

Student ID:

Question 1 (10 marks)

The following figure shows (a) a 3-bit image of size 5-by-5 image in the square, with x and y coordinates specified, (b) a Laplacian filter.

	x	0	1	2	3	4	
y	0	3	7	6	2	0	Laplacian filter
	1	2	4	6	1	1	
	2	4	7	2	5	4	
	3	3	0	6	2	1	
	4	5	7	5	1	2	
							0 1 0
							1 -4 1
							0 1 0

(a)

(b)

Compute the following:

- The output of a 3×3 mean filter at (3,3).
- The output of a 3×3 median filter at (2,3).
- The output of the 3×3 Laplacian filter shown above at (1,3).
- Obtain the histogram of the image.
- Apply histogram equalization on the above image and calculate the histogram equalized image, and the new histograms.

Question 2 (10 marks)

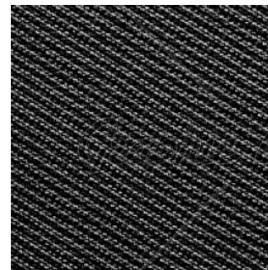
Consider the following images,



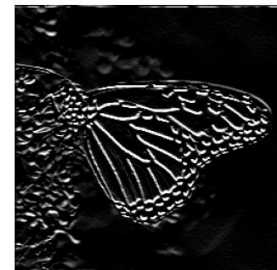
(a)



(b)

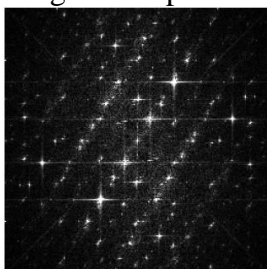


(c)

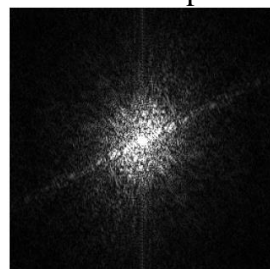


(d)

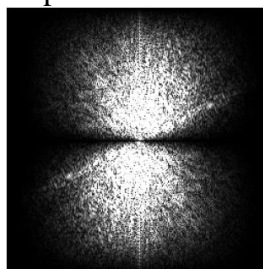
The modulus of the 2D DFT (followed by fftshift) of these images is shown below. Which image corresponds to which Fourier spectrum? Explain the reasons.



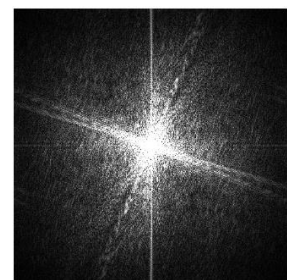
(1)



(2)



(3)



(4)

Question 3 (10 marks)

Suppose that you form a lowpass spatial filter that average the four immediate neighbors of a point (x,y) , but excludes the point itself.

- (a) Find the equivalent filter $H(u,v)$ in the frequency domain.
- (b) Show that your result is a lowpass filter.

Question 4 (10 marks)

Please refer the page 42-45 of lecture notes EE 4211_2B_2020, utilize spatial enhancement methods to enhance the images (in the attachment), and write codes for the task.

Question 5 (10 marks)

Please refer the page 46-48 of lecture notes EE 4211_3B_2020, utilize image enhancement methods in frequency domain to enhance the images (in the attachment), and write codes for the task.