MORPHOLOGICAL OPERATIONS

Set Theory:

- Deals with the properties of sets
- Examples are subset, union, intersection, complement and etc.
- For more information of these properties you may visit Mam Jing's pdf.

https://uvle.upd.edu.ph/pluginfile.php/506366/mod_resource/content/1/A8-%20Morphological%20operation%202019.pdf

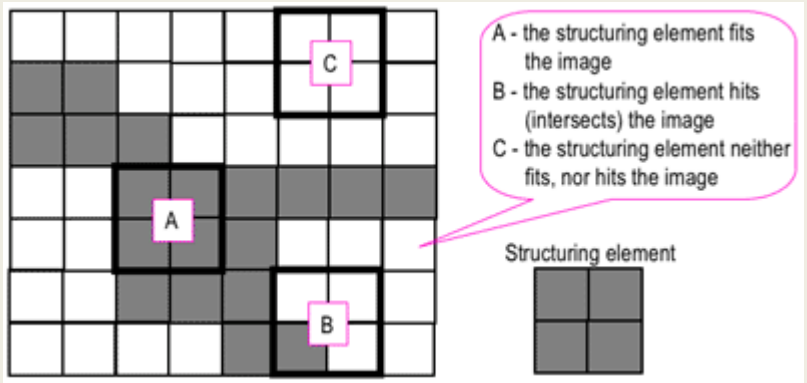
Morphology:

- Changes the image via Set Theory
- We will discuss 2 morphological operations: Dilations and Erosion
- Morphology is also dependent with the use a “structuring element” to change an image.
- Structuring element is a basis on how morphology is performed. It is usually binary (or logical)

Dilation

- Let z be the set of all points in the space and A is a subset of z while B is a structuring element.

- The Dilation of A by B of a pixel is true if and only if their intersection is not an empty set.

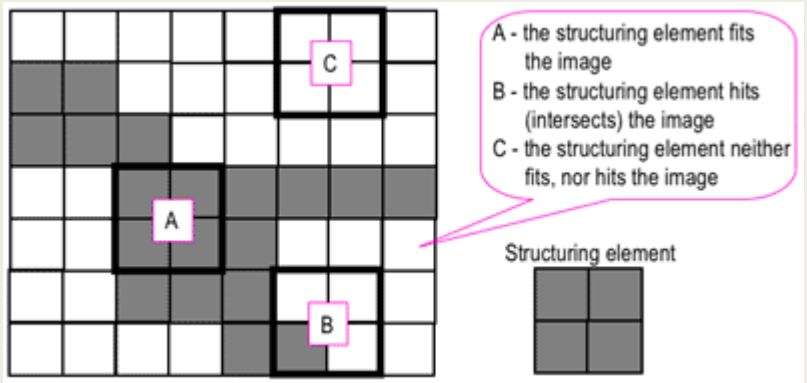


The Dilation of A and B by the structuring element is 1 since their intersection is not empty while it is 0 for C because their intersection is an empty set.

Erosion

- Let z be the set of all points in the space and A is a subset of z while B is a structuring element.

- The Erosion of A by B of a pixel is true if and only if A fits B perfectly or A and B are identical.



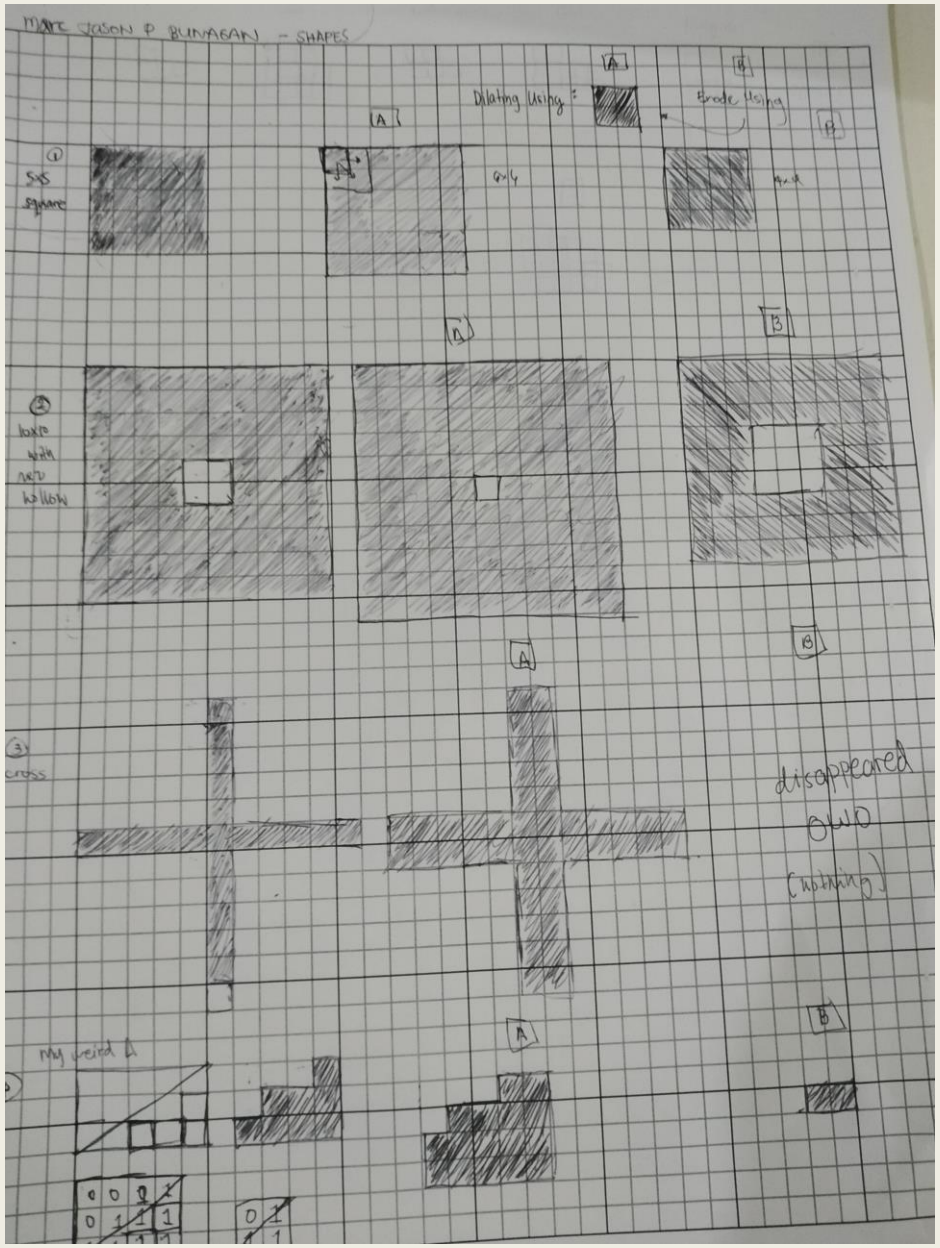
The Erosion of A by the structuring element is 1 since it is identical to the structuring element while it is 0 for B and C because they are not identical to the structuring element.

