see Fig 2)

   - Right-click on the Calculator project in the Package Explorer
   - On the context menu select “New / Class”.



   - Set ‘Source folder’ to Calculator/src
   - Set the ‘Package’ to calculator.
   - Set the ‘Name’ to View
   - Set Modifiers to public
   - Set Superclass to javax.swing.JFrame (Click Browse and then type the full class name.)
   - Check checkboxes ‘public static void main(String [] args) and ‘Generate comments’
   - Click on Finish.

4. Edit the import declaration to be

```
import javax.swing.*;
import java.awt.*;
```

5. Add a 0-parameter private constructor for View:

   - In the constructor for View call setSize(300,300), setVisible(true) and setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE)
   - Your constructor should look like this

```
private View() {
    setSize(300,300) ;
    setVisible( true ) ;
    setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE) ;
}
```

6. main is a bit complicated (and strange). It should look like this:

```
public static void main(String[] args) {
        SwingUtilities.invokeLater( new Runnable() {
            public void run() {
                new View() ;
            }} ) ;
    }
```

7. Run the program (see Fig 3)
   - Save the file with control-s (on Macs: command-s)
   - Check that there are no errors. (Errors will be indicated by red Xs in the Package Explorer.)
   - In the Package Explorer, right click on the file `View.java`.
   - On the popup context menu, select 'Run As / Java Application'
   - You should see the frame and should be able to close it.

2 Adding a Model

1. Obtain the `Model.java` file and the `Op.java` file from the course's website and save them both to the `Calculator/src/calculator` directory with the workspace directory.
2. In the Package Explorer, right click on the Calculator project and select Refresh. The two new files should appear in the Package Explorer.
3. Open the Model class in the editor. Identify its public methods.
4. Open Eclipse's Outline view by selecting on the menu Window / Show View / Outline. The public methods are indicated in the Outline view by green circles.
5. To the View class add an initialized private field

```
private final Model model = new Model();
```

3 Adding some components

In the constructor for View:

1. Set the layout manager for the View by adding

   ```
   setLayout(new FlowLayout() );
   ```

   as the first line of the constructor.
2. Add (after the call to setLayout) code to add 10 buttons to the View, labeled 0 to 9. I added each button with code

   ```
   JButton digitButton = new JButton( Integer.toString(i) ) ;
   add( digitButton ) ;
   ```

3. Also add a button labeled "+", a button labelled "Clear", and a button labelled "=".
4. Declare a private final field of type JLabel. Call it valueLabel. Initialize this field by creating a new JLabel.
5. In the constructor add the value label to the frame.
6. Create a new method in View

   ```
   void refresh() {
       valueLabel.setText( model.getResult() ) ; }
   ```

7. Add a call to refresh as the final command in View's constructor.
8. Try running your application. See Fig. 4

4 Closing the loop

Create a class DigitListener that implements the interface java.awt.event.ActionListener. Each DigitListener should know a View and a Model. (I.e. it should have pointers to a View and to a Model as its fields.) The constructor of DigitListener should record a pointer to a View, a pointer to a Model, and an int. Since DigitListener implements ActionListener, it must have a subroutine with signature

```
@Override public void actionPerformed( ActionEvent e )
```

This subroutine should update the model by calling digit and then refresh the view. (Note that although the parameter is not used, it must still be declared.)

Back in View's constructor you need to create instances of DigitListener and associate them with the appropriate listener like this.

```
JButton digitButton = new JButton( Integer.toString(i) ) ;
digitButton.addActionListener( new DigitListener( this, model, i ) ) ;
add( digitButton ) ;
```

Try your application now. Click on the digit buttons. You should see the effect in the operand label.

Notice how the Swing framework is calling your code even though the dependence goes the other way. This is an example of "inversion of dependence".

Create a class OperationListener similar to DigitListener, but that calls method operation rather than digit in the model. Note that the operation method of class Model takes a parameter of the enumeration class Op. The Op class defines a number of constants of type Op. To refer to these, you simply write Op.ADD or Op.CLEAR etc.

