CarRecall specification examaple

This example shows how Mango exposes cases splits to the user, if desired. Once generated, the specification may be navigated by opening folders in the Mango Explorer and following links in the revealed specification views.

Start by loading the FirstYearCode project.

On MacOSX, go to Eclipse>Preferences>"Mango Preferences". For other operating systems: Window>Preferences>"Mango Preferences".

Hit "Restore Defaults", in particular, "Suppress advice dialogs" and "Do not pause (Mango will make default choices)" should be unchecked.

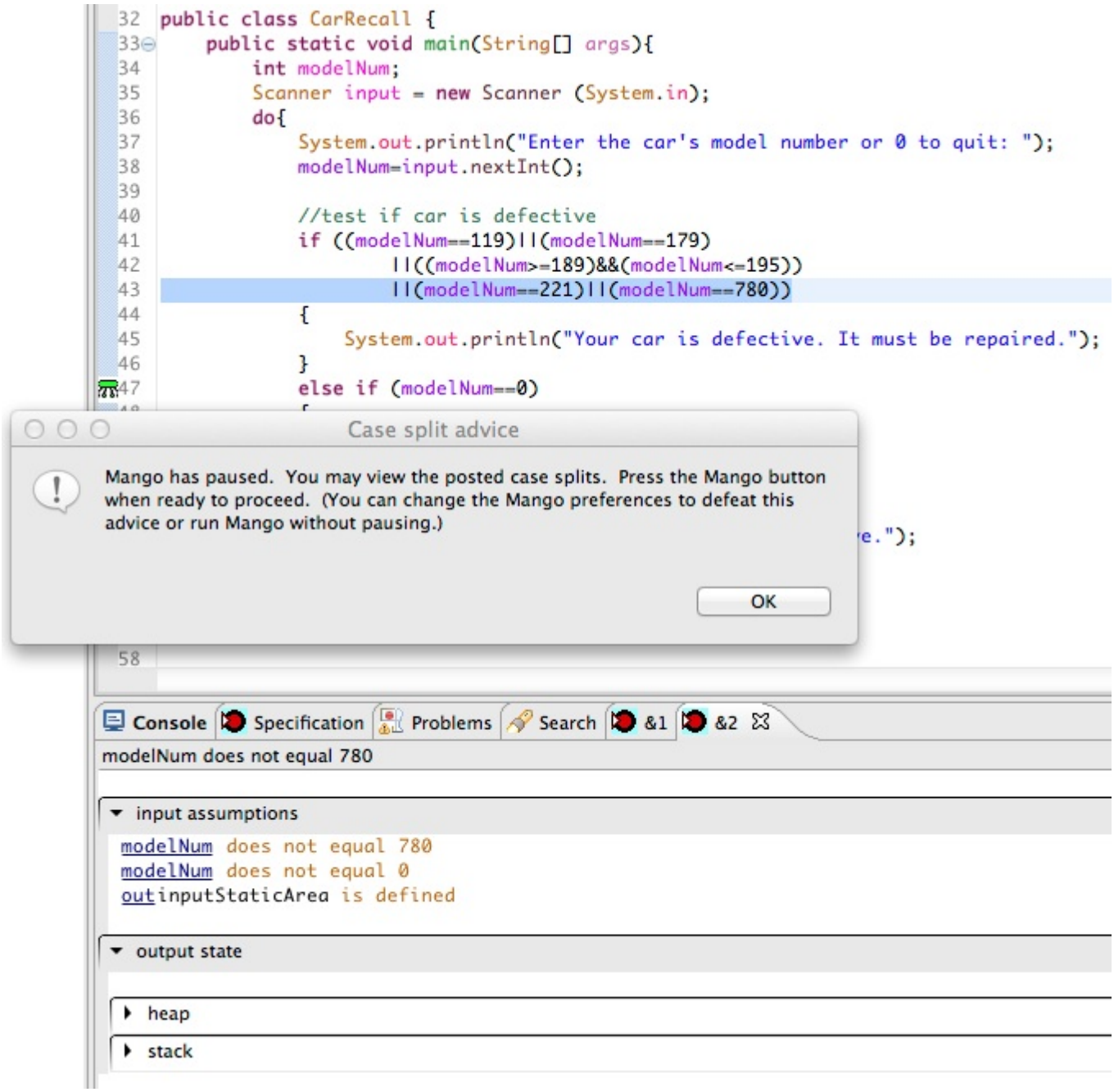
Hit OK to close the preferences.

