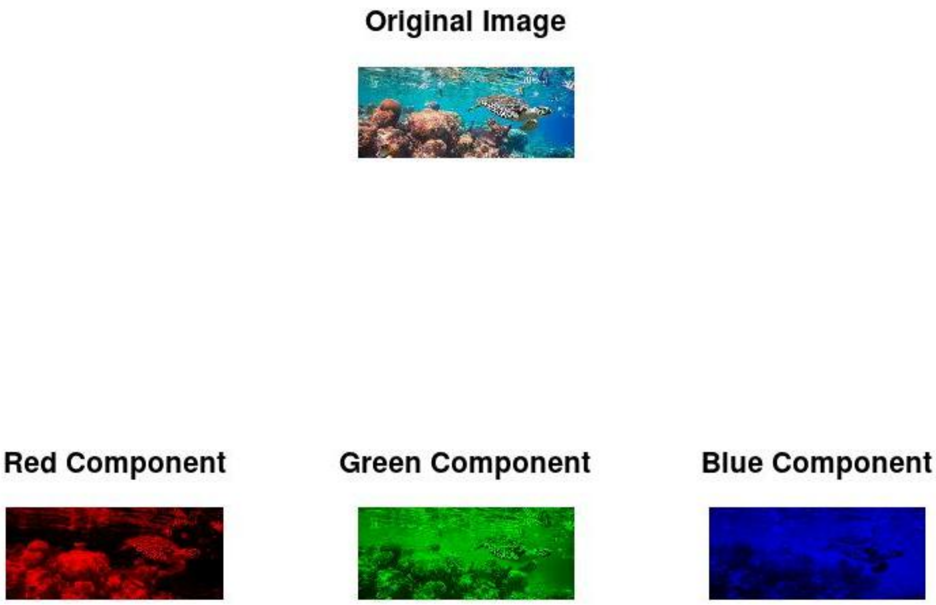
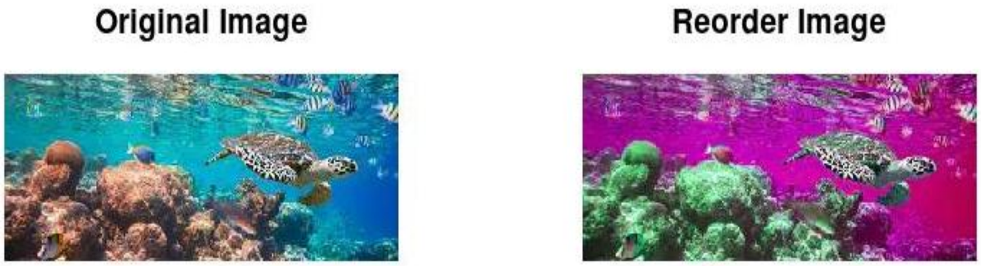
In-class Activity

Ex1. Image Sensing and Acquisition (25 marks)

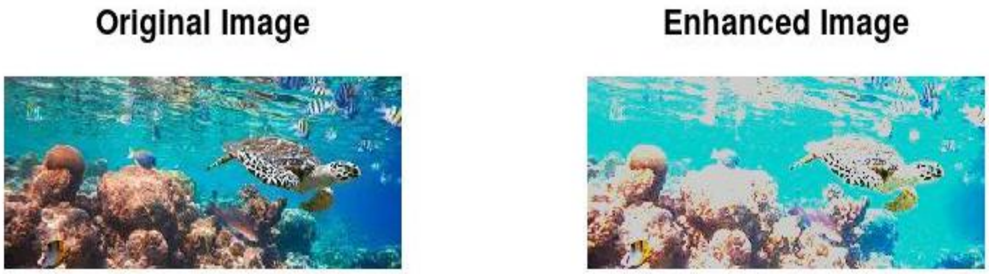
1. Read a given color image (‘*sea.jpg*’). Display the original image and its tricolor elements: Red (R), Green (G) and Blue (B) separately.



