EE610 Autumn 2019
Assignment 1

Instructions:

1. Input images for each question are available in the folder named **Data**.
2. Please use **MATLAB** or **Python** preferably for the coding.
3. Submit a single PDF file on Moodle containing answers, output images and properly commented code for each question. Also specify parameters used, if any, like order of filter, spatial filtering mask etc.
4. Please name your submission file as **Language_YourName_RollNumber_Assignment1.pdf**. For example, if person 'xyz' with roll number 12345 has used Python for the assignment, the file should be named as **Python_xyz_12345_Assignment1.pdf**.
5. Do submit the code even if you don't get the output. Partial marks may be given if code is conceptually correct.
6. You will be asked to give a demo of your code if we suspect plagiarism or any other wrongdoing.

Questions:

1. Enhance the contrast of the image **q1.png** using the log transformation or the antilog transformation as per requirement. Explain why you chose the log or antilog transformation.
   [1 mark]

2. Perform local histogram equalization with appropriate patch size for the tungsten filament image **q2.png**. Comment on the comparison of your output with the results of global histogram equalization (Fig. 3.27 (b)) and enhancement using local histogram statistics (Fig. 3.27 (c)) given in the 3rd edition of the book Digital Image Processing by Rafael C. Gonzalez and Richard E. Woods.
   [2 marks]

3. Denoise the images **q3a.png** and **q3b.png** using a 3x3 spatial smoothing filter or a 3x3 median filter depending on the type of noise you observe in the image. If you are using the spatial smoothing filter, perform the equivalent operations in Fourier domain also (include magnitude spectrum of input, filter and output in the report along with the output images). Explain your choice of filter for each image.
   [Note: While performing equivalent operations in Fourier domain for the spatial smoothing filter, pad the image and filter with appropriate number of zeros to avoid wraparound error.]
   [2 marks]

4. Enhance the edges in the image **q4.png** using a 3x3 sharpening Laplacian filter in the spatial and Fourier domains (include magnitude spectrum of input, filter and output in the report along with the output images).
   [Note: While performing equivalent operations in Fourier domain, pad the image and filter with appropriate number of zeros to avoid wraparound error.]
   [2 marks]

5. Compare the performance of ideal, Butterworth and Gaussian low pass filters in frequency domain on the image **q5.png** (include magnitude spectrum of input, filter and output in the report along with the output images). Comment on the comparative performance of the three filters.
   [1.5 marks]

6. Compare the performance of ideal, Butterworth and Gaussian high pass filters in frequency domain on the image **q6.png** (include magnitude spectrum of input, filter and output in the report along with the output images). Comment on the comparative performance of the three filters.
   [1.5 marks]