Project 4
Digital Image Processing
CSCE 4240/5225 – Spring 2022
Distributed: Friday, March 4
Due: Friday, March 24

[Solutions to this assignment must be submitted via the CANVAS web site prior to midnight on the due date. It may be submitted a day late with NO penalty. It may be submitted the second day after the due date but penalized 10 pts. This is an assignment to be performed by individuals, not groups. No one has my permission to copy a solution from another or to allow another to copy from his/her solution. Such behavior will be a grading criterion and, if found, result in a ZERO grade for this assignment.]

Purpose: (1) To familiarize you with tools for converting spatial images to frequency-based numeric matrices, visualizing the frequency form, and the inversion of the frequency form to the spatial form, and (2) encourage you to study the Fourier Transform properties in Table 4.1 of the textbook.

What to do:

- Convert the image (fetched from CANVAS) to the frequency form using a Fourier Transform (call it FFT1).
- Take the conjugate (call it FFT2) of the FT from the first step (FFT1).
- Set to zero all the values of the FT from the first step within 50 cells of the origin (call it FFT3).
- Set to zero all the values of the FT from the first step NOT within 50 cells of the origin (call it FFT4)

To clarify the above steps, the sequence of frequency form "images," are summarized in the table below.

FFT1	The Fourier transform (FT) of the original spatial image.
FFT2	The conjugate of each component in the FFT1 matrix
FFT3	Same as the FFT1 matrix except all the values within a radius of 50 of the origin are set to zero. (Remember the origin is the center component of the discrete FT array.)
FFT4	Same as the FFT1 matrix except all the values NOT within a radius of 50 of the origin are set to zero.

That which is to be submitted is described here. The "what to do" section above requests the printing the frequency-based images FFT1, …, FFT4. That DOES NOT MEAN to print and hand in many thousands of complex numbers. PLEASE DON'T SUBMIT PAGES AND PAGES FILLED WITH COMPLEX NUMBERS. There is an approach to visualizing (printing) frequency matrices corresponding to images. Learn it (using the slides from CANVAS lectures or the internet).

Hand in: (1) The code for the tasks, (2) FFT1 and the spatial image that results from its inversion, (3) FFT2 and the spatial image that results from its inversion, (4) FFT3 and the spatial image that results from its inversion, and (5) FFT4 and the spatial image that results from its inversion (6) a report described below.

Report: A report, approximately, one page in length, noting your observations and your hypotheses concerning the effects of each operation. *The report grade will be 25 points of the 100 points total for the assignment.* Note this is a higher percent than in the past. For the effects exhibited by FF2, you may wish to consult Table 4.1 of the text.