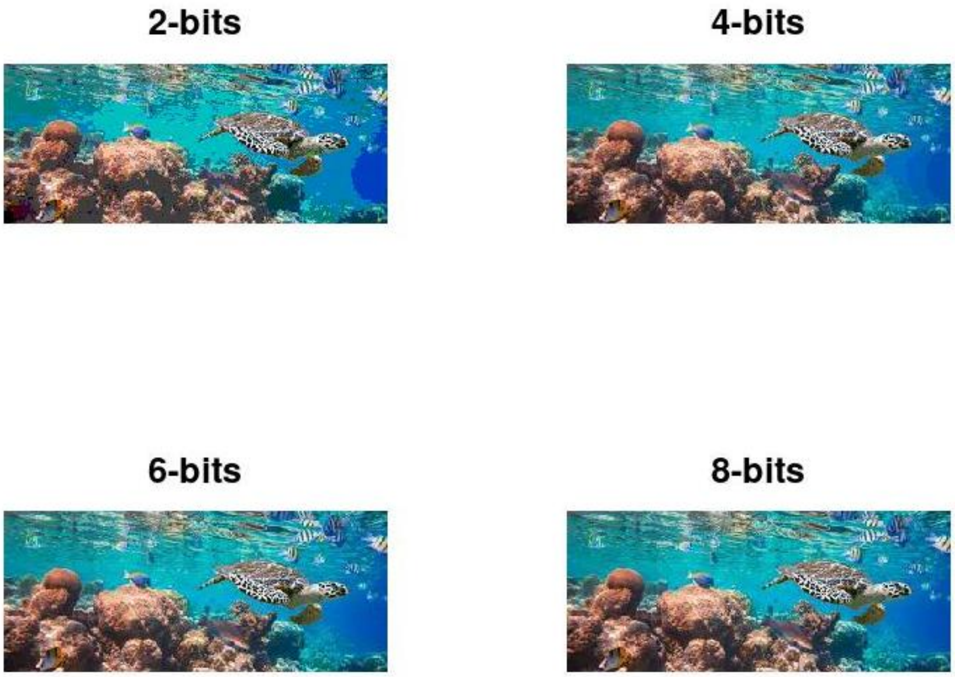
2. Reorder the three components to create a new image as (BRG).



3. Make the original image increase the contrast by a gamma correction scale 1.2, then darker 80% using a scale value.



4. Quantize and display the grayscale image using 2 bits, 4 bits, 6 bits and 8 bits. Visualize the effect of the operations.



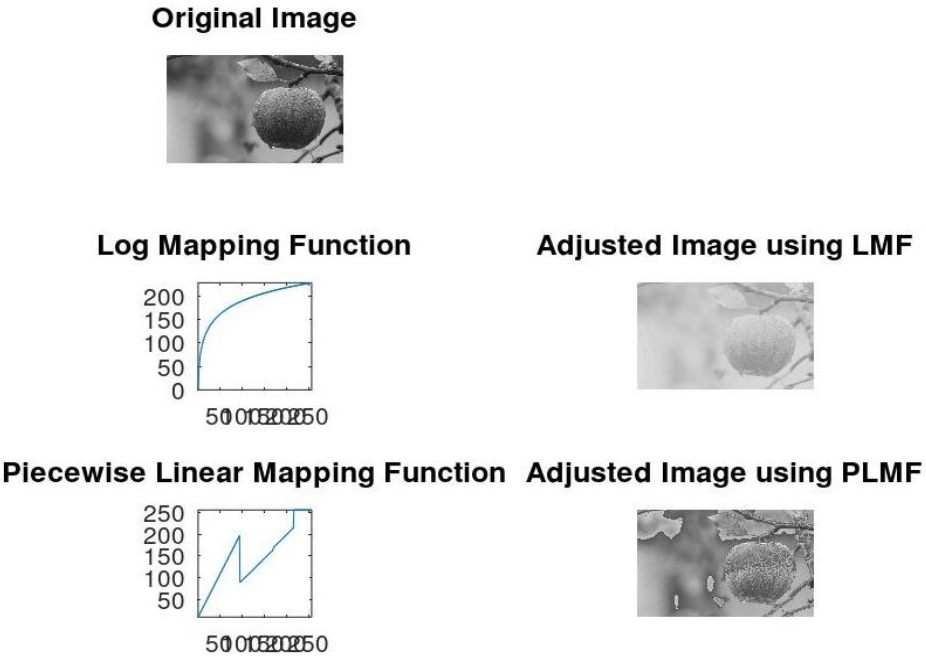
Ex2. Geometrics Operations, Histogram Equalization (25 marks)

1. Read a given grayscale image (‘*apple.jpg*’). Contrast the original image with:

   a. logarithm transformation with the constant c = 256/log(512);

   b. piecewise linear transformation with

$$s = \begin{cases} 2f + 10 & if\ 0 < r \leq 93 \\ f - 5 & if\ 93 < r \leq 168 \\ f & if\ 168 < r \leq 214 \\ 255 & if\ 214 < r \leq 255 \end{cases}$$

