CS 1120: Media Computation Spring 2017
Assignment 1: Basic image filters

Due: Monday, February 5, 2018, by 11:59 p.m.

Make sure you read the directions carefully. This assignment consists of several pieces and you need to complete all of the pieces for full credit.

- This assignment consists of the creation of several methods as outlined below. These methods should all be saved in a file called **hw1.py** (which is homework 1)
- To test these methods described below you may use any image file of your choice. Do not use large images: JES was not built for speed.

This assignment is worth **60 points**, which accounts for **4.375%** of your final grade.

Task 1 (30 points)

You have learned that gray is any color where the red, green, and blue values in a pixel are all equal.

For example,

```
setRed(pixel,128)
setGreen(pixel,128)
setBlue(pixel,128)
```

produces a middle of the scale gray. Since you can set each color channel to any value from 0 to 255, there are 256 gray colors in the representation of color we use in this class (notice this definition means that both black and white are, in fact, versions of gray).

We extend this idea by defining that grayscale images are any picture where every pixel is set to some version of gray. There are a variety of techniques we can use to decide which version of gray each pixel should be set to. In your textbook you read that one way is to use the concept of a pixel's luminance - the average of its three color components. This is, however, only ONE way to determine which version of gray to select for a pixel. In this task, you will explore several different methods for selecting the intensity value to which you set each pixel.

Define the following three functions. Each of them takes a picture object as an argument.

1) **makeGrayscale1(picture)** should use the average of the three color channels to determine the luminance of a particular pixel.

2) **makeGrayscale2(picture)** should use the value in the red channel to determine the luminance of a particular pixel. That is, if the color of a pixel is (R=111, G=24, B=216) then the pixel's grayscale color should be (R=111, G=111, B=111).

3) **makeGrayscale3(picture)** should use the following formula to determine the luminance:

```
lum = 0.3 * red + 0.59 * green + 0.11 * blue
```

That is, if the color of a pixel is (R=111, G=24, B=216), then the pixel's grayscale color should be:

```
111 * 0.3 + 24 * 0.59 + 216 * 0.11 = 182 or (R=182, G=182, B=182)
```

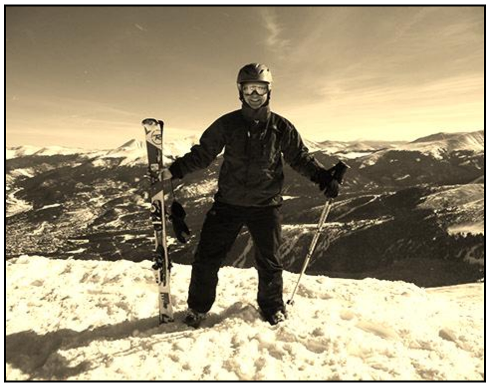
Task 2 (10 points)

If you think of "old fashioned" photographs like cowboy photos from the American West of the 1800s, you probably don't actually think about grayscale photos but instead you think of sepia-toned photos. Sepia tone was a printing technique that gave photos a sort of yellowish color rather than gray.

For example, here is the same photo in color, grayscale, and sepia-toned:

color version

grayscale version


sepia-toned version

Using these color values referenced on wikipedia create a function called makeSepiaTone() which takes a picture as a parameter and converts that photo to sepia tone.

```
newRed = (R * 0.393 + G * 0.769 + B * 0.189)
newGreen = (R * 0.349 + G * 0.686 + B * 0.168)
newBlue = (R * 0.272 + G * 0.534 + B * 0.131)
```

NOTE: If you look at this closely you will see that this formula does not always produce "valid" results. That is, it will produce RGB values greater than 255 if the original color is close to white.

For example, if my color was (R=250, G=248, B=239) then the formula above would produce a NEW red value of

```
newRed = (250 * 0.393 + 248 * 0.769 + 239 * 0.189)
newRed =     98.25    +    190.712  +   45.171
newRed =                  334.133
```

