Using a Design Recipe with Java

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The nature of computer science

- Computers are fast and stupid
- Metaphors clarify the data flow in the machine
- Little Green Men do our bidding!
- “The shape of the data should define the shape of the problem.” - Michael Hunt Episcopal HS
- Comp Sci is creative writing meets engineering

Why a design recipe?

- Makes the programmers thinking “visible”
- The recipe gives the student a structure to follow
- Lessens the dependance on syntax
- The examples show understanding of the problem and the solution
- Tests clarify the solutions matches the problem

Design Recipe

- Programming problems ARE math “word problems”
- Math skills are essential for comp sci
- Creativity is essential for comp sci
- Why not use a systematic approach?

What's a design recipe?

- Problem Analysis & Data Definition
- Contract, Purpose & Effect Statements, Header
- Examples
- Function Template
- Function Definition
- Tests

From HtDP to AP/IB

- This is not a new idea! :)
- Borrowed from the “How to Design Programs” curriculum (formerly at Rice U.)
- All about applying math skills to solve problems
- In HtDP the language of choice is Scheme
- In AP & IB comp sci the language is Java

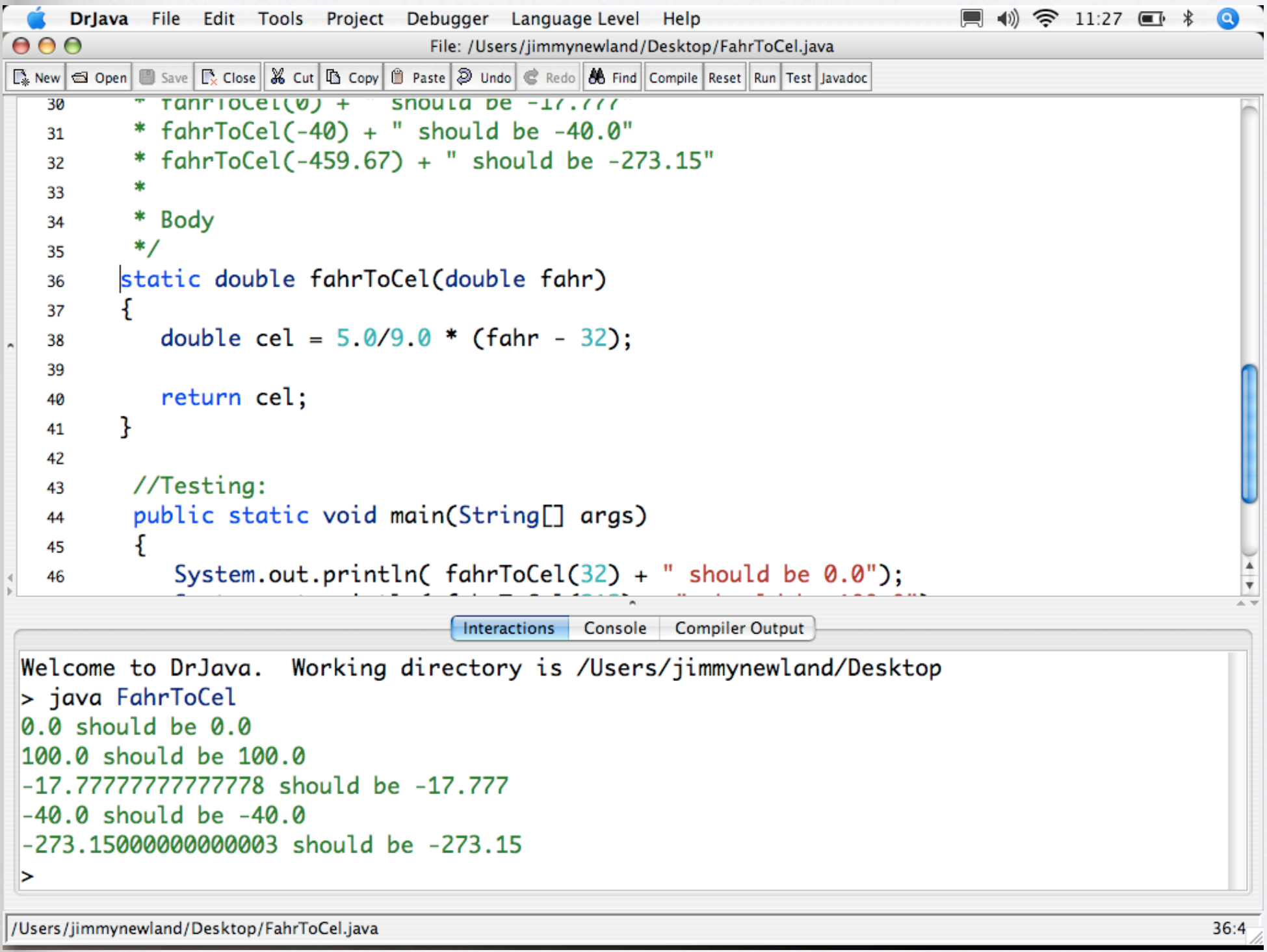
Fahrenheit to Celsius

- Design a program that will convert a given Fahrenheit temperature to the corresponding Celsius temperature. Remember that the mathematical relationship between Fahrenheit and Celsius is:

  Celsius Temp = 5/9 * (Fahrenheit Temp - 32)

  or more simply

  C = 5/9 * (F - 32)


DrJava File Edit Tools Project Debugger Language Level Help
11:27
File: /Users/jimmynewland/Desktop/FahrToCel.java
New Open Save Close Cut Copy Paste Undo Redo Find Compile Reset Run Test Javadoc
30 * fahrToCel(0) + " should be -17.777"
31 * fahrToCel(-40) + " should be -40.0"
32 * fahrToCel(-459.67) + " should be -273.15"
33 *
34 * Body
35 */
36 static double fahrToCel(double fahr)
37 {
38 double cel = 5.0/9.0 * (fahr - 32);
39
40 return cel;
41 }
42
43 //Testing:
44 public static void main(String[] args)
45 {