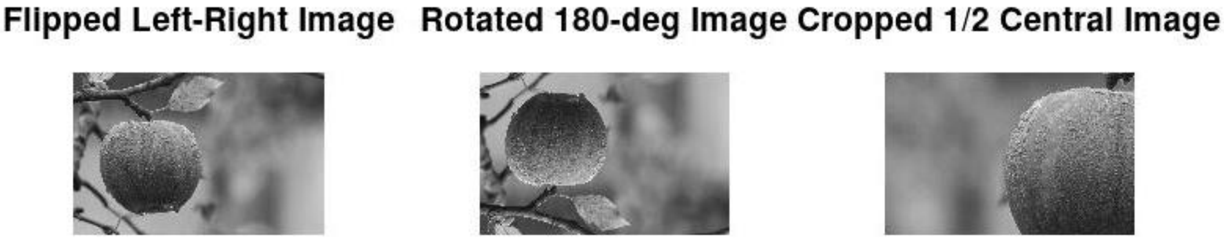


2. Peform three different actions:

   a. flip left to right using *fliplr*

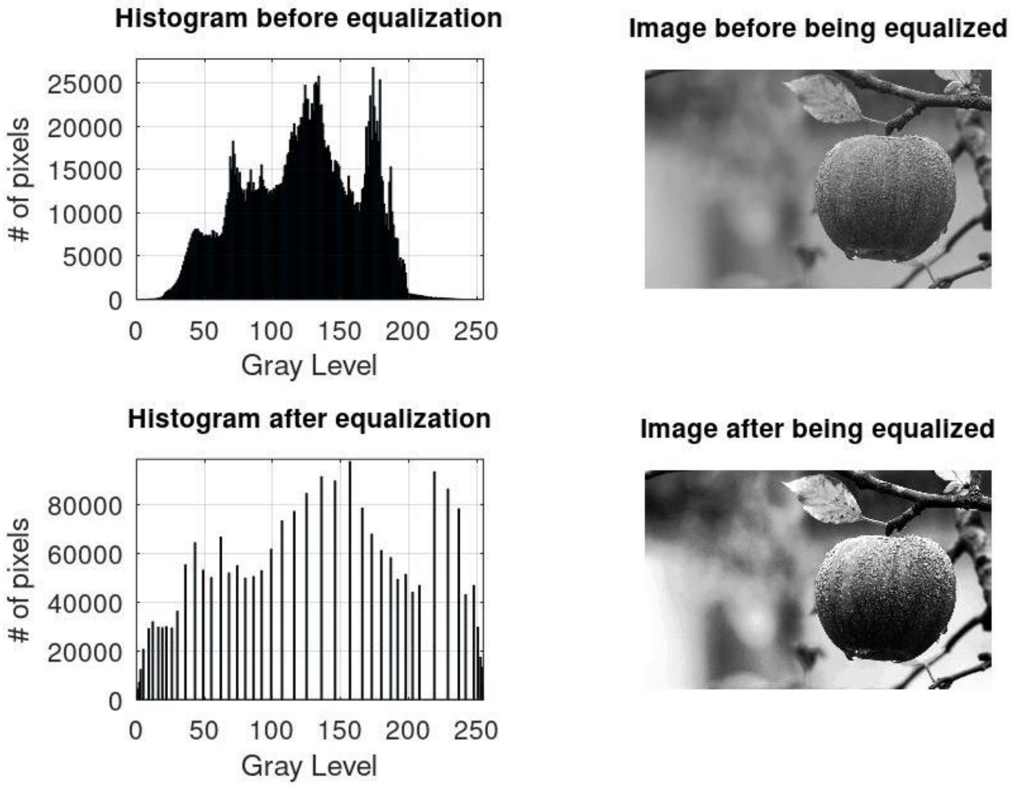
   b. rotate clockwise 180 degrees using *imrotate*

   c. crop ½ central of the image using *imcrop*



Flipped Left-Right Image **Rotated 180-deg Image** **Cropped 1/2 Central Image**

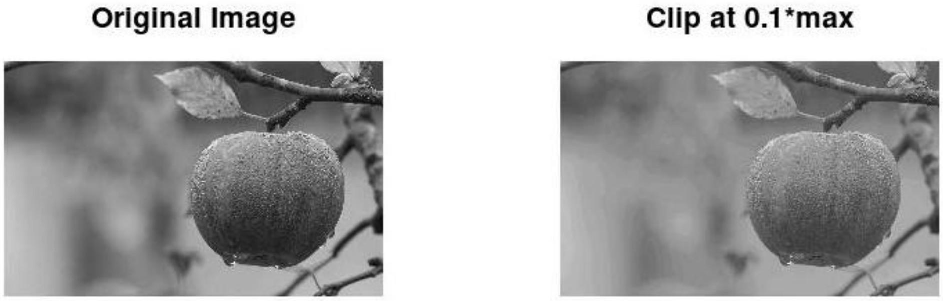
3. Plot the histogram of the original image. Perform global histogram equalization.



