Implement a simple mean filter of kernel 3x3 and 5x5. Also implement a median filter of the same size kernels. Apply it on the ‘ruler’ image sent for the assignment. …….. 4

The images need to be embedded in the following table (remove the […] and embed the corresponding image).

	Kernel Size 3x3	Kernel Size 5x5
Mean Filter		
Median Filter	[Image to be input here]	[Image to be input here]

Which of these two filters preserve the edges better and why?

Sharpen the ‘tank’ image using first and second order techniques. Embed the resulting images in the following table. …… 6

In place [technique#] write the name of the operator and size of mask.

First Order		Order	
[Technique 1]	[Image to be input here]	[Technique 1]	[Image to be input here]
[Technique 2]	[Image to be input here]	[Technique 2]	[Image to be input here]
[Technique 3]	[Image to be input here]	[Technique 3]	[Image to be input here]

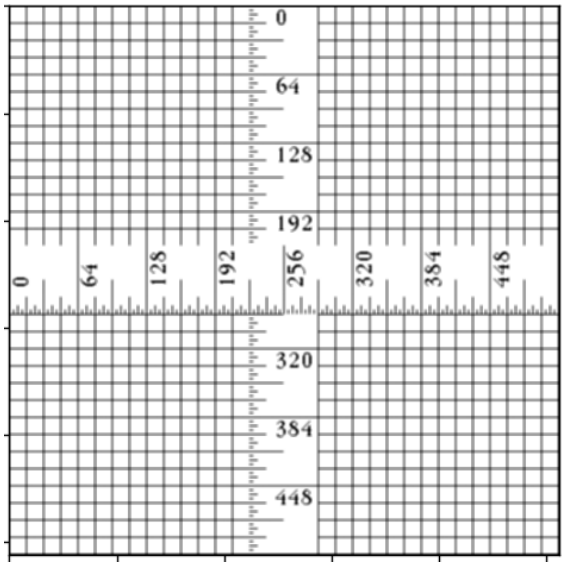
Add more rows to the table if needed

This question is kept purposefully open ended. Not all the techniques have been discussed in class. Marks will be assigned based on ranking. Students with the best results will be given the highest marks (out of 2). The rest (4 marks) will be based on your effort, i.e. higher the effort higher will be the marks.

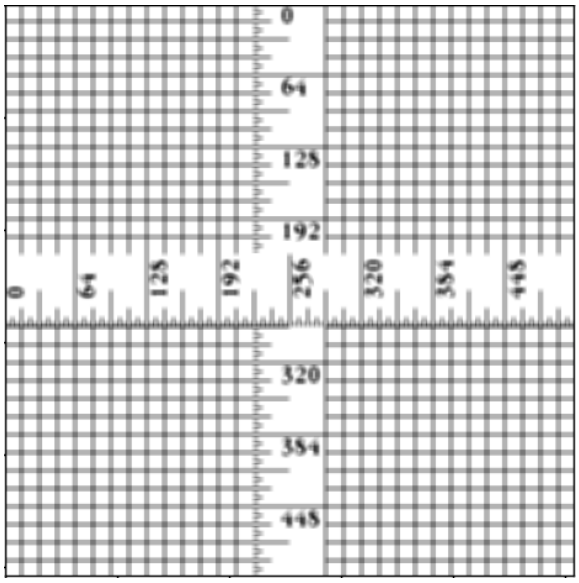
Answers:

Mean Filters:

