Problem 1. For the image pepper.jpg, perform the following operations and compare their results with the original image.

1) Add a constant value of 50. What is the effect of this operation?
2) Set all pixels in the range [120,180] to 50
3) Compute the log10 of the image. What is the effect of this operation?

Problem 2. For the image ***bridge2.gif***

1) Read the image and display it.
2) Process the image using the following functions

a. $T(r) = c \log_{10}(r+1)$.

b. $T(r) = 10^{CR} - 1$.

c. Linear stretching over the entire dynamic range.

In each case, you need to display the resulting image and compute following statistics: minimum, maximum, mean, and standard deviation.

Compare the results you obtained visually and discuss their relation with the numbers you obtained.

Problem 3.

Bit-plane slicing could be a useful technique in image compression. Generating bit planes can be easily done by checking the individual bits of pixels' values. However, this could be computationally intensive. In this problem you are required to compare the performance of generating the bit planes using two approaches. The first one directly uses the binary functions available in Matlab while the second one does not use any of these functions. Test your code on the ***cameraman.gif*** image.

However, explain your second approach and include the code and a table that lists the number of ones in each bit plane obtained by the two methods. Also, use the Profiler tool available in Matlab to measure the speed up obtained by the second method over the first one.

Problem4.

For the image ***building1.gif***

1) Read the image and display it.
2) Compute the following statistics of the image: minimum, maximum, mean, median, and standard deviation. Also, determine the number of pixels that have a gray level value of 128.
3) Try adding a constant value of 50 to the image, display and compare it to the original image. Re-compute the values in (2) for the new image. Discuss your results.
4) Try to modify the pixel values in the image using

$$g(x,y) = \frac{255}{\max(f(x,y)) - \min(f(x,y))}\left[f(x,y) - \min(f(x,y)\right]$$

where f(x,y) is the original image. Display and compare the output image with the original image and with the image obtained in (2). Also, recompute the values found in (2). Discuss your results.

Problem 5.

The image ***hw1sp2012Prob2.gif*** contains two square objects. Pixels in the first square have the intensity of 150 while those in the second square have the intensity of 220. Read the image and do the following:

1) The small square is to be translated by 40 pixels in both directions.
2) The large square is to be rotated by 60 degrees counter clockwise.

Write the code to perform these transformations. Show the image before and after transformation on the same figure. Remember that the transformations are applied to the objects and not to the entire image. In other words, you should shift the point of origin to the center of each object before applying the transformation.

Problem 6.

For the image *skeleton.gif*, try to modify the image using the following functions

1) $G(x,y) = e^{cF(x,y)}$
2) $G(x,y) = c\log_{10}[(F(x,y)+1]$
3) $G(x,y) = \begin{cases} F(x,y)\ ,\ F(x,y) \le 10 \\ 2 * F(x,y)\ ,\ \text{otherwise} \end{cases}$

Show the results in each case. Which function produces the best result in your opinion? Discuss your results.

Problem 7.

Resize the image pepper.jpg, with scale factor 0.5 . (Delete one row of each two rows and one column of each two columns)

Resize the obtained image with scale factor 2 using the following interpolation methods:

a) Nearest Neighbour
b) Bilinear
c) Linear

In each case show the resized image, original image and difference image (between original image and resized image).