Histogram before equalization **Image before being equalized**

Histogram after equalization **Image after being equalized**

4. Perform Contrast Local Adaptive Histogram Equalization (CLAHE) with the clipping ratio = 0.3.

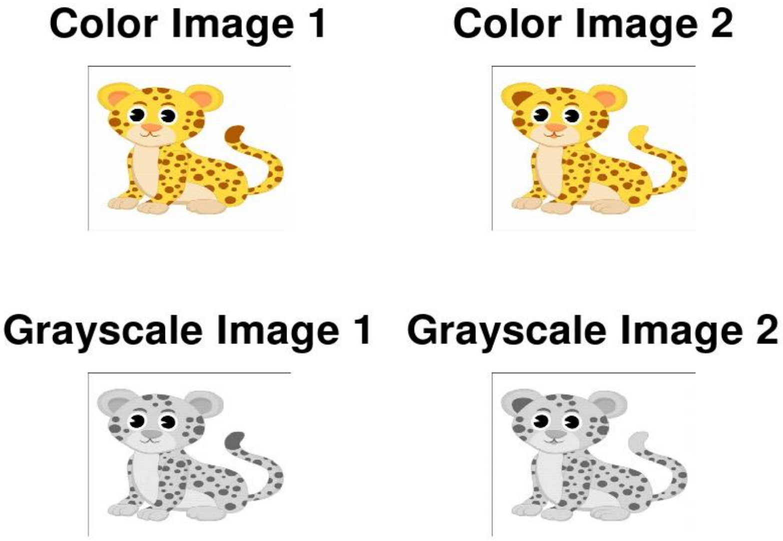


Original Image **Clip at 0.1*max**

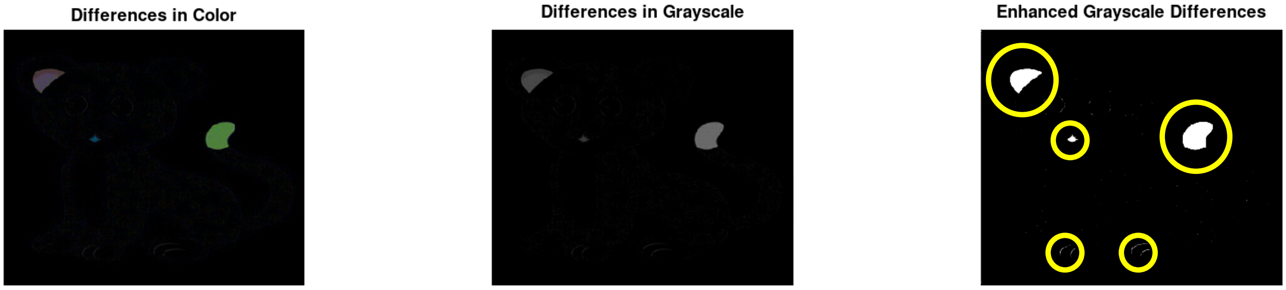
Ex3. Image Comparison (20 marks)

Given two color images named *cat_a.png* and *cat_b.png*.

(a) Display two images in color and grayscale format in the same figure. Save this image as 'Color_Grayscale.jpg'



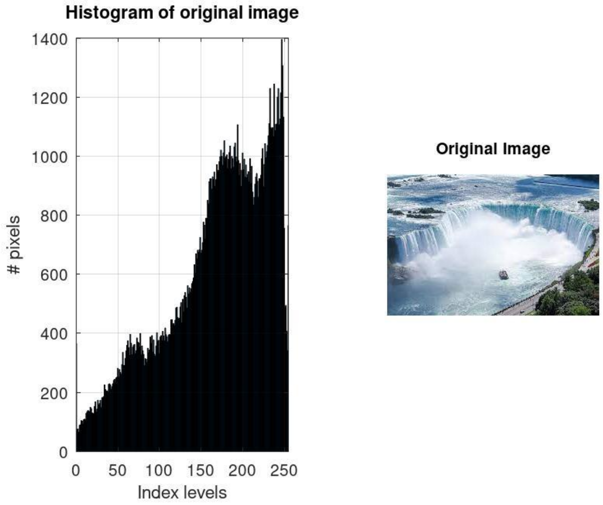
(b) Find 5 differences between two images. Display in color, grayscale and enhanced grayscale (contrast increases 40%, brighter 200%).



