Homework One

A290/A590 Introductory Track – Spring Semester 2008

Work these (at least start them) out in class so I can help.

Abstract

Write programs that solve the problems below as indicated. Turn these programs in person to me, in class, or during office hours. E-mail the programs when you are done with them to me at dgerman@indiana.edu

1 The Temperature Converter

Write a program that converts Fahrenheit temperatures into Celsius. Assuming that \( f \) is the given temperature in degrees Fahrenheit, the temperature in degrees Celsius can be calculated using the following formula:

\[ c = \frac{5}{9} (f - 32) \]

Your program should ask the user for a temperature expressed in degrees Fahrenheit and it should then output the converted value in degrees Celsius. Here’s an example of how your program should behave:

frilled.cs.indiana.edu% javac Converter.java
frilled.cs.indiana.edu% java Converter
Please enter the temperature in degrees Fahrenheit: 64
64.0 degrees Fahrenheit is equal to 17.78 degrees Celsius.
frilled.cs.indiana.edu% java Converter
Please enter the temperature in degrees Fahrenheit: 80
80.0 degrees Fahrenheit is equal to 26.67 degrees Celsius.
frilled.cs.indiana.edu% java Converter
Please enter the temperature in degrees Fahrenheit: 20
20.0 degrees Fahrenheit is equal to -6.67 degrees Celsius.
frilled.cs.indiana.edu% java Converter
Please enter the temperature in degrees Fahrenheit: -10
-10.0 degrees Fahrenheit is equal to -23.33 degrees Celsius.

2 Calculating A Car’s Autonomy

Given a car’s mileage \( m \), expressed in miles per gallon and the amount of fuel in the car’s tank \( f \), expressed in gallons write a formula to determine the autonomy of that car in miles. Then use the formula that you wrote
to write a program that asks the user for the mileage of a car and the amount of fuel in the car and prints back the autonomy of the car in miles. When finished your program should behave like this:

```
frilled.cs.indiana.edu% javac Autonomy.java
frilled.cs.indiana.edu% java Autonomy
Please enter the mileage for this car (miles/gallon): 20.7
Please enter the amount of fuel (in gallons): 2.6
The autonomy of the car is: 53.82 miles.
frilled.cs.indiana.edu% java Autonomy
Please enter the mileage for this car (miles/gallon): 50
Please enter the amount of fuel (in gallons): 0
The autonomy of the car is: 0.0 miles.
frilled.cs.indiana.edu% java Autonomy
Please enter the mileage for this car (miles/gallon): 50
Please enter the amount of fuel (in gallons): -2
The autonomy of the car is: -100.0 miles.
frilled.cs.indiana.edu% java Autonomy
Please enter the mileage for this car (miles/gallon): three
Exception in thread "main" java.lang.NumberFormatException: For input string: "three"
at java.lang.NumberFormatException.forInputString(NumberFormatException.java:48)
at java.lang.FloatingDecimal.readJavaFormatString(FloatingDecimal.java:1207)
at java.lang.Double.parseDouble(Double.java:220)
at ConsoleReader.readDouble(ConsoleReader.java:26)
at Autonomy.main(Autonomy.java:5)
```

3 Swapping First with Last in a String

Write a program that asks for a string of characters of any length and writes back the string obtained by swapping the first with the last characters in the given string. Here’s how your program might behave when finished, including two situations when the behaviour of the program is unspecified (so the program could throw a legitimate error in those cases):

```
frilled.cs.indiana.edu% javac Swap.java
frilled.cs.indiana.edu% java Swap
Please enter a string of characters (of any length): alpha
Here's the string after the swap: alpha
frilled.cs.indiana.edu% java Swap
Please enter a string of characters (of any length): hoop
Here's the string after the swap: pooh
frilled.cs.indiana.edu% java Swap
Please enter a string of characters (of any length): abcde
Here's the string after the swap: ebcda
frilled.cs.indiana.edu% java Swap
Please enter a string of characters (of any length): a
Exception in thread "main" java.lang.StringIndexOutOfBoundsException: String index out of range: -1
```
Please enter a string of characters (of any length):

```
Exception in thread "main" java.lang.StringIndexOutOfBoundsException: String index out of range: -1
    at java.lang.String.charAt(String.java:444)
    at Swap.main(Swap.java:6)
```

Here's the string after the swap: ab

```
frilled.cs.indiana.edu% java Swap
Please enter a string of characters (of any length): ab
Here's the string after the swap: ba
```

4 Calculating the Area of a Triangle

The area of a triangle can be calculated from its side lengths by Heron’s formula:

\[
\text{Area} = \sqrt{s(s - a)(s - b)(s - c)}
\]

where \(a\), \(b\), and \(c\) are the side lengths and \(s\) is the semiperimeter:

\[
s = \frac{a + b + c}{2}
\]

Write a program to read the three sides of a triangle and calculate its area by Heron’s formula. When finished your program might behave like this:

```
frilled.cs.indiana.edu% java Triangle
Please enter the length of the first side: 3
Please enter the length of the second side: 4
Please enter the length of the third side: 5
The semiperimeter is: 6.0
The area of the triangle is: 6.0
```

```
frilled.cs.indiana.edu% java Triangle
Please enter the length of the first side: 1
Please enter the length of the second side: 1
Please enter the length of the third side: 1.4142
The semiperimeter is: 1.7071
The area of the triangle is: 0.49999999990803207
```

```
frilled.cs.indiana.edu% java Triangle
Please enter the length of the first side:
Exception in thread "main" java.lang.NumberFormatException: empty String
    at java.lang.FloatingDecimal.readJavaFormatString(FloatingDecimal.java:983)
    at java.lang.Double.parseDouble(Double.java:220)
    at ConsoleReader.readDouble(ConsoleReader.java:26)
    at Triangle.main(Triangle.java:5)
```

```
frilled.cs.indiana.edu% java Triangle
Please enter the length of the first side: -2
Please enter the length of the second side: 3
Please enter the length of the third side: 4
The semiperimeter is: 2.5
```

3
The area of the triangle is: 2.9047375096555625

Cases are included where the behaviour of the program is unspecified. In other words instead of a user-friendly program we’re talking of a program-friendly user.

5 Euclidean Distance in the Plane

The Euclidean distance between two points \((x_1, y_1)\) and \((x_2, y_2)\) in the plane is:

\[
\text{Distance} = \sqrt{(x_1 - x_2)^2 + (y_1 - y_2)^2}
\]

Write a program that reads the coordinates of two points and calculates then distance between them. When finished your program might work like the one illustrated below:

```
frilled.cs.indiana.edu% java Distance
Please enter x_1: 0
Please enter y_1: 3
Please enter x_2: 4
Please enter y_2: 0
The distance between (0.0, 3.0) and (4.0, 0.0) is: 5.0
frilled.cs.indiana.edu% java Distance
Please enter x_1: -1
Please enter y_1: 4
Please enter x_2: -3.2
Please enter y_2: 18.9
The distance between (-1.0, 4.0) and (-3.2, 18.9) is: 15.06154042586614
frilled.cs.indiana.edu% java Distance
Please enter x_1:
Exception in thread "main" java.lang.NumberFormatException: empty String
  at java.lang.FloatingDecimal.readJavaFormatString(FloatingDecimal.java:983)
  at java.lang.Double.parseDouble(Double.java:220)
  at ConsoleReader.readDouble(ConsoleReader.java:26)
  at Distance.main(Distance.java:5)
frilled.cs.indiana.edu%
```