a) 3x3

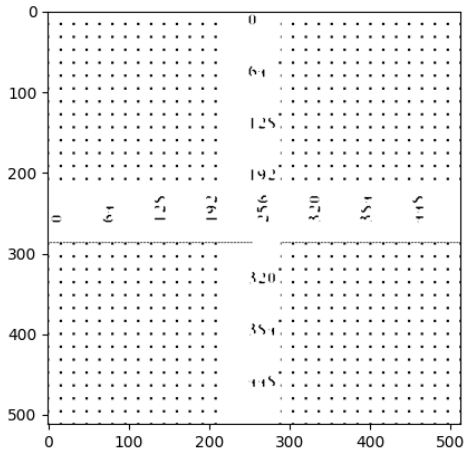


b) 5x5

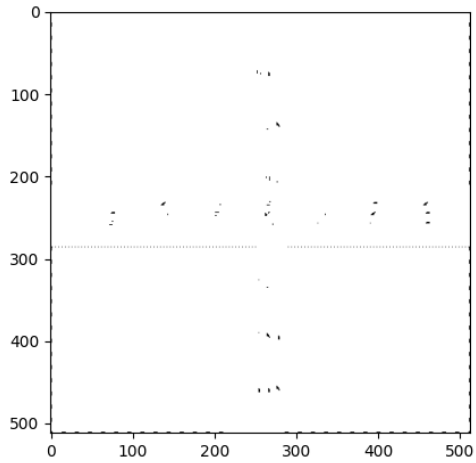


Median Filters

a) 3x3



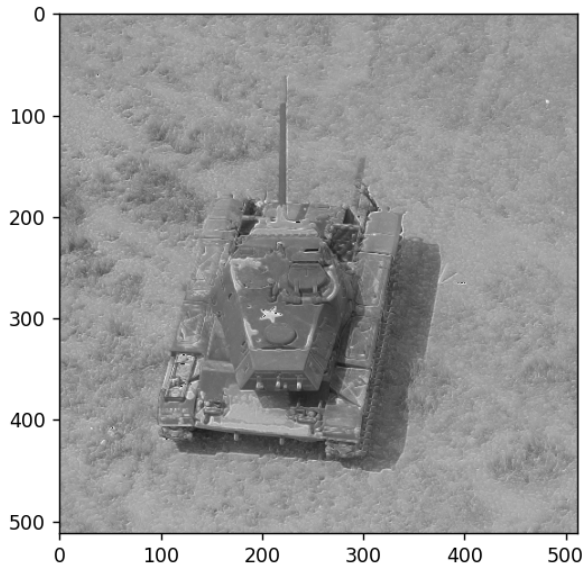
b) 5x5



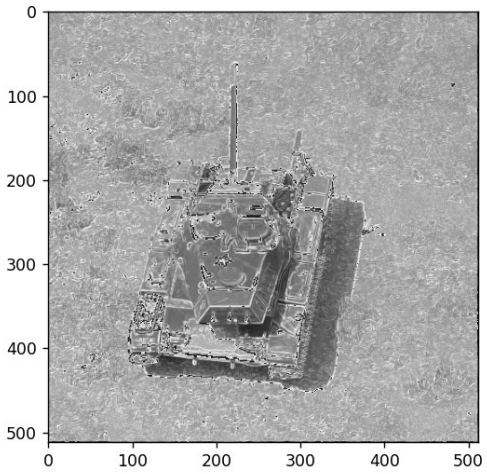
1) Mean filters are used to reduce the noise and smoothen the picture. We replace the value of the pixel with the average of the neighbouring pixels.
2) Median filter is also used to reduce the noise and smoothen the picture. We replace the value of the pixel with the median value among the neighbouring pixels.
3) Median filter is used to remove salt and pepper noise. This is when there are extreme changes in neighbouring pixels like img[i][j] = 0 and img[i+1][j] = 255. Here median filter performs better.
4) In case we need to blur a part of the image, eg blur a person's face from an image, etc, we need to mean filter instead of a median filter.
5) The type of filter to be used depends on the work that we need to perform. Median filters are somewhat slightly better but at the cost that they are not linear and thus computationally heavy.