In the Package Explorer, in the FirstYearCode project, open src/firstYearCode/CarRecall.java.

In the CarRecall editor, double-click on "CarRecall" in the class declaration line "public class CarRecall {". This will select both CarRecall and the CarRecall editor tab.

Right-click, Mango>populate. When the box in the Mango Explorer view becomes green, right-click, Mango>run.

At the first case split, Mango will notify the user of a pause. (see figure)



Click OK, the Mango Explorer box will turn green. After a while it is easier just to when the box changes color and not bother with the notification. Check "Suppress advice dialogs" to defeat notification in the future, if desired.

The line of source code corresponding to the case split has been highlighted. Observe the two cases, named &1 and &2, by clicking on their tabs. Each specification view is a functional description, and as such has two parts, "input assumptions" and "output state". For the "modelNum equals 780" case, the heap may be opened to reveal that "Your car is defective" has been appended to the "out" buffer. (see figure).

```
40              //test if car is defective
41              if ((modelNum==119)||(modelNum==179)
42                      ||((modelNum>=189)&&(modelNum<=195))
43                      ||(modelNum==221)||(modelNum==780))
44              {
45                  System.out.println("Your car is defective. It must be repaired.");
46              }
47              else if (modelNum==0)
48              {
49                  System.out.println ("Program terminated.");
50              }
51              else
52              {
53                  System.out.println ("Your car is not defective.");
54              }
55          }while (modelNum!=0);
56      }
57  }
58
```

Problems | Specification | Console | &1 | &2

modelNum equals 780

input assumptions

```
modelNum equals 780
outinputStaticArea is defined
```

output state

heap

<localVar> at unresolved location

```
outinputStaticArea.buffer=outinputStaticArea.buffer + Your car is defective. It must be
repaired.<nl>
```

stack

Likewise, in the case "modelNum does not equal 780", the heap contains "Your car is not defective". So far so good, but what happened to the case modelNum==0, yielding "Program terminated". The short answer is that Mango hasn't forgotten about it, but isn't ready to consider it either. More specifically, Mango currently is building the specification for the loop body. The case modeNum==0 is a loop termination condition which does not yield a state transition for the loop body, so it is not relevant at the moment.

Spend some time assimilating the correspondence between procedural programming, the java code, and functional programming, the specification views. When you are ready, hit the green button so that Mango can proceed to the next case (see figure).

```
            modelNum=input.nextInt();

            //test if car is defective
            if ((modelNum==119)||(modelNum==179)
                    ||((modelNum>=189)&&(modelNum<=195))
                    ||(modelNum==221)||(modelNum==780))
            {
                System.out.println("Your car is defective. It must be repaired.");
            }
            else if (modelNum==0)
            {
                System.out.println ("Program terminated.");
            }
            else
            {
                System.out.println ("Your car is not defective.");
            }
        }while (modelNum!=0);
    }
}
```

Problems | Specification | Console | firstYearCode.CarRecall.main([Ljava/lang/String;)V.loop | &1 | &2

modelNum does not equal 221

input assumptions

modelNum does not equal 221
Does modelNum equal 780?

output state

heap

<localVar> at unresolved location

outinputStaticArea.buffer=outinputStaticArea.buffer + var1

stack

Observe that if modelNum does not equal 221, then execution drops through to the case Mango has already analyzed. This is because when we read code, we proceed top down in execution order. But the Mango functional analysis is always bottom up in the reverse of execution order. Put more simply, Mango starts at the end and works backwards through the case-splits. Notice the input assumptions "Does modelNum equal 780?". The technical interpretation of this assumption goes like this: "This case satisfies all input assumptions for the nested case "Does modelNum equal 780". The reason for this shorthand notation is pragmatic. To explicitly say what those assumptions are quickly leads to exponential growth in the size of the specification. Trust me on this, I have been there. Fortunately, there is a simpler, more useful interpretation: "The output state for this case will have variables in it referencing the nested case "Does modelNum equal 780?".

Indeed, observe that the heap has such a variable, "var1". Go ahead and click on it now.