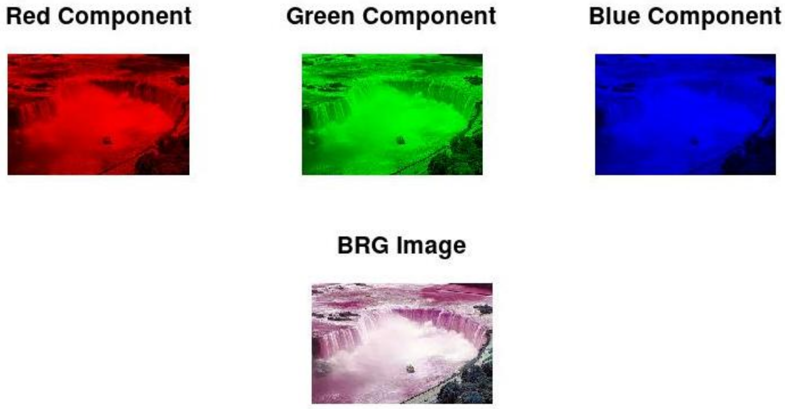
Ex4. (15 marks) – Image Histogram and Equalization

Given a color image named *waterfall.jfif*.

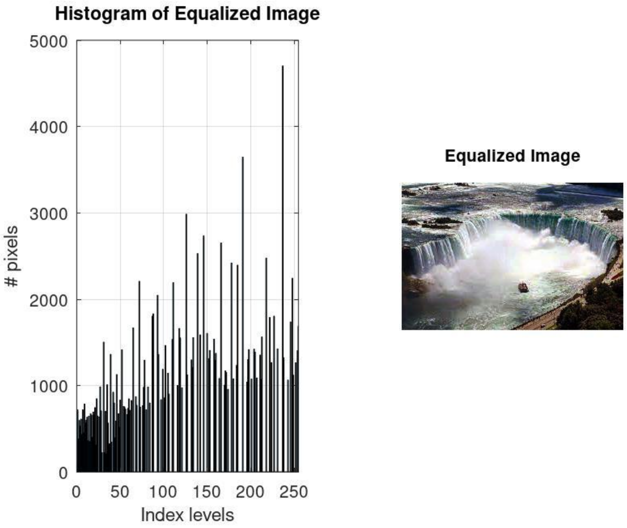
(a) Plot the original image and its histogram. Save this image as 'Color_Histogram.jpeg'



(b) Display three primary components Red, Green and Blue of the original image. Recombine them in Blue, Red, Green order. Plot these images in the same figure and save as 'Primary_Colors_and_BRG_Image.jpeg'

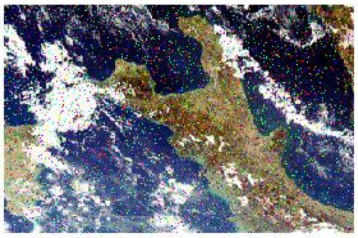


(c) Apply histogram equalization for the original image. Plot the image and its histogram after being equalized. Save this figure as 'Equalization_Histogram.jpeg'

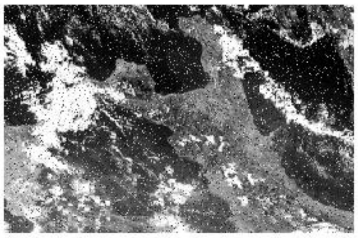


Ex5. Image Restoration – Noise Reduction and Sharpening (15 marks)

1. Read a given noisy color image (‘*weather.png*’). Display the original image in color and grayscale format.



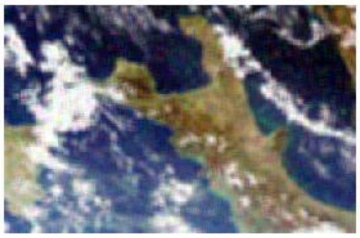
Original Color Image



Original Grayscale Image

2. Using two filters (one must be Butterworth) to sharpen the denoise image. Parameters are optional[1].

Sharpened Image 1



Sharpened Image 2

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[1] *Reference links: https://setosa.io/ev/image-kernels/ or https://blog.demofox.org/2022/02/26/image-sharpening-convolution-kernels/*