46 System.out.println(fahrToCel(32) + " should be 0.0");
Interactions Console Compiler Output
Welcome to DrJava. Working directory is /Users/jimmynewland/Desktop
> java FahrToCel
0.0 should be 0.0
100.0 should be 100.0
-17.77777777777778 should be -17.777
-40.0 should be -40.0
-273.15000000000003 should be -273.15
>
/Users/jimmynewland/Desktop/FahrToCel.java
36:4

```
public class FahrToCel {
   /**
    * Purpose: Design a program that will convert a given Fahrenheit
    * temperature to the corresponding Celsius temperature.
    *     C = 5/9 * (F - 32)
    *
    * Contract: Consumes: double number (temp in Fahrenheit)
    *    Returns:  double number (temp in Celsius)
    *
    * Header: double fahrToCel(double fahr)
    *
    * Examples:
    * fahrToCel(32) + " should be 0.0"
    * fahrToCel(212) + " should be 100.0"
    *
    * Body
    */
   static double fahrToCel(double fahr) {
     double cel = 5.0/9.0 * (fahr - 32);
     return cel; }

    //Testing:
    public static void main(String[] args)
    {  System.out.println( fahrToCel(32) + " should be 0.0");
       System.out.println( fahrToCel(212) + " should be 100.0");} }
```

Body Mass Index

- Create a java method that computes a person's body mass index (BMI). BMI is defined as the weight, expressed in kilograms, divided by the square of the height expressed in meters. (One inch is 0.0254 meters and one pound is 0.454 kilograms. The method calculateBmi should take the weight in pounds and height in inches as integer input arguments and should return the BMI.

Absolute Value

- Create a java method that computes the absolute value of a given integer such that if the given number is positive or 0, then that number is returned, otherwise the number is made positive by multiplying it by -1 and the new value is returned.

References

- How to Design Programs
  http://www.htdp.org
  - HtDP “Design Recipe as a Table”
    http://htdp.org/2003-09-26/Book/curriculum-Z-H-5.html#node_fig_Temp_22
- Scheme
  http://en.wikipedia.org/wiki/Scheme_(programming_language)
- DrJava
  http://www.drjava.org
- My “Java Design Recipe”
  http://compsci.jayfox.net/DesignRecipe.java