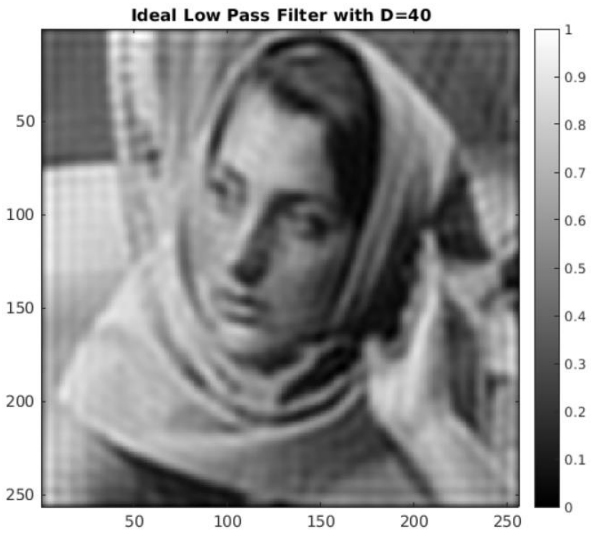
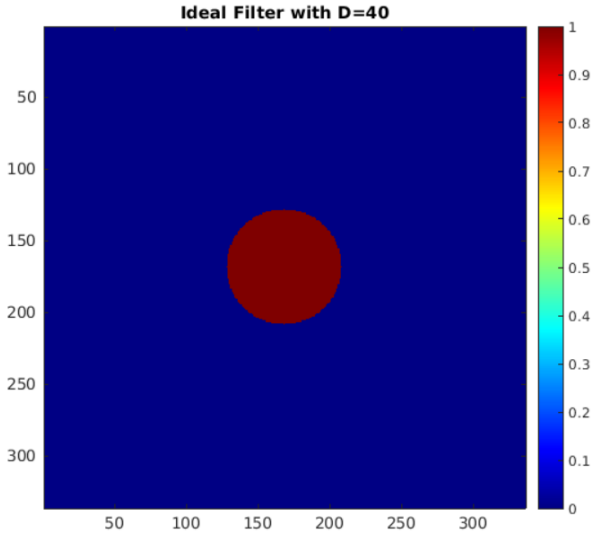
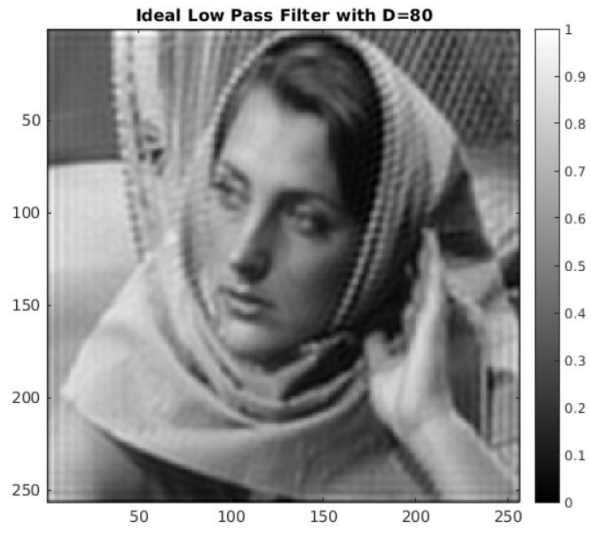
# CS663 Assignment 5

