



The purpose of this assignment is to introduce you to programming in Java and familiarize you with the mechanics of preparing and submitting assignment solutions.

0. **Install our Java programming environment (recommended).** Install our novice-friendly Java programming environment on your computer by following these step-by-step instructions for [Mac OS X](#) , [Windows](#) , or [Linux](#) .

As part of these instructions, you will write, compile, and execute the program [HelloWorld.java](#) .

```
~/Desktop/hello> javac HelloWorld.java

~/Desktop/hello> java HelloWorld
Hello, World
```

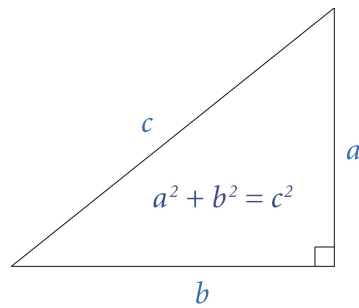
1. **Strings and command-line arguments.** Write a program `HelloGoodbye.java` that takes two names as command-line arguments and prints hello and goodbye messages as shown below (with the names for the hello message in the same order as the command-line arguments and with the names for the goodbye message in reverse order).

```
~/Desktop/hello> javac HelloGoodbye.java

~/Desktop/hello> java HelloGoodbye Kevin Bob
Hello Kevin and Bob.
Goodbye Bob and Kevin.

~/Desktop/hello> java HelloGoodbye Alejandra Bahati
Hello Alejandra and Bahati.
Goodbye Bahati and Alejandra.
```

2. **Integers and booleans.** Write a program `RightTriangle` that takes three int command-line arguments and determines whether they constitute the side lengths of some right triangle.



The following two conditions are necessary and sufficient:

- Each integer must be positive.
- The sum of the squares of two of the integers must equal the square of the third integer.

```
~/Desktop/hello> javac RightTriangle.java

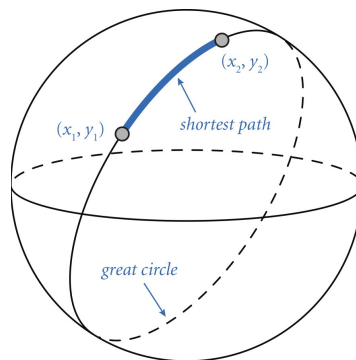
~/Desktop/hello> java RightTriangle 3 4 5
true

~/Desktop/hello> java RightTriangle 13 12 5
true

~/Desktop/hello> java RightTriangle 1 2 3
false

~/Desktop/hello> java RightTriangle -3 4 -5
false
```

3. **Floating-point numbers and the Math library.** The *great-circle distance* is the length of the shortest path between two points (x_1, y_1) and (x_2, y_2) on the surface of a sphere, where the path is constrained to be along the surface.



Write a program `GreatCircle.java` that takes four double command-line arguments x_1 , y_1 , x_2 , and y_2 —the latitude and longitude (in degrees) of two points on the surface of the earth—and prints the great-circle distance (in kilometers) between them. Use the following [Haversine formula](#)

$$distance = 2r \arcsin \left(\sqrt{\sin^2 \left(\frac{x_2 - x_1}{2} \right) + \cos x_1 \cos x_2 \sin^2 \left(\frac{y_2 - y_1}{2} \right)} \right)$$

where $r = 6,371.0$ is the mean radius of the Earth (in kilometers).

```
~/Desktop/hello> javac GreatCircle.java

~/Desktop/hello> java GreatCircle 40.35 74.65 48.87 -2.33 // Princeton to Paris
5902.927099258561 kilometers

~/Desktop/hello> java GreatCircle 60.0 15.0 120.0 105.0 // for debugging
4604.53989281927 kilometers
```

Hint: The command-line arguments are given in degrees but Java's trigonometric functions use radians. Use `Math.toRadians()` to convert from degrees to radians.

Although the Earth is not a perfect sphere, this formula is a good approximation to the true distance.

4. **Type conversion.** Several different formats are used to represent color. For example, the primary format for LCD displays, digital cameras, and web pages—known as the *RGB format*—specifies the level of red (R), green (G), and blue (B) on an integer scale from 0 to 255. The primary format for publishing books and magazines—known as the *CMYK format*—specifies the level of cyan (C), magenta (M), yellow (Y), and black (K) on a real scale from 0.0 to 1.0.

Write a program `CMYKtoRGB.java` that converts from CMYK format to RGB format using these mathematical formulas:

$$\begin{aligned} \text{white} &= 1 - \text{black} \\ \text{red} &= 255 \times \text{white} \times (1 - \text{cyan}) \\ \text{green} &= 255 \times \text{white} \times (1 - \text{magenta}) \\ \text{blue} &= 255 \times \text{white} \times (1 - \text{yellow}) \end{aligned}$$

Your program must take four double command-line arguments cyan, magenta, yellow, and black; compute the corresponding RGB values, each rounded to the nearest integer; and print the RGB values, as in the following sample executions:

```
~/Desktop/hello> javac CMYKtoRGB.java

~/Desktop/hello> java CMYKtoRGB 0.0 1.0 0.0 0.0 // magenta
red   = 255
green = 0
blue  = 255

~/Desktop/hello> java CMYKtoRGB 0.0 0.4392156862745098 1.0 0.0 // Princeton orange
red   = 255
green = 143
blue  = 0
```

Submission. Submit a .zip file containing `HelloWorld.java`, `HelloGoodbye.java`, `RightTriangle.java`, `GreatCircle.java`, and `CMYKtoRGB.java`. You may not call library functions except those in the `java.lang` (such as `Integer.parseInt()` and `Math.sqrt()`). Do not use loops, conditionals, arrays or other Java features that have not yet been introduced in the course.

This assignment was developed by Kevin Wayne.
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