Student ID:

Question 1 (10 points)

Write a MATLAB/python program as following instructions:

- input a gray-scale image '1.tif'.
- apply sobel filter on the image
- define a threshold as the 15% of the maximum of the gradient magnitude. Then for each pixel, if the gradient magnitude is smaller than the threshold, change the gradient magnitude to zero. Show corresponding image.
- Utilize the Hough transform to detect the two lines and process edge linking.
- Note: Utilize subplot to plot 4 images, including original image, the processed gradient magnitude, hough transform with largest two points, detected two lines in the original images.
- Note: you need to provide sufficient comments on the codes.

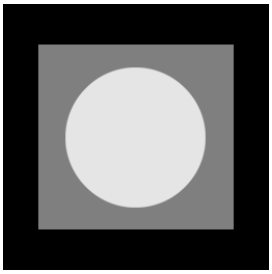
Question 2 (20 marks)

Write a MATLAB/python program as following instructions:

- input a gray-scale image '2.tif'
- Apply butterworth low pass filtering, laplacian filtering on the image. Use subplot to plot 3 images, including original image, the one with butterworth low pass filtering and the one with laplacian filtering
- Add salt noise to the image, choose one of suitable mean filters and one of the suitable Order-Statistics filter to remove noise. Use subplot to plot 4 images, including original image, noise image, image after the first kind of filter, image after the second kind of filter
- Note: you need to provide sufficient comments on the codes.

Question 3 (10 points)

Given the following image,



Please match the filter banks and the corresponding processed images. Explain your reasons.

2	-1	-1
-1	2	-1
-1	-1	2

(a)

-1	-1	2
-1	2	-1
2	-1	-1

(b)

-1	-1	-1
2	2	2
-1	-1	-1

(c)

-1	2	-1
-1	2	-1
-1	2	-1

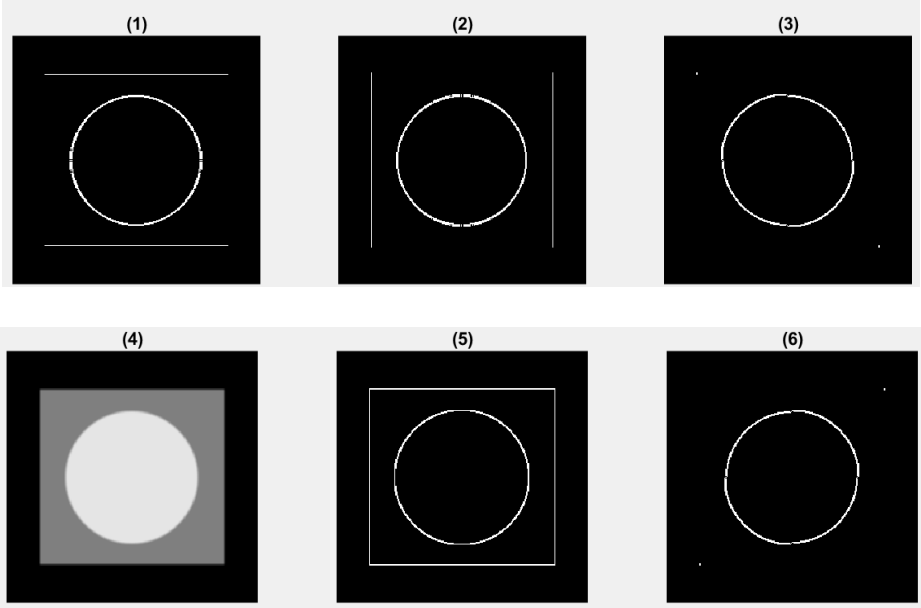
(d)

1	1	1
1	-8	1
1	1	1

(e)

1	1	1
1	1	1
1	1	1

(f)



Question 4 (10 points)

(a) Consider the images shown. The image on the right was obtained by lowpass filtering the image on the left with a Gaussian lowpass filter and then highpass filtering the result with a Gaussian highpass filter. Explain why the center part of the finger ring in the figure on the right appears so bright and solid.

(b) Do you think the result would have been different if the order of the filtering process had been reversed?