Assignment 1 (Due: Oct. 30, 2016)

1. Gaussian distribution (or also called normal distribution) is an important kind of distributions widely encountered in the engineering fields. If a random variable $X$ conforms to Gaussian distribution, the probability density function of $X$ is

$$f(x) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(x-\mu)^2}{2\sigma^2}}$$

Please prove that the mean and the variance of $X$ are $\mu$ and $\sigma^2$, respectively.

2. Programming. This exercise will deepen your understanding of image’s histogram. You need to implement histogram generation and histogram equalization functions by yourself. So, in this exercise, the Matlab routines `imhist` and `histeq` cannot be called.

You are required to implement two functions “myimhist” and “myhisteq”. “myimhist” can generate a histogram for the given image and “myhisteq” can perform the histogram equalization operation to the given image.

Please take a picture $f$ of our campus. Then, perform the histogram equalization to $f$ to get $g$ using “myhisteq”. Compute and display $f$’s and $g$’s histograms using “myimhist” to see whether there are some differences between the two histograms.

3. Programming. The need for image padding when filtering in the frequency domain was discussed in our lectures. We showed that images needed to be padded by appending zeros to the ends of rows and columns in the image (see the following image on the left). Do you think it would make a difference if we centered the image and surrounded it by a border of zeros instead (see the image on the right), but without changing the total number of zeros used? Please verify your idea by a Matlab program. You can use your own images for testing.