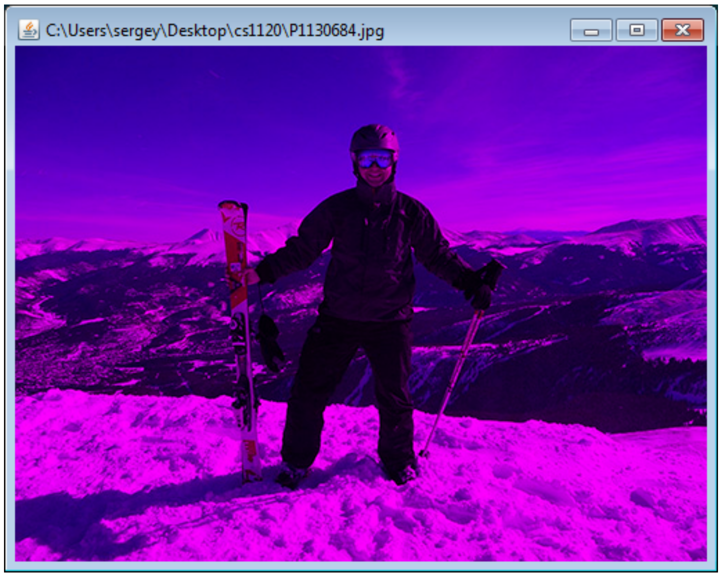
If you use setRed(pixel,334) then JES will automatically change any values greater than 255 to 255 (it will also set any values less than zero to zero, but that won't happen here.)

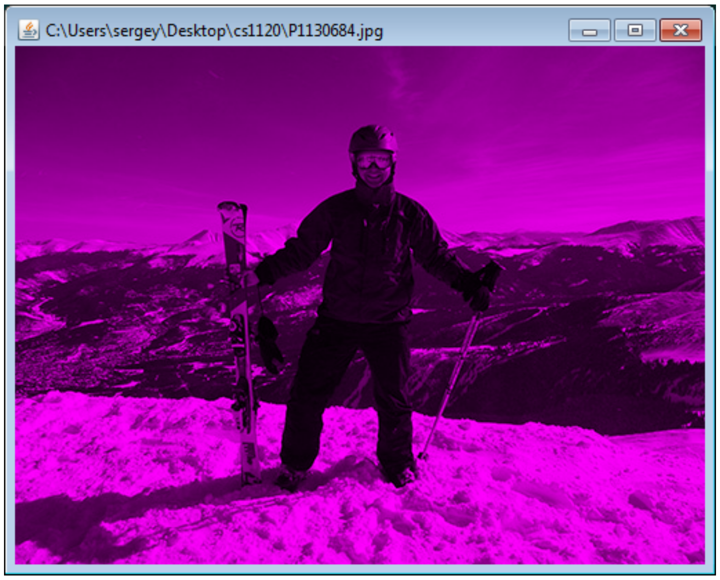
Finally, please note that your textbook contains a program for Sepia much later in the book. This version has absolutely nothing to do with your task in this assignment. Using the code from the book will result in an automatic score of zero for this assignment.

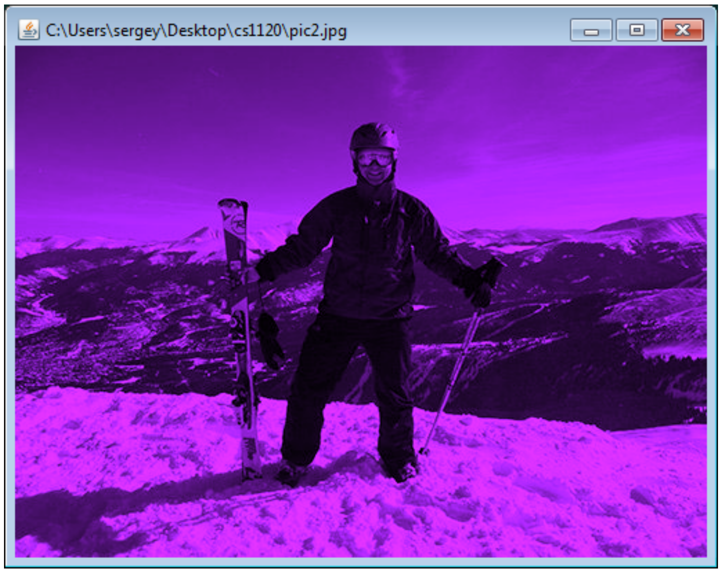
Task 3 (20 points)

UNI has a slogan that says “Purple for Life” For this task you will write a function called purple4Life() that takes in one picture as a parameter and makes it “purple” You should experiment with what modifications to the Red, Green, and Blue channels (if any) are necessary to give your photo a nice purple color.

Below are a few possibilities. Notice that the first one is the simplest solution (just set green to 0), but not the best one. The last one looks like a true UNI purple. As a suggestion, you may want to check this document: https://uni.edu/ur/style-guide/UNI_Style_Guide.pdf (see page 8). Full credit will be given for creative, non-trivial solutions (i.e., the first one is trivial).







Submit your work

Submit your file **hw1.py** to eLearning. Your file should contain the following function definitions:

```
makeGrayscale1(picture)
makeGrayscale2(picture)
makeGrayscale3(picture)
makeSepiaTone(picture)
purple4Life(picture)
```