PROBLEM-SOLVING EXERCISE #5

PROBLEM SOLVING 5 DELIVERABLES SUBMIT ONLINE ON MOODLE

You should work in teams of either two or three. You may not work alone. Turn in Parts A, B, C, D, and E along with your **chained email cover sheet** to the PS 5 - SUBMIT link on your lecture professor's moodle link by **December 5, 2022, 8:00 pm**. Submission should be a pdf document. One submission per team. **Be sure to clearly label everything you turn in**.

NOISE AND FILTERING

In many cases, data contain noise. This noise may be prohibitive to interpreting the data into useful, accurate information. Noise can come in several forms, an anomaly from the output of a sensor, noise with a normal distribution, salt and pepper noise, distortion at a particular frequency, and others. Filter can be used to remove or reduce the noise. Using filters, you can also remove or alter data that doesn't have noise and create 'noise' or special effects. In this problem-solving exercise we will use some basic methods to filter noise from data, including filtering an image.

PART A

For each of the following tables of values coming from a sensor, would it be best to use the values, the first derivative, or the second derivative to threshold noise? Explain. Apply the method you chose and identify the threshold rule (i.e. If x > y or x < y then noise)

i.

Sensor values	First Deriv.	Second Deriv.
21		
25		
29		
33		
38		
44		
38		
42		
46		
50		
54		

ii.

Sensor values	First Deriv.	Second Deriv.
176		
191		
208		
227		
248		
271		
285		
305		
327		
351		
377		

PART B

Given the following image, apply filter F to this image (do not use Matlab for this – do the calculations manually):

20	21	20	22	21	21
20	255	48	45	56	20
20	47	29	45	56	22
20	28	55	0	45	21
20	64	66	50	52	22
20	22	21	22	21	22

Filter F:

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

The '0' and '255' represent black and white noise, respectively. Comment on what happened to the noise after this filter was applied.

PART C

Use Matlab and apply the following filters to the posted hallway image (hall.bmp). Screen shot the resulting screen **for each** filter and turn them in.

i.

1/9	1/9	1/9
1/9	1/9	1/9
1/9	1/9	1/9

ii.

-1	-1	0
-1	0	1
0	1	1

PART D

An additional image has been posted on the web site including 2% salt and pepper noise (hallnoise.bmp). Use Matlab again and apply the mean filter (Part Ci) to remove the noise. Screen shot the resulting screen and turn it in.

PART E

Make your own cool 3 x 3 filter or look one up on the Internet and apply it to the hallnoise image using Matlab again. Remember that it's best if your filter adds to 1. Turn in a screen shot of the result and the values of your filter.
