HW#3
Due 23:59 on 6th of January, Friday

In the homework, your task is to obtain some of the results illustrated in the lectures. In each part, you are referred to one or more slides used in the lectures and asked to generate the results shown in the slides in Matlab (or Phyton). Slide numbers given are the exact page numbers in the documents (not the written slide numbers).

In your solution, you should briefly explain how your implementation works, the mathematical background behind it, and provide figures that show your results. All codes should also be provided at the end of your solution to get credit. You should not use any built-in Matlab/Phyton function to directly perform the required task unless stated. General-purpose functions like fft2, ifft2, conv2, imagesc, image, etc. can be used if needed.

Q1) From "image processing basics_week10"

- Obtain and plot the color components of an image for the RGB, CMY, HSI, and YCbCr color models – slide 15-19 (can use a built-in function, if available)
  Image to be used: color image shared in ODTUClass
- Illustrate that filtering the R, G, B components independently is equivalent to filtering the I component (keeping H and S as it is) in the HSI model - slide 22
  Image to be used: color image shared in ODTUClass

Q2) From "Image enhancement_part1_week10" and
"Image enhancement_part2_week11"

- Enhance the contrast of a dark image using proper point-wise intensity transformations discussed in the class: negative, power law, log, inverse log, histogram equalization, ...
- Plot also the histograms of the original and enhanced images - slide 15 and other relevant slides (can use a built-in function for histogram equalization, if available)
  Image to be used: dark image shared in ODTUClass

Q3) From "Image enhancement_part2_week11"

- Sharpen an image using the unsharp masking approach (with two different alpha values) - slide 28.
- Also repeat this sharpening task using Sobel's kernel in non-directional form and using Laplacian kernel - slide 40, 43, 44 and other relevant slides.
  Image to be used: 256x256 grayscale Lena image

Q4) From "Image transforms applications_week8",
"Image enhancement_part2_week11",
"Image_restoration_part1_week12",
"Image restoration_part2_week13"

- Apply the different type of approaches that can be used for noise reduction in images as discussed in this course. As noise, consider adding two different type of noise: additive white Gaussian noise and salt-and-pepper noise. The noise should be visible in your noisy images. Compare and contrast the different approaches for each noise type, and state their pros and cons.
  Image to be used: 256x256 grayscale Lena image

Q5) From "Image restoration_part2_week13"

- Consider the restoration problem in slide 10. Apply different restoration methods: inverse filtering, pseudo-inverse filtering, and regularized LS filtering (with Tikhonov regularization). Comment on the pros and cons of each method based on your own observations.
  Image to be used: 256x256 grayscale Lena image