Homework 3 Question 2

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1. **Introduction**:
   In this assignment, we implemented two types of low pass filters, namely the ideal low pass filter and the Gaussian low pass filter, with different cutoff frequencies and standard deviations, respectively. We applied these filters to the ”barbara256.png” image and analyzed their effects. Additionally, we examined the frequency responses of these filters and the Fourier transforms of the original and filtered images.

2. **Implementation**:
   2.1. Reading and Preprocessing the Image We started by reading the ”barbara256.png” image and converting it to a double precision format. The original image was displayed for reference. To ensure proper filtering, we padded the image to double its dimensions.

   2.2. Ideal Low Pass Filter For the ideal low pass filter, we implemented the IdealLowPass_filter function. This function computes the Fourier transform of the input image, creates a filter with a specified cutoff frequency, and applies the filter in the frequency domain. The resulting image was obtained by performing the inverse Fourier transform.

   2.3. Gaussian Low Pass Filter Similarly, we implemented the GaussianLowPass_filter function for the Gaussian low pass filter. This function applies a Gaussian filter to the Fourier transform of the input image based on a given standard deviation (σ). The inverse Fourier transform yields the filtered image.

3. **Explanation and Discussion**:
   The **ringing** artifacts are visible for ideal low pass filter and not for gaussian low pass filter as can be seen in the image shown below
   Thus, the gaussian low pass filter is effective in removing the ringing artefacts caused due to the Jinc function

P.T.O

Ideal LPF D = 40

Ideal LPF D = 80

Gauss LPF σ = 40

Gauss LPF σ = 80