Associate an OperationListener with the "+" button, the Clear button, and the "="

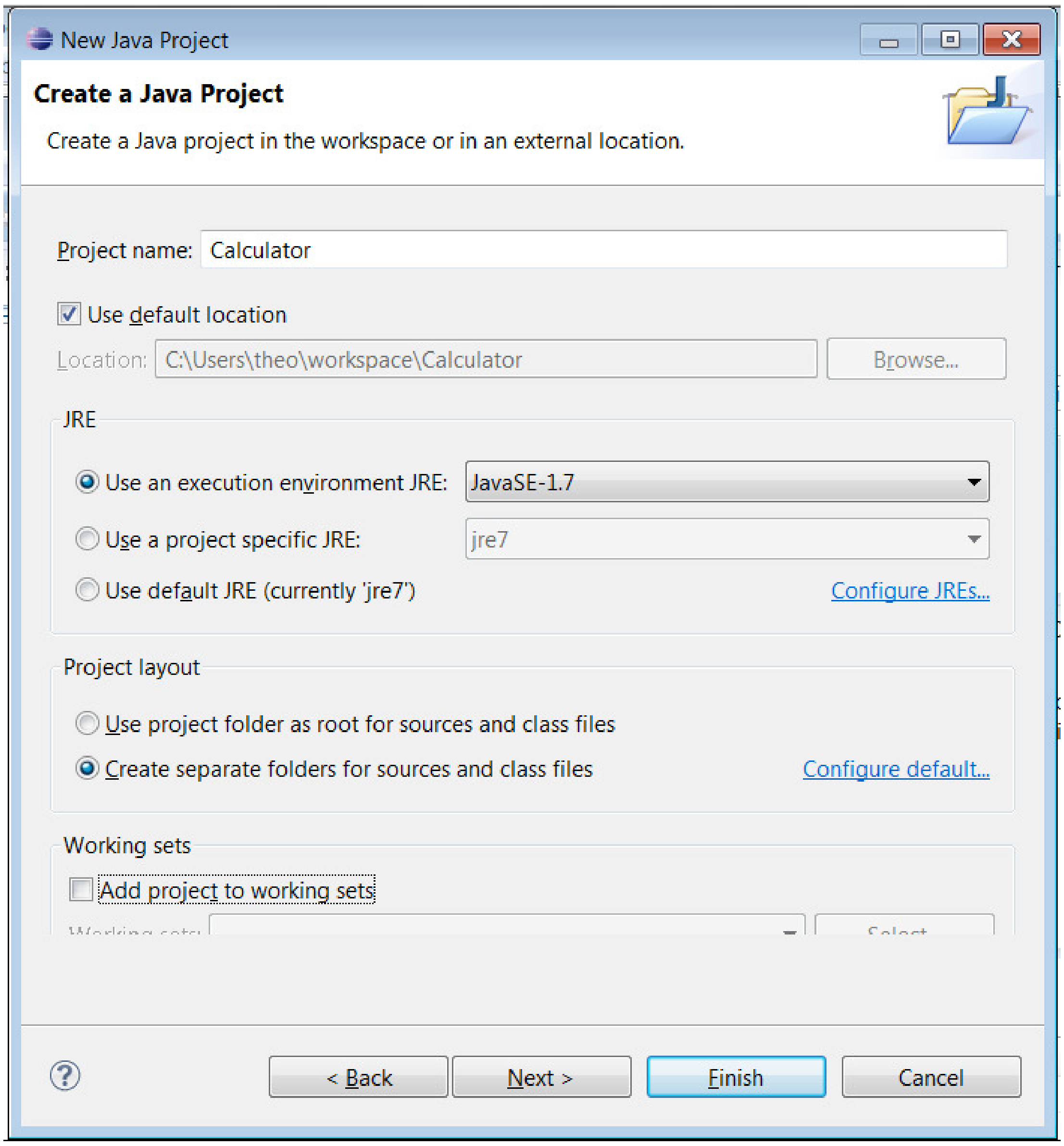
Figure 5 shows your application at this point as a UML class diagram.

Try your application now.

5 More to try

Try adding one button for each operation. Try changing the style of the buttons. Try adding more operations to the model. See if you can add buttons to change the precision or the base. If you prefer RPN, create an RPN calculator. Make the calculator programmable.

Obviously there is much more to learn about layout of components within containers. Try using GridLayout or GridBagLayout and also using JPanels and borders.



New Java Project

Create a Java Project

Create a Java project in the workspace or in an external location.