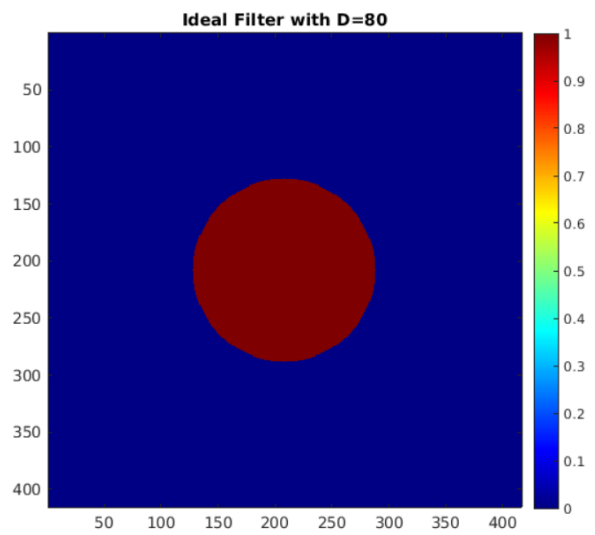
Question 4

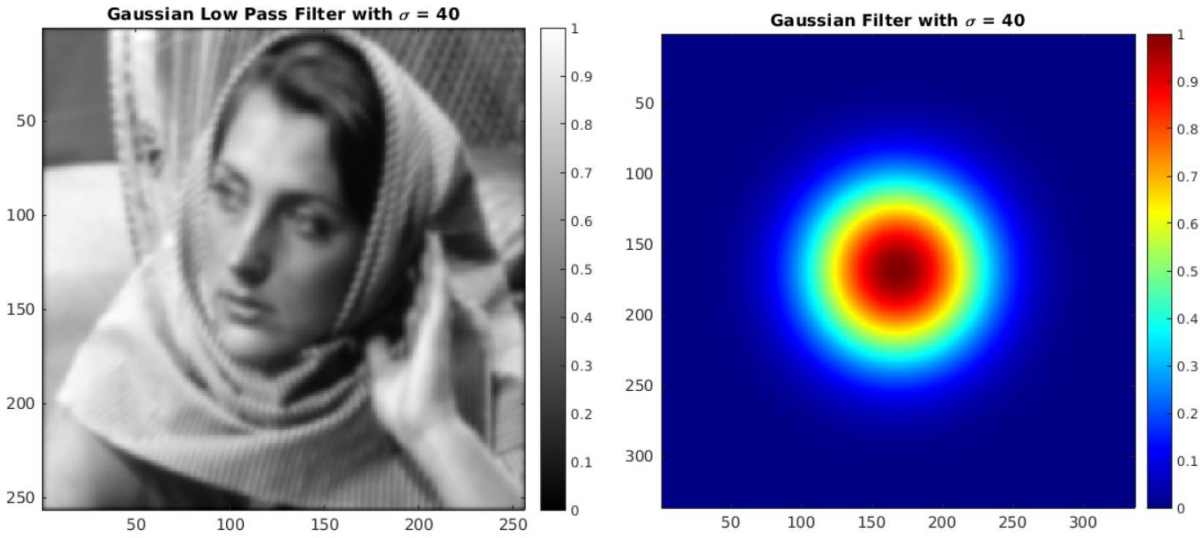
The output images are as follows:

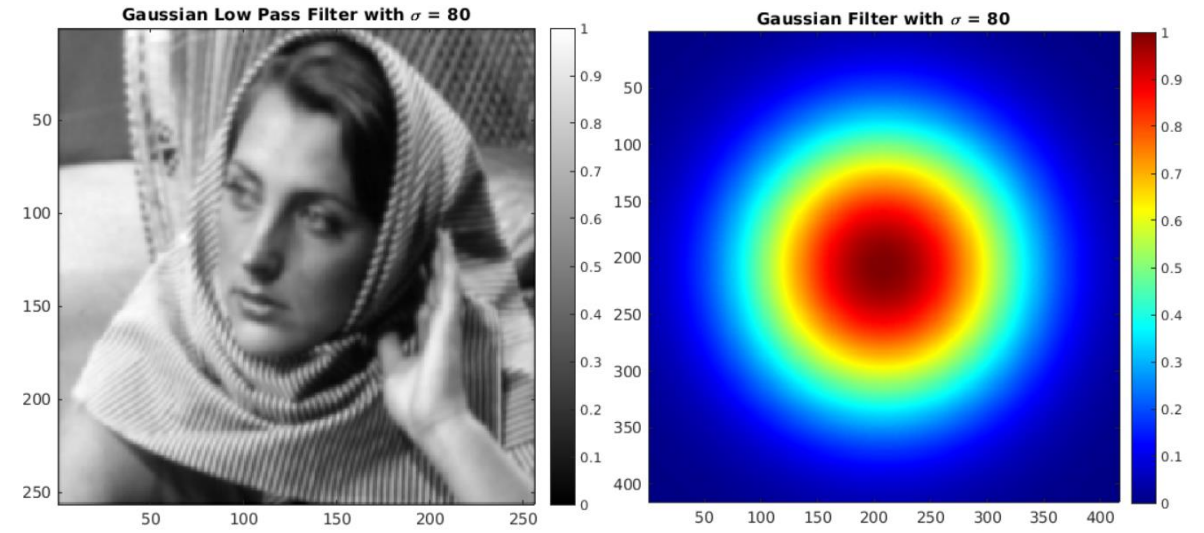






Following are the Observations:

1. Image blurring is seen in both the cases.

2. The ringing artifacts are clearly seen when ideal low-pass filter is applied whereas they are not present in case of the gaussian low-pass filter. These ringing features are due to convolution with jinc function (Inverse Fourier transform of ideal low pass filter) in spatial domain. With increase in D, higher frequencies are included and hence there is less blurring of edges. The frequency of ringing increases with increase in D.

3. Gaussian filter works better than ideal low pass in terms of ringing phenomenon.

4. Zero padding was done to avoid aliasing. Convolving $(2D + 1 \times 2D + 1)$ filter with $m \times n$ image in spatial domain will produce image of size $(m + 2D \times n + 2D)$. Hence padded filter of this size is produced in frequency domain with desired characteristics.