First order filter:

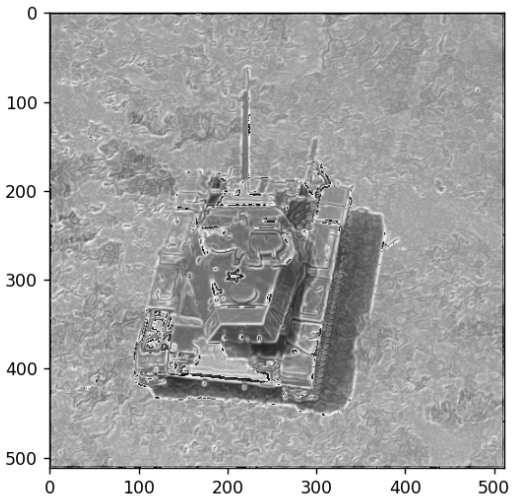
a) Sobel 2x2



b) Prewitt 3x3

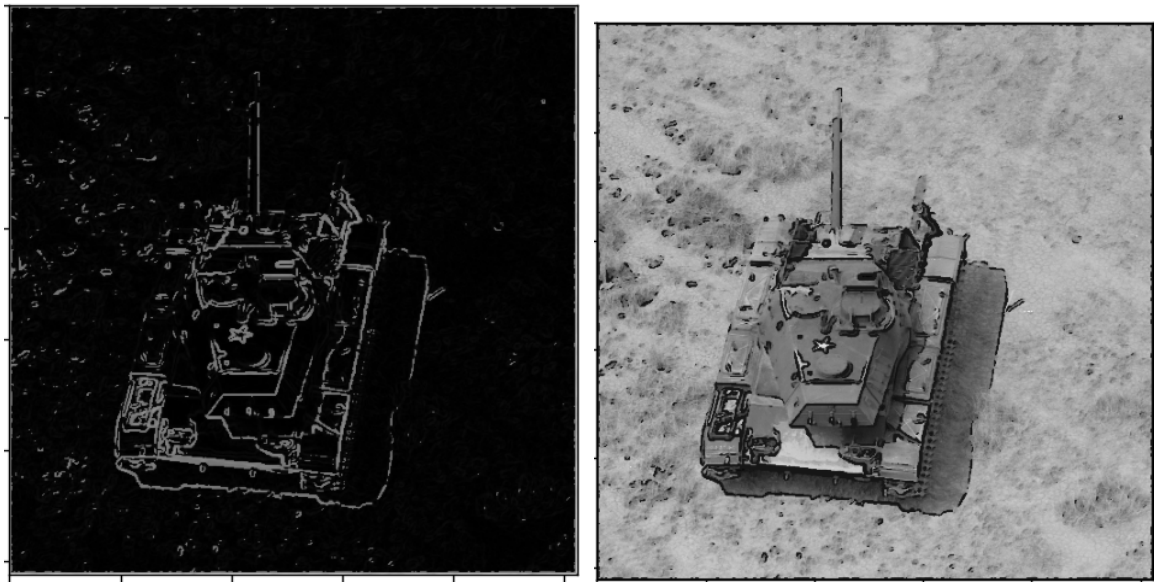


c) Robert 3x3



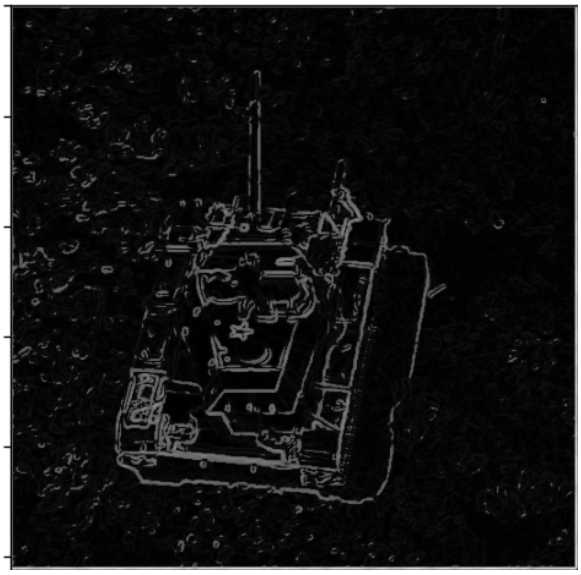
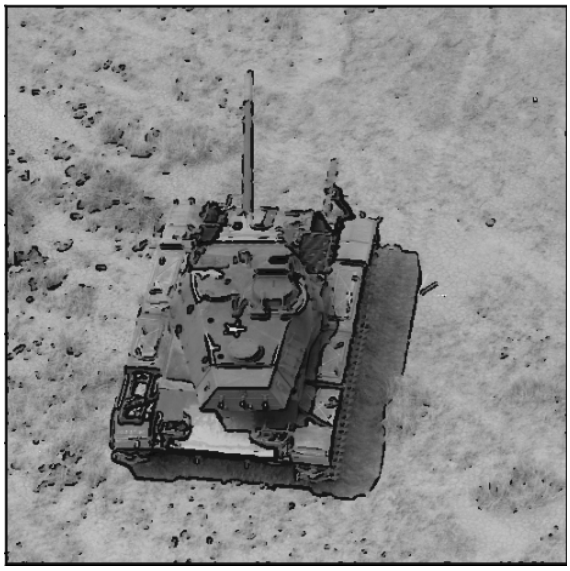
d) Sobel 2x2 with Gaussian filter and thresholding:

Masking : Sharpened Image:



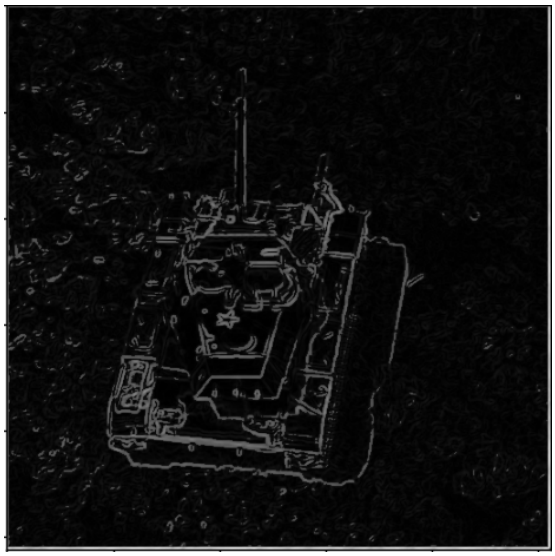
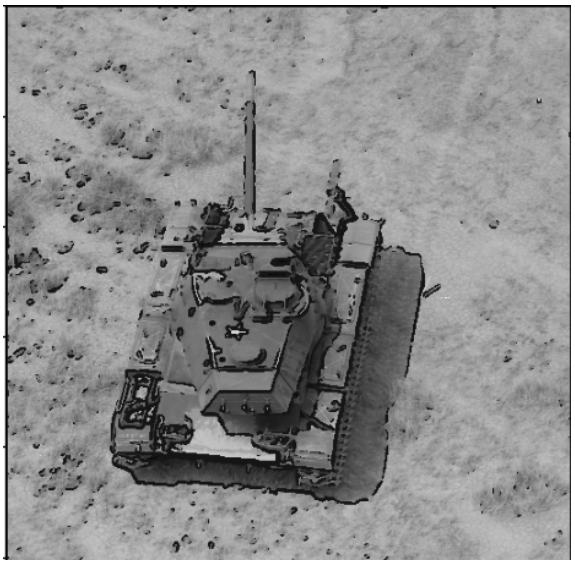
e) prewitt 3x3 with Gaussian filter and thresholding:

Masking: Sharpened Image:

f) Robert 3x3 with Gaussian filter and thresholding

Masking: Sharpened Image:

Second order:

a) Gaussian + Laplacian with Edge detection:

Kernel = sharpen = np.array([

[-1, -1, -1],

[-1, 9, -1],

[-1, -1, -1]

])

