Assignment 2: INTENSITY TRANSFORMATION and HISTOGRAM PROCESSING

1. Write your program to produce the negative of the 2_2.bmp image.
HINT: The negative of an image = (2^n – I)-1, where n is the number of bits and I is the intensity value
of a pixel on this image.

2. Write your program to produce the eight bit-plane images of the 2_2.bmp image.

3. Histogram and cumulative distribution function of histogram.
For this problem, use the Lenna image, 2_2.bmp. Keep the range of the pixel values in [0,255]. The histogram of a digital image with gray levels in the range [0,L-1] is a discrete function $h(k)=N_k$, where N_k is the number of pixels in the image having gray level k. Write your own program to plot the histogram and the cumulative distribution function (cdf) of the histogram of the Lenna image.
Normalize the histogram and make sure it sums to one.
HINT: After loading the image, use one of the bands to plot the histogram. DO NOT use imhist or hist. You need to write your own code to plot the histogram. You may use cdfplot to plot the cumulative distribution function.

4. You have two low-quality images (2_1.jpg, 2_3.jpg) that you want to enhance. You will be examining the following three general histogram-based enhancement algorithms:
a. Linear stretching;
b. Histogram equalization;
c. Histogram specification.
For each image and each method, please submit the original and the new image after processing. For original and new image, please also include their histogram and cdf plots for you to get a better understanding of what's going on with these processing in regard with the image histogram. Compare the effects of these methods. For each image, please comment on the effects and pick up one method that you think works best for that image.

HINTS:
1. You need to implement your own functions for linear stretching, histogram equalization and specification. But you may use these commands to help you: rgb2hsv, hsv2rgb, subplot, imshow, cumsum, imhist
2. You may want to convert the image to HSV first before doing any operations; specifically, you want to process the V channel (value, i.e., intensity) only. After the V channel is altered, you want to combine it with original H and S channel and convert back to RGB.
3. For histogram equalization, compute pdf and cdf first and then use the cdf as the transform function. You can use imhist to help you get the image histogram and then use cumsum to get the cdf from histogram, but please DON'T use histeq to directly perform histogram equalization / specification.
4. For histogram specification, you may specify any histogram to get the best result. Note that if you specify the target histogram as a uniform distribution, you're doing histogram equalization. You can also try normal distribution as the specified histogram to get the transform function and see how the result turns out. Use normpdf to generate a normally distributed sequence in MATLAB. Please type help normpdf to see how to

use this function to generate a desired normally distributed histogram. Remember usually we want a histogram that has 256 bins.