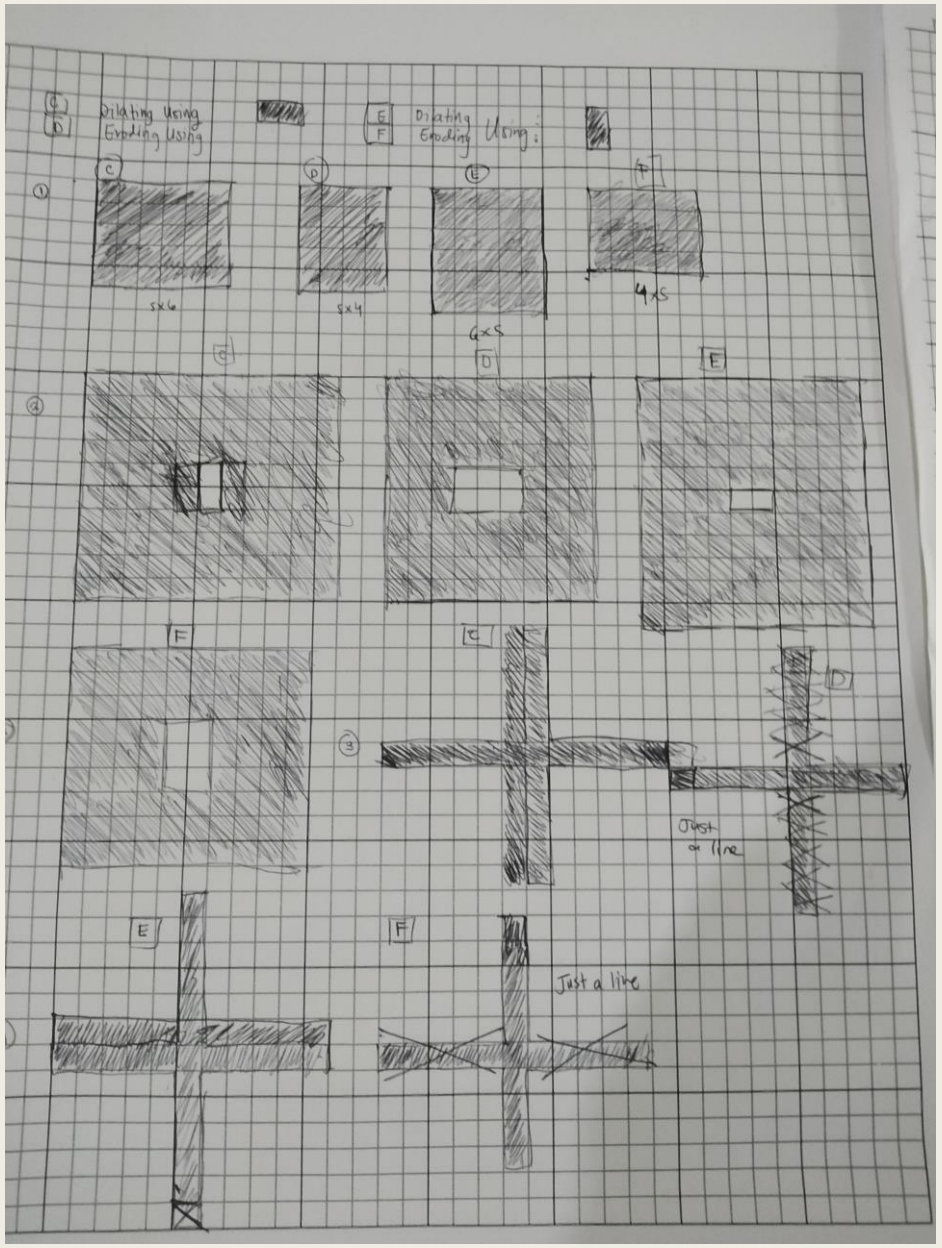
Hand drawn

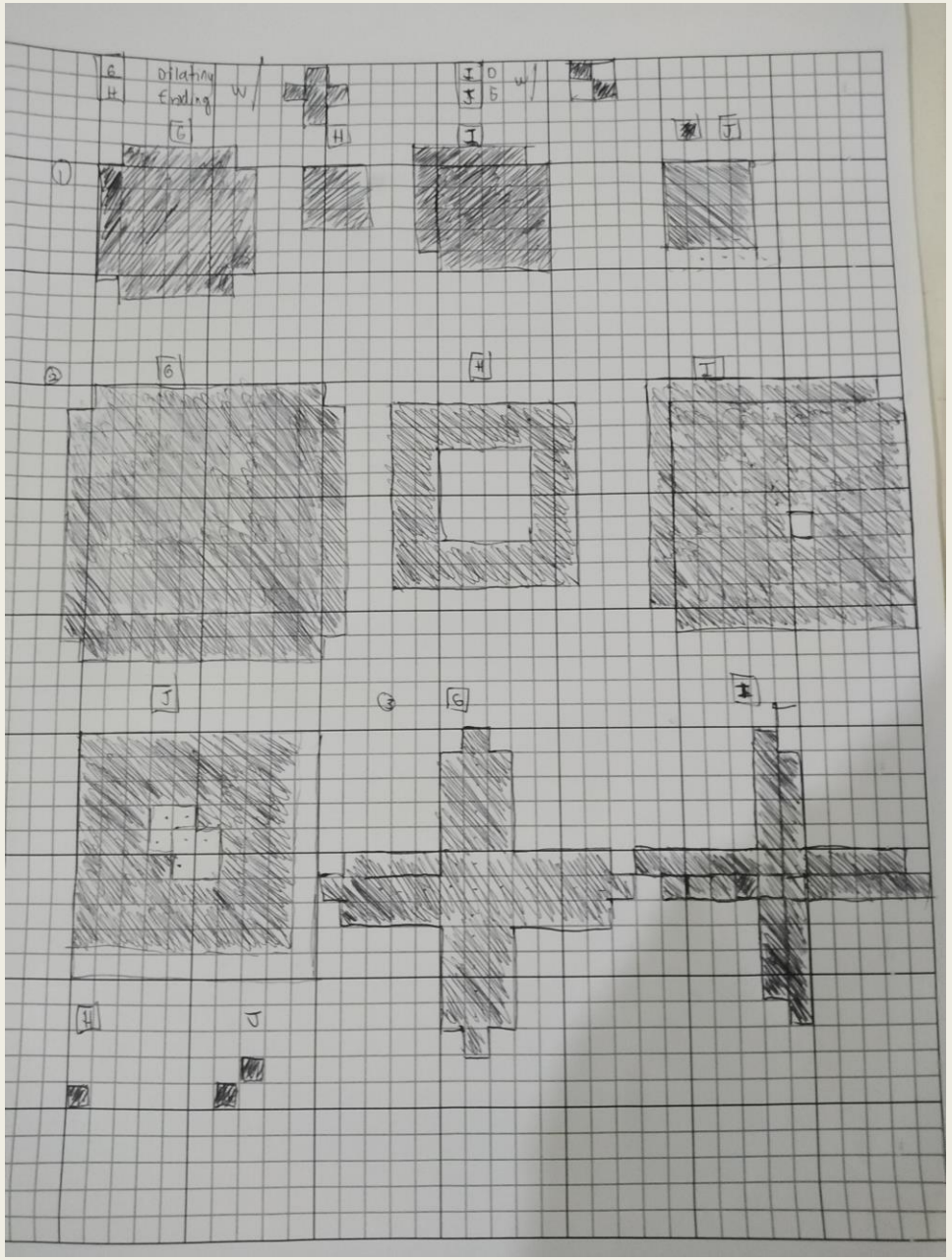
- Using my knowledge on how Dilation and Erosion works, I used my pen and graphing paper to predict the Dilation and Erosion of 4 different figures with, 5 different structuring elements.

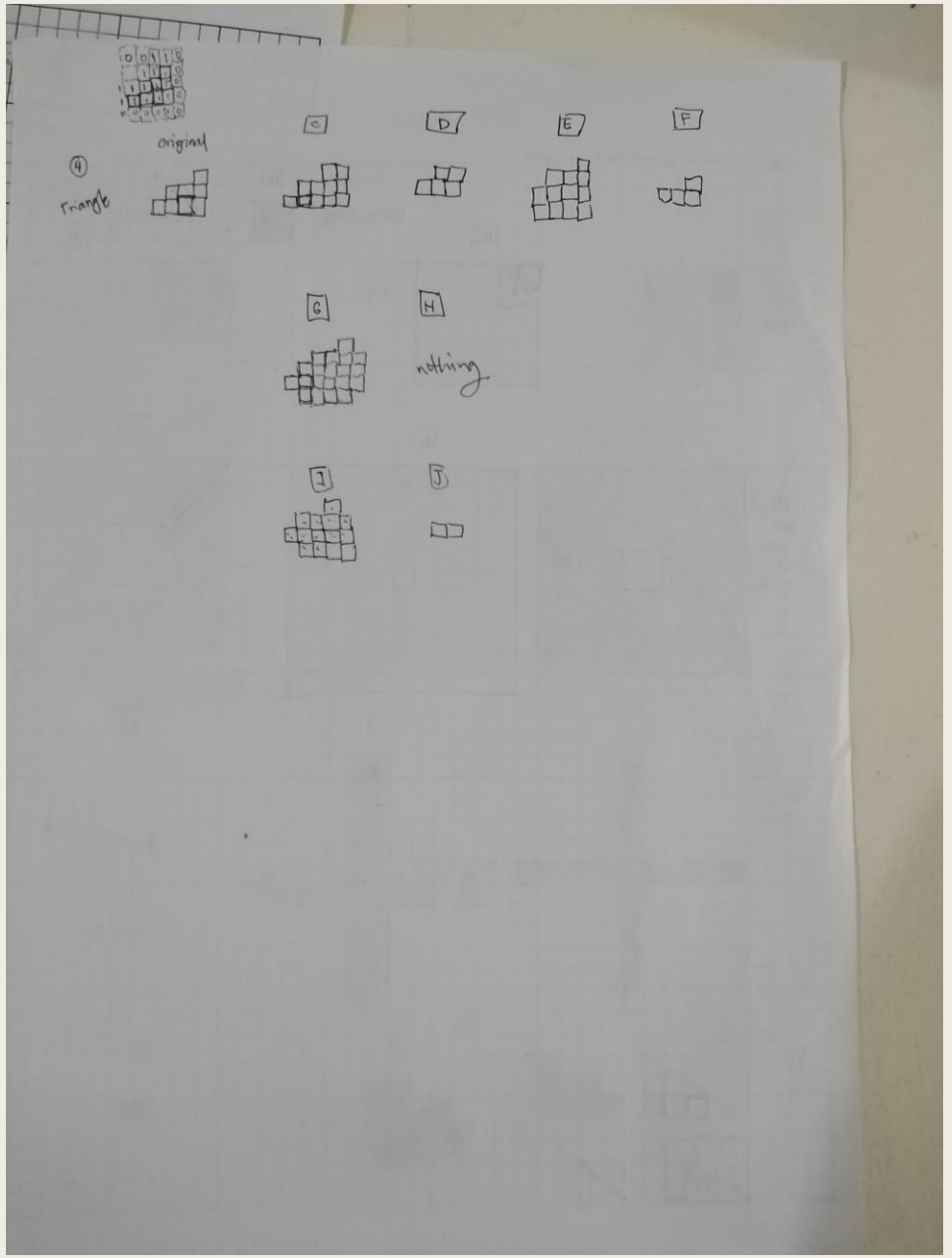
Figures (4):
1.) 5x5 square
2.) 10x10 square with 2x2 hollow
3.) cross with 5 pixel long ends
4.) 4x3 triangle

Structuring elements(5):
1.) 2x2 square
2.) 1x2 tile
3.) 2x1 tile
4.) cross with 1 pixel long ends
5.) a diagonal in a 2x2 matrix


Marc Jason P Bunagan - SHAPES
Dilating Using :
Erode Using
5x5 square
6x4
4x4
10x10 with 7x7 hollow
cross
disappeared
OWO
(nothing)
my weird Δ


Dilating Using
Eroding Using
Dilating
Eroding Using :
5x6
5x4
6x5
4x5
Just a line
Just a line


Dilating
Eroding


original
triangle
nothing

General Observation

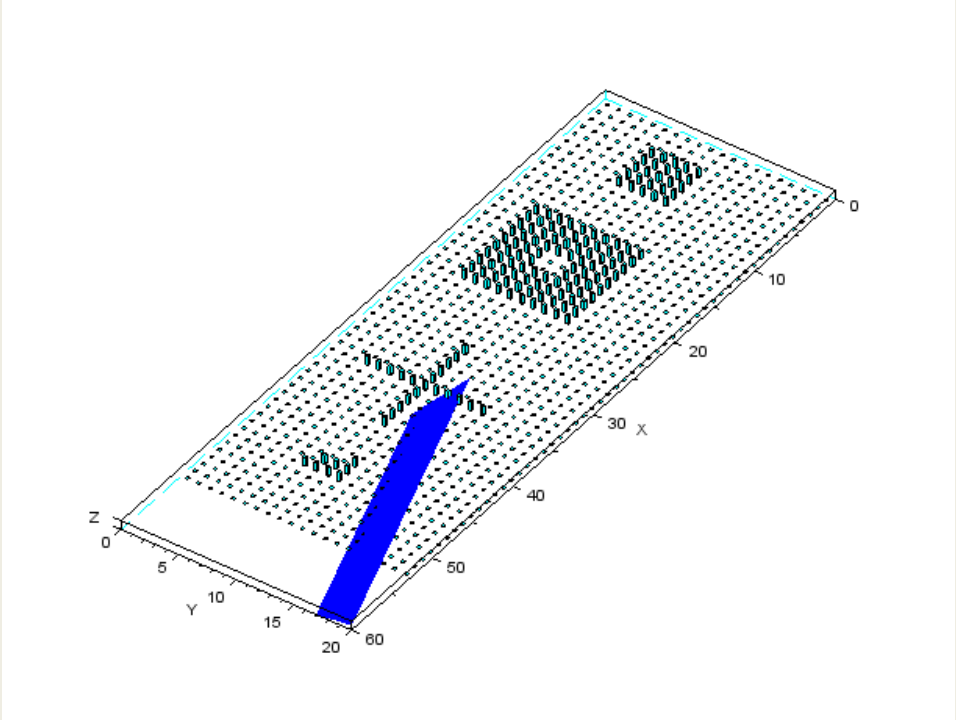
- Dilation: More blocks are added. (hence the name)
- Erosion: Blocks are subtracted (hence also the name)

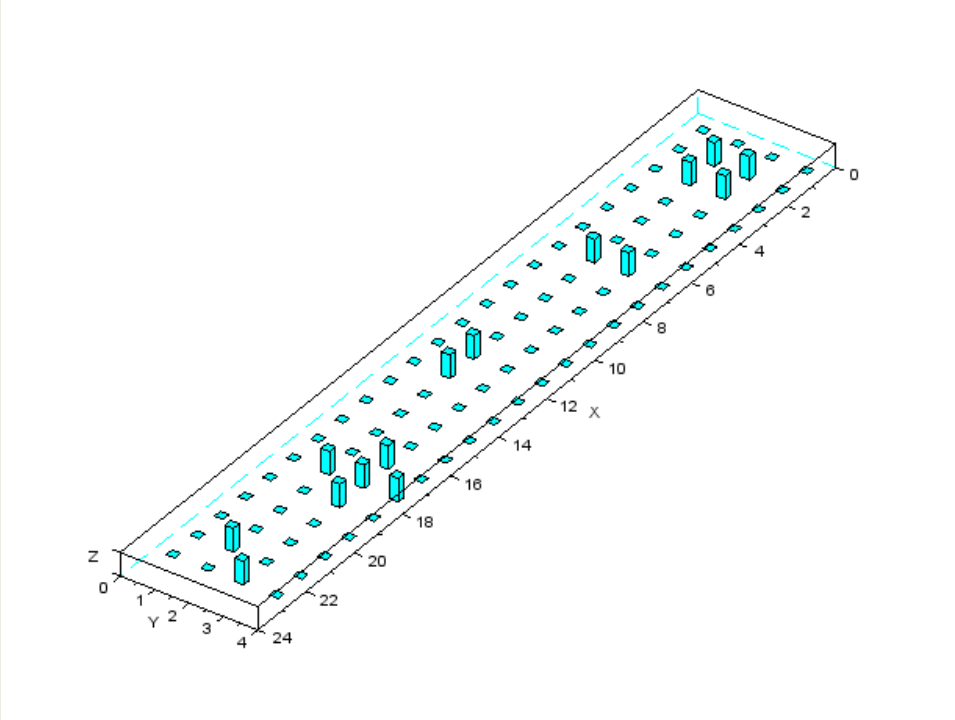
- I had initial errors in graphing especially the erosion of 2x1 and 1x2 of the cross because I forgot that it is impossible to have a structuring element in those places.
- The morphology is certainly dependent on the operation, figure and structuring element used.

Coded Results:

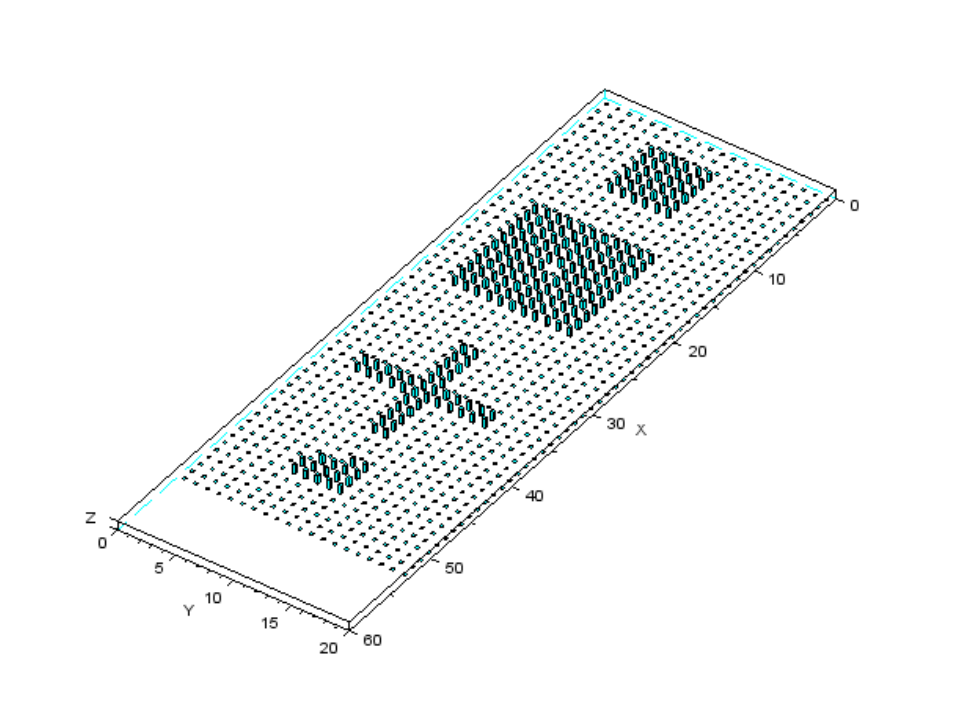
- I also coded what the morphologies look like to confirm my hand drawn predictions.
- The plot used was a 2D histogram from scilab because since it looks very small when you save it as an image. (Blurred when enlarged)

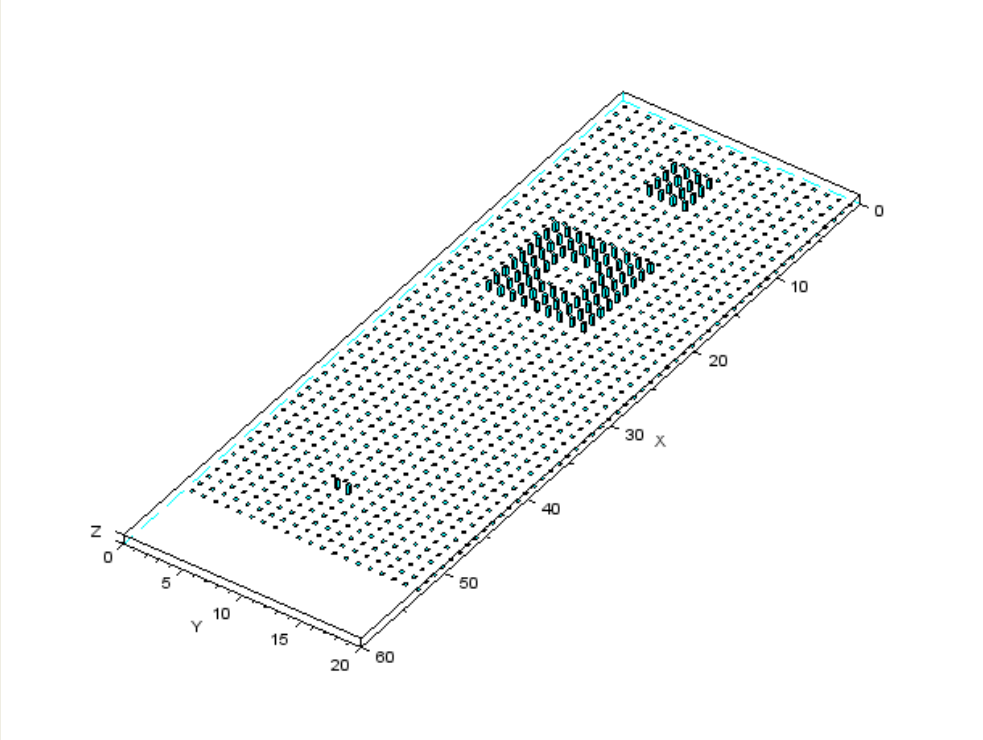
Original Figures (left) and Structuring elements (right):



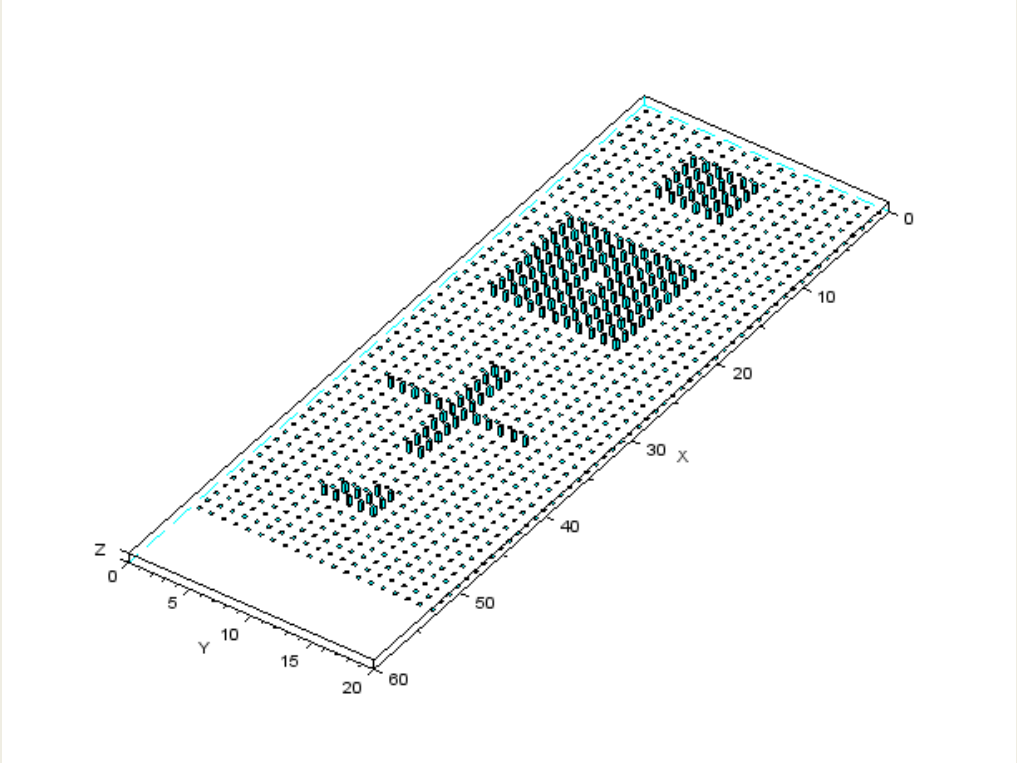


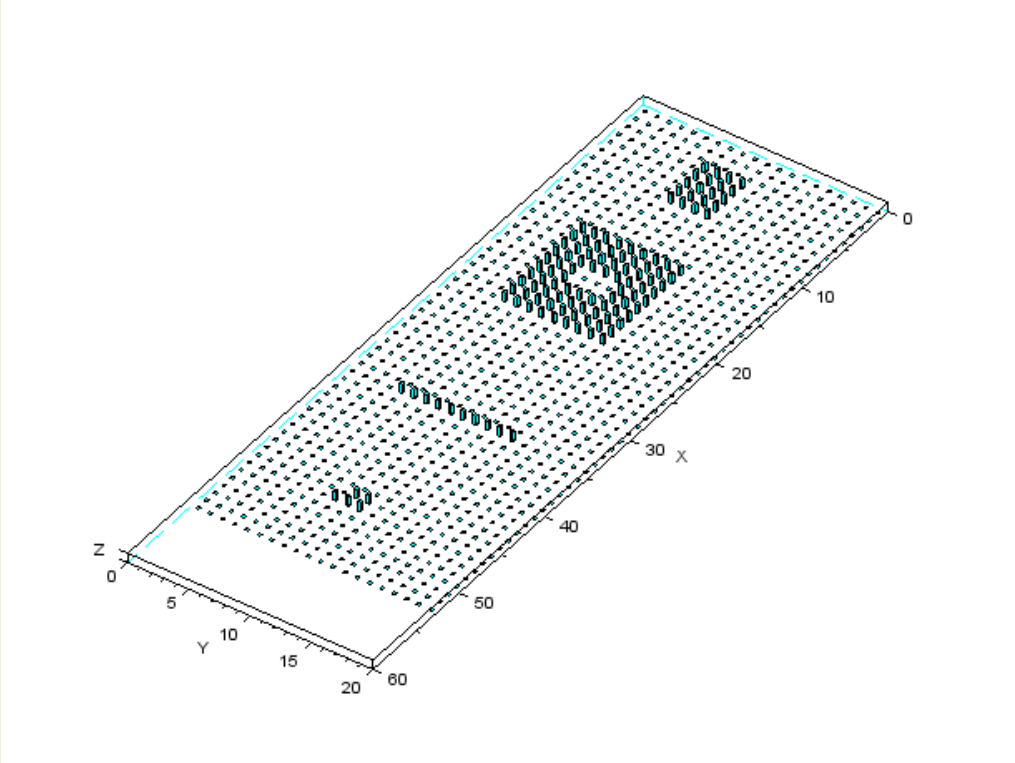
1.) Dilation with Square (left) and Erosion with Square (right):



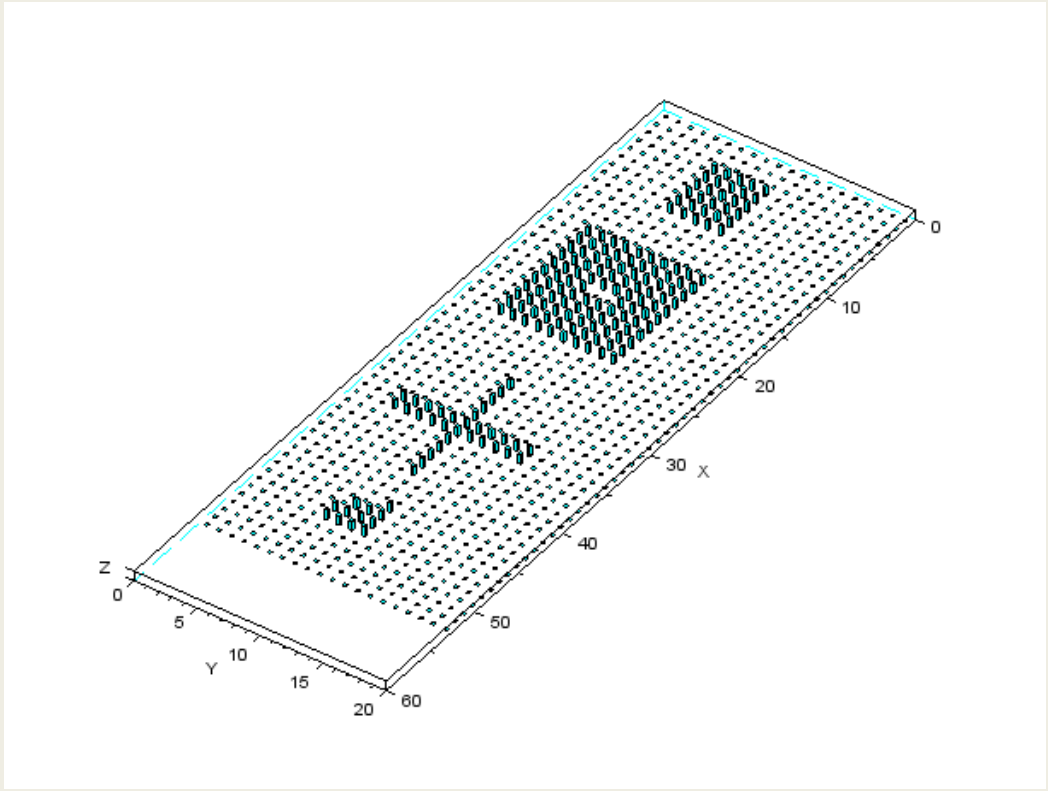


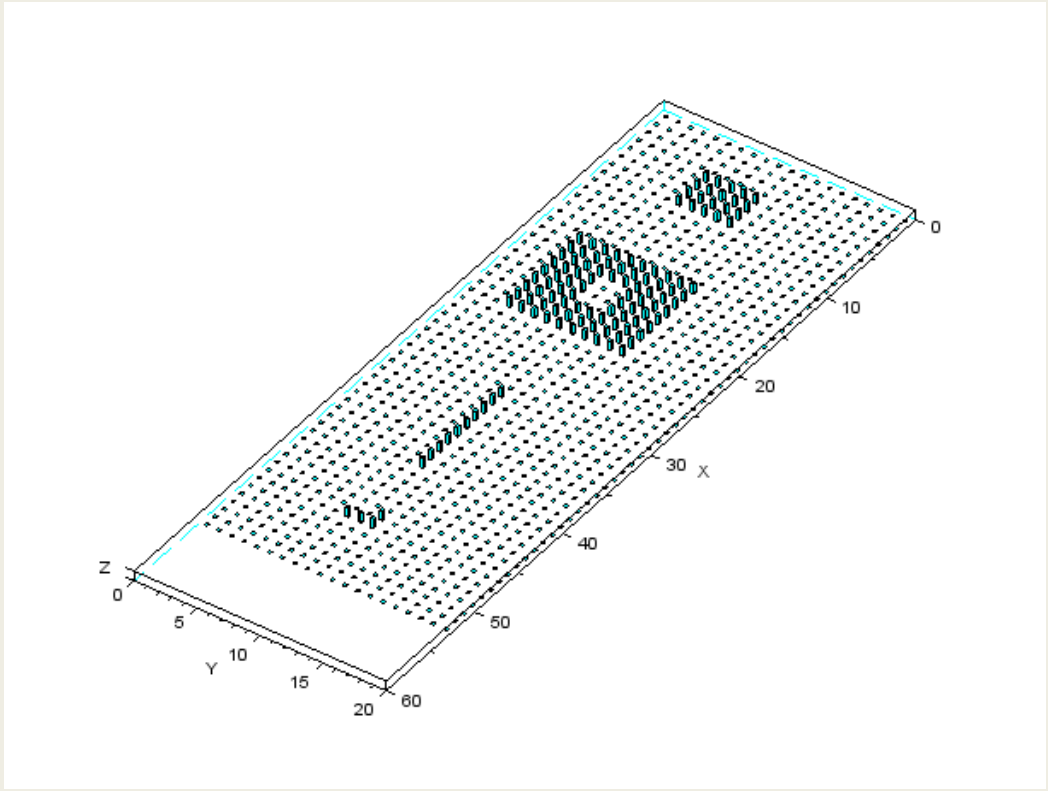
2.) Dilation with 1x2 (left) and Erosion with 1x2 (right):



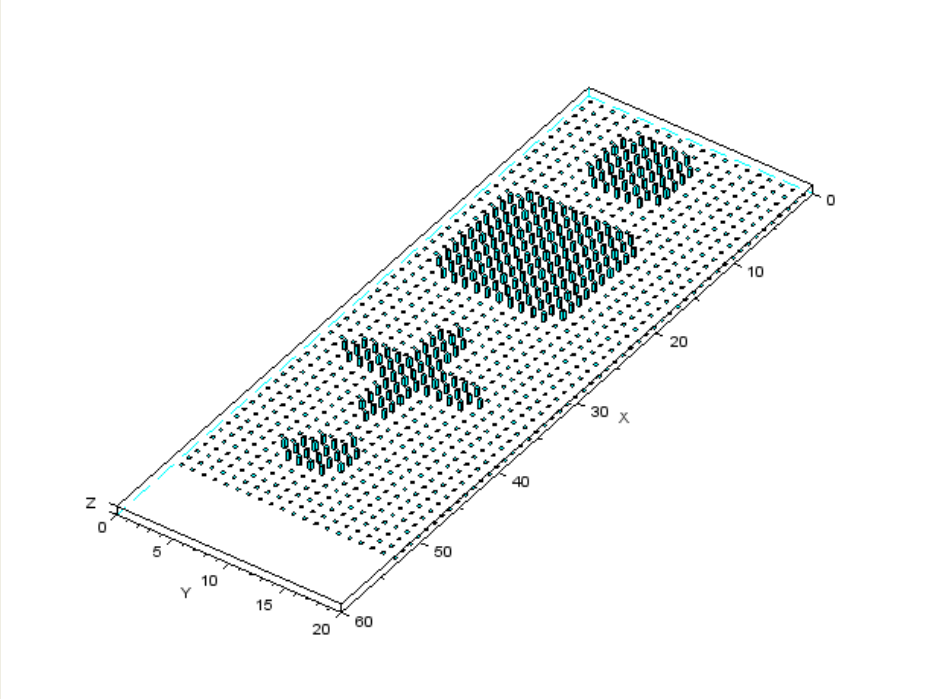


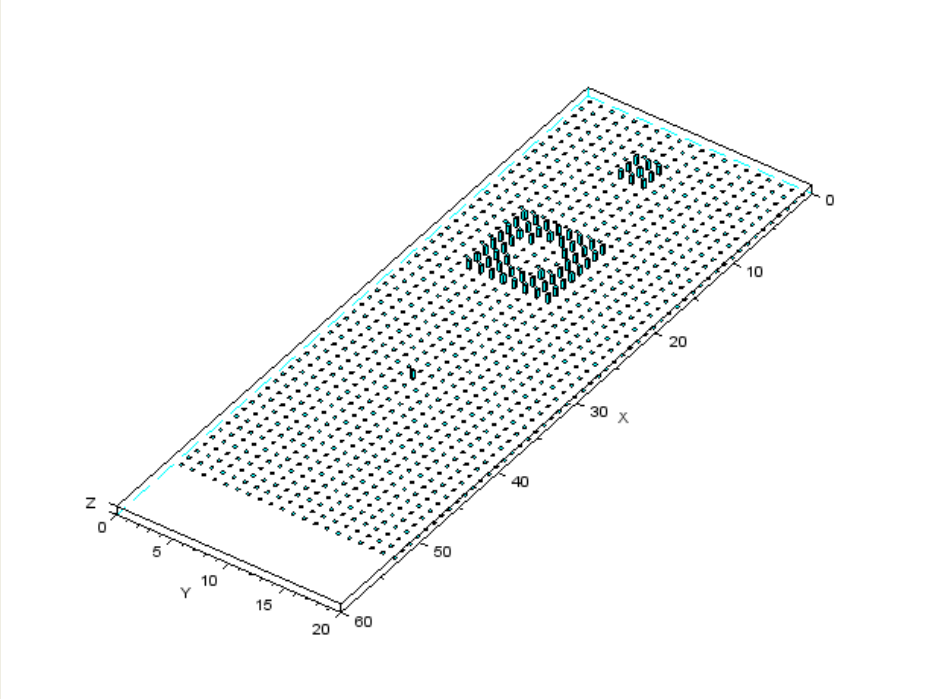
Dilation with 2x1 (left) and Erosion with 2x1 (right):



