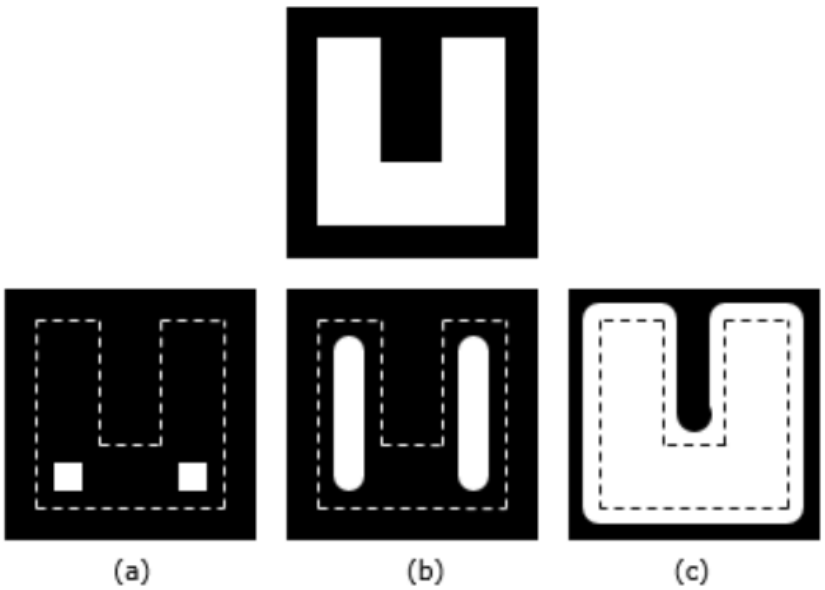
HW2 for EE 4211 2020/2021A

Student ID:
Name:

Question 1 (10 marks)
The following figure shows an image that has been corrupted by either salt noise or pepper noise. Is it salt noise or pepper noise? Given a choice of (1) arithmetic mean filter; (2) harmonic mean filter; and (3) contraharmonic mean filter, which one is most appropriate for this task. Explain. (10 marks)

Question 2 (10 marks)
With reference to the image shown, give the structuring element and morphological operations that produced each of the results shown in images (a) through (c). Show the origin of each structuring element clearly. The dashed lines show the boundary of the original set and are included only for reference. Note that in (c) all corners are rounded.

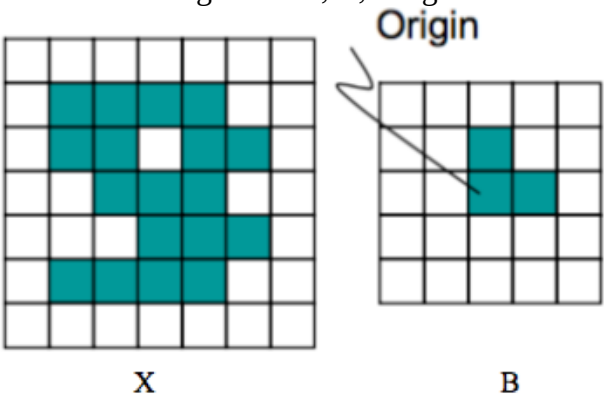


Question 3 (10 marks)

Dilation and Erosion are two primitive operators, which may be used to define other morphological operations.

(a) Explain how erosion and dilation is performed. (2 marks)

(b) Binary image, X and structuring element, B, are given as follows



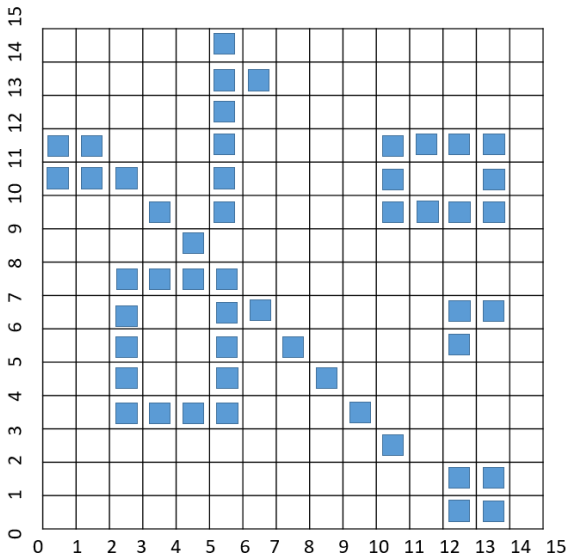
Calculate Y1= XΘB, where Θ denotes the morphological erosion operator and Y2= X⊕B where ⊕ denotes the morphological dilation operator; (4 marks)

(c) Calculate the corresponding closing procedure. (4 marks)

Question 4 (10 marks)

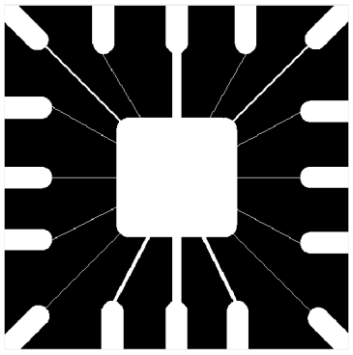
(a) In the Hough Transform, a point (x0, y0) in the xy-plane is mapped into a curve in the (ρ, θ)-parameter space. Write down the equation of the curve and explain the reason. (4 marks)

(b) If we apply the Hough transform on the image below, what would be the maximum values for the accumulator cell in the (ρ, θ) space? What are the corresponding (ρ, θ) values. (6 marks)



Question 5 (10 marks)

(a) Given an image,



Please match the filter banks and the corresponding processing images, explain the reason.

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

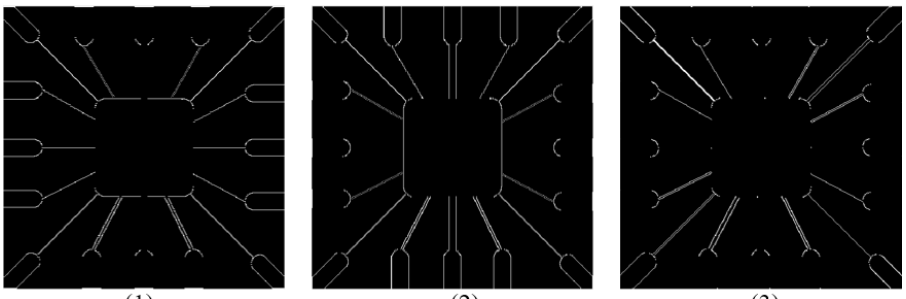
(d)

1	1	1
1	-8	1
1	1	1

(e)

1	1	1
1	1	1
1	1	1

(f)



(1) (2) (3)

(4) (5) (6)