


```

newimg.setRGB(0,0,width,height,rgbarray,0,width); //save the changed
    array (rgbarray) to newimg. rgbarray should contain your altered image
try{ //Save the changes to a file
    File outputfile = new File("rose_changed.jpg");
    ImageIO.write(newimg, "jpg", outputfile);
} catch(IOException e) {
    System.out.println("Cannont write file");
}
}
}

```

Part 1 - Grayscale (30 points)

Grayscale is an image processing technique that takes a 3 channel RGB image and turns it into a single channel of gray values. The color image can be represented in vector form as $\langle R, G, B \rangle$. The range of values that a pixel may take is 0-255. To properly convert a color image into a grayscale image, one must use the following formula:

$$Y = 0.2989R + 0.5870G + 0.1140B \quad (1)$$

where R,G,B represent the intensity values of the red, green, and blue channel respectively, and Y represents the grayscale value. One can create a grayscale version by replacing the $\langle R, G, B \rangle$ vector with the following, $\langle Y, Y, Y \rangle$.

Part 2 - Keep the red (30 points)

In artistic image processing, occasionally you may see images that reduce the RGB channels to grayscale; however, highlight a specific object by maintaining it's original color distribution. In this part, you will not perform the conversion to grayscale for a particular pixel if the R value is greater than 150 *and* the green value is less than 100.

Part 3 - Contrast stretch (30 points)

Contrast stretching (often called normalization) is a simple image enhancement technique that attempts to improve the contrast in an image by "stretching" the range of intensity values it contains to span a desired range of values, e.g. the the full range of pixel values that the image type concerned allows. Contrast stretching takes the following form,

$$\langle \hat{R}, \hat{G}, \hat{B} \rangle = (\langle R, G, B \rangle - c) \frac{(b - a)}{(d - c)} + a \quad (2)$$

where a and b are the lower and upper limits, respectively. In our case, these limits will be set to 0 and 255. c and d represent the mapped range. For our application, set $c = 0$ and $d = 180$.

Part 3 - PDF write up (30 points) Create a 1-2 page write up that summarizes the interesting parts of your program. Include any problems or insights that you encountered.

Deliverables: Submit on the CSC website.



(a) Original image.



(b) Grayscale result.



(c) Keep the red result.



(d) Contrast Stretch result.

Figure 1: Results from the different methods implemented by this project.