Project name: Calculator

[✓] Use default location

Location: C:\Users\theo\workspace\Calculator

JRE

[●] Use an execution environment JRE: JavaSE-1.7

[○] Use a project specific JRE: jre7

[○] Use default JRE (currently 'jre7')

Project layout

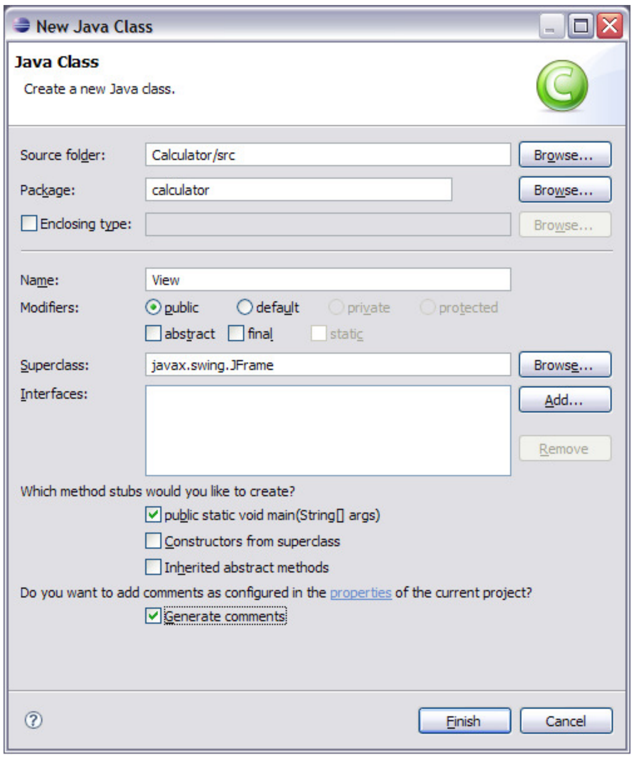
[○] Use project folder as root for sources and class files

[●] Create separate folders for sources and class files

Working sets

[ ] Add project to working sets

Figure 1:



Source folder: Calculator/src

Package: calculator

☐ Enclosing type:

Name: View

Modifiers: [✓ public] default private protected

☐ abstract ☐ final ☐ static

Superclass: javax.swing.JFrame

Interfaces:

Which method stubs would you like to create?

☑ public static void main(String[] args)

☐ Constructors from superclass

☐ Inherited abstract methods

Do you want to add comments as configured in the properties of the current project?

☑ Generate comments

Figure 2:

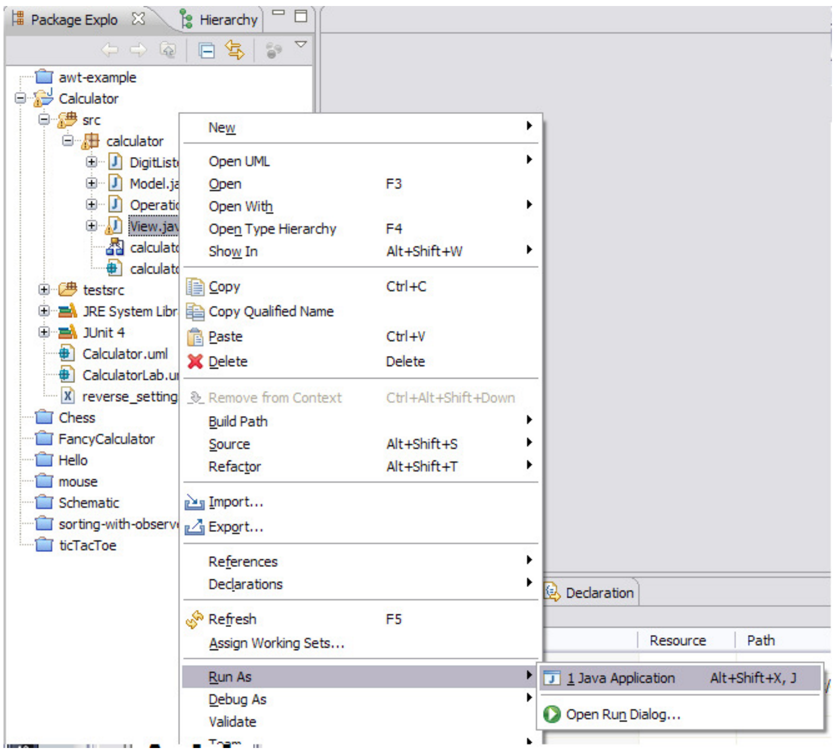


Figure 3:

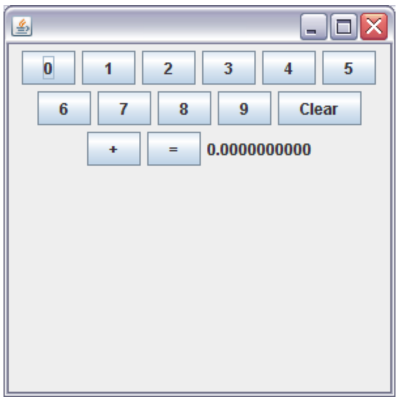


Figure 4:

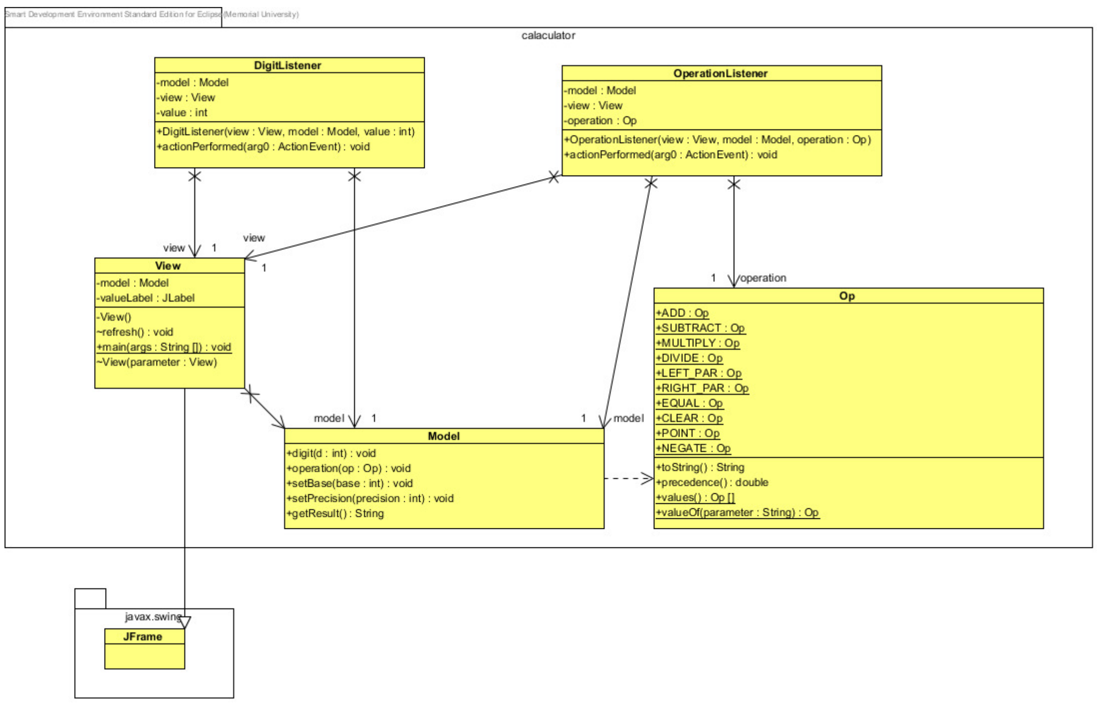

Smart Development Environment Standard Edition for Eclipse (Memorial University)
calaculator
DigitListener
-model : Model
-view : View
-value : int
+DigitListener(view : View, model : Model, value : int)
+actionPerformed(arg0 : ActionEvent) : void
OperationListener
-model : Model
-view : View
-operation : Op
+OperationListener(view : View, model : Model, operation : Op)
+actionPerformed(arg0 : ActionEvent) : void
View
-model : Model
-valueLabel : JLabel
-View()
~refresh() : void
+main(args : String []) : void
~View(parameter : View)
Model
+digit(d : int) : void
+operation(op : Op) : void
+setBase(base : int) : void
+setPrecision(precision : int) : void
+getResult() : String
Op
+ADD : Op
+SUBTRACT : Op
+MULTIPLY : Op
+DIVIDE : Op
+LEFT_PAR : Op
+RIGHT_PAR : Op
+EQUAL : Op
+CLEAR : Op
+POINT : Op
+NEGATE : Op
+toString() : String
+precedence() : double
+values() : Op []
+valueOf(parameter : String) : Op
view
1
view
1
model
1
1
model
1
operation
javax.swing
JFrame

Figure 5: