Hack 6.0

Computer Science I – Java

Department of Computer Science & Engineering
University of Nebraska–Lincoln

Introduction

Hack session activities are small weekly programming assignments intended to get you started on full programming assignments. Collaboration is allowed and, in fact, *highly encouraged*. You may start on the activity before your hack session, but during the hack session you must either be actively working on this activity or *helping others* work on the activity. You are graded using the same rubric as assignments so documentation, style, design and correctness are all important.

Problem Statement

In this hack you'll get some more practice writing functions that utilize pass-by-reference (pointers), error handling and enumerated types. There are several different ways to model colors including RGB and CMYK. RGB is generally used in displays and models a color with three values in the range $[0, 255]$ corresponding to the red, green and blue "contribution" to the color. For example, the triple $(255, 255, 0)$ corresponds to a full red and green (additive) value which results in yellow. CMYK or Cyan-Magenta-Yellow-Black is a model used in printing where four colors of ink are combined to make various colors. In this system, the four values are on the scale $[0, 1]$. Write functions to convert between these models.

1. Write a function to convert from an RGB color model to CMYK. To convert to CMYK, you first need to scale each integer value to the range $[0, 1]$ by simply computing

$$r' = \frac{r}{255}, \quad g' = \frac{g}{255}, \quad b' = \frac{b}{255}$$

and then using the following formulas:

$$k = 1 - \max\{r', g', b'\}$$
$$c = \frac{(1 - r' - k)}{(1 - k)}$$
$$m = \frac{(1 - g' - k)}{(1 - k)}$$
$$y = \frac{(1 - b' - k)}{(1 - k)}$$

Your method should have the following signature:

```
public static CMYK rgbToCMYK(RGB color)
```

Note that one edge case is black, when $(r, g, b) = (0, 0, 0)$ which would lead to a division by zero in the formulas. The equivalent CMYK values are $(0, 0, 0, 1)$.

2. Write a function to convert from CMYK to RGB using the following formulas.

$$r = 255 \cdot (1 - c) \cdot (1 - k)$$
$$g = 255 \cdot (1 - m) \cdot (1 - k)$$
$$b = 255 \cdot (1 - y) \cdot (1 - k)$$

Results should be rounded. Your method should have the following signature:

```
public static RGB cmykToRGB(CMYK color)
```

The `RGB` and `CMYK` classes have been provided for you. See the `main` method of each class for examples on how to create and use *instances* of each class.

Place both methods in a source file named `ColorUtils.java` in the package `unl.cse`.
For both methods, identify any and all error conditions and throw an `IllegalArgumentException` with an appropriate error message.

Instructions

- You are encouraged to collaborate any number of students before, during, and after your scheduled hack session.
- Design at least 3 test cases for each function *before* you begin designing or implementing your program. Test cases are input-output pairs that are known to be correct using means other than your program.
- You may (in fact are encouraged) to define any additional "helper" functions that you find useful.

- Include the name(s) of everyone who worked together on this activity in your source file's header.
- A testing file, `ColorUtilsTests.java` has been provided that uses JUnit (https://junit.org/junit5/), a unit testing framework for Java. We have already written several test cases for you. Using these examples, implement your test cases using JUnit for your two functions. You should add at least 3 test methods.

  The starter file should be sufficient to demonstrate how to use JUnit, but the full documentation can be found here: https://junit.org/junit5/docs/current/api/. A `readme.me` file has also been provided describing how to add JUnit to your Eclipse project.
- Turn in all of your files via webhandin, making sure that it runs and executes correctly in the webgrader. Each individual student will need to hand in their own copy and will receive their own individual grade.