Image;

b) Gaussian Blur and Laplacian

kernel = sharpen = np.array([

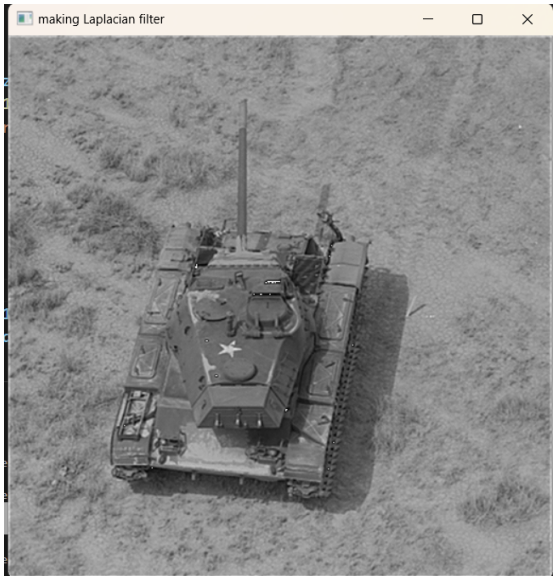
[0, -1, 0],

[-1, 5, -1],

[0, -1, 0]

])

Image:



c) Gaussian with self-made kernel (name of the file is self_made_filter_1.py)

kernel = sharpen = np.array([

[-1, -2, -1],

[-2, 13, -2],

[-1, -2, -1]

])

Image =

d) Gaussian with self-made kernel (name of the file is self_made_filter_2.py)

Kernel = sharpen = np.array([

[-2, -1, -2],

[-1, 13, -1],

[-2, -1, -2]

])

Image =

e) 4 times mean filter and random kernel (name of the file is self_made_filter_4.py)

kernel = sharpen = np.array([

[0, 0, 3, 2, 2, 2, 3, 0, 0],

[0, 2, 3, 5, 5, 5, 3, 2, 0],

[3, 3, 5, 3, 0, 3, 5, 3, 3],

[2, 5, 3, -12, -23, -12, 3, 5, 2],

[2, 5, 0, -23, -40, -23, 0, 5, 2],

[2, 5, 3, -12, -23, -12, 3, 5, 2],

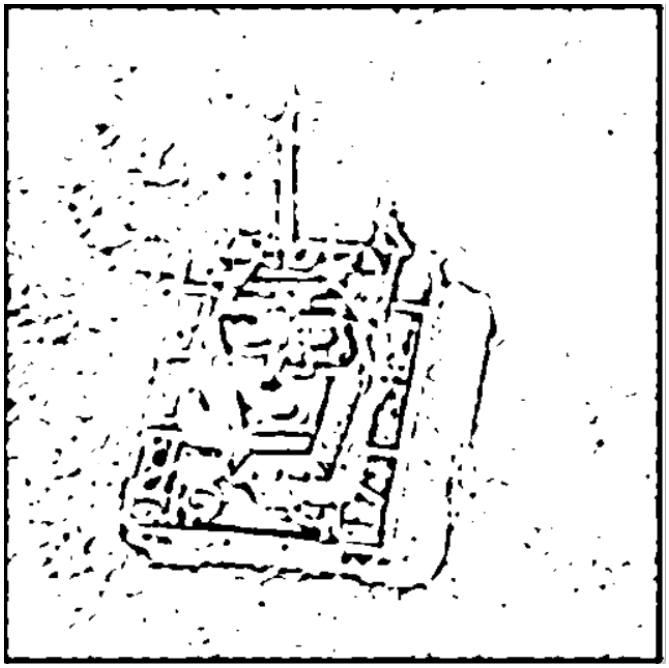
[3, 3, 5, 3, 0, 3, 5, 3, 3],

[0, 2, 3, 5, 5, 5, 3, 2, 0],

[0, 0, 3, 2, 2, 2, 3, 0, 0],

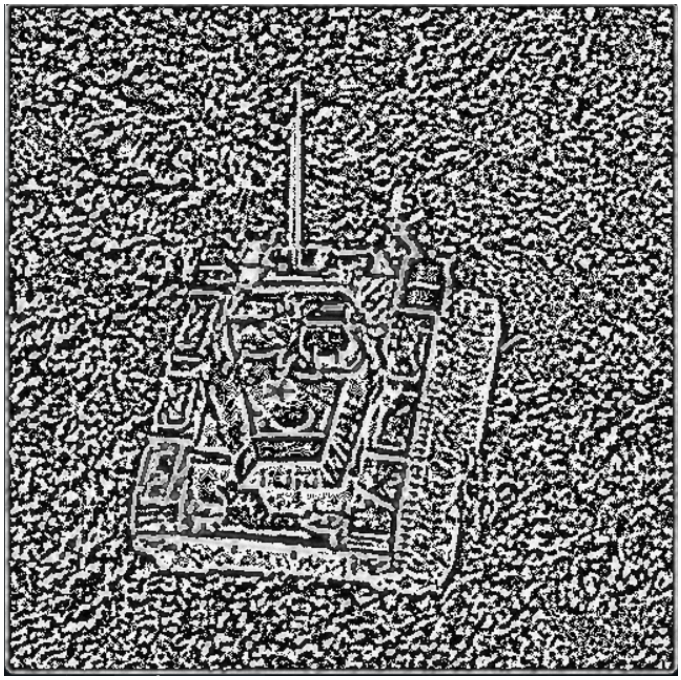
])

mask =



f) gaussian and random kernel (file name as self_made_kernel_4.py)

```
kernel =     sharpen = np.array([
                [0, 0, -1, 0, 0],
                [0, -1, -2, -1, 0],
                [-1, -2, 16, -2, -1],
                [0, -1, -2, -1, 0],
                [0, 0, -1, 0, 0],
             ])
mask =
```



g) doG filter Difference of Gaussian

mask obtained by gaussian 3x3 filter - gaussian 5x5 filter

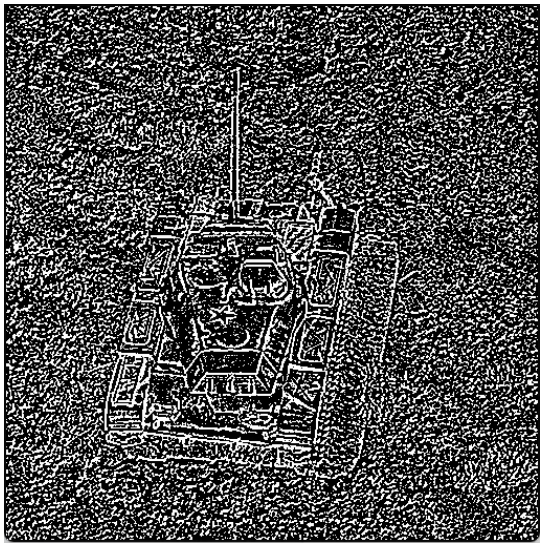


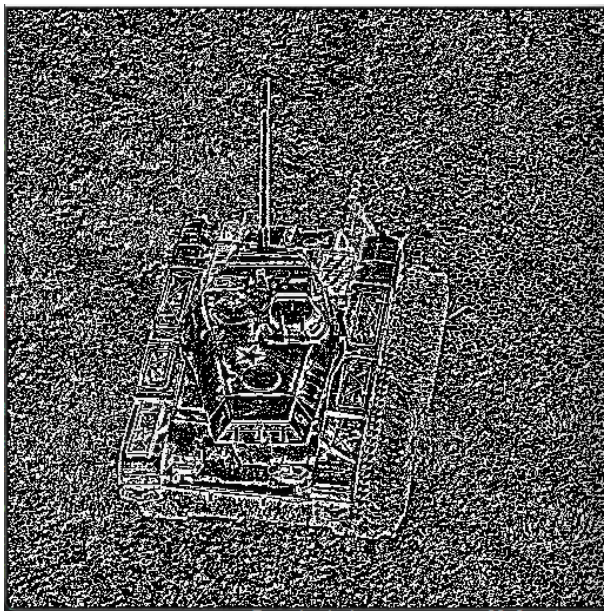
Image =

Unsharpening

a) mean filter 3x3

for the improved image I have applied the filter 3 times

mask: sharpened Image:



b) mean filter 5x5

for the improved image I have applied the filter 3 times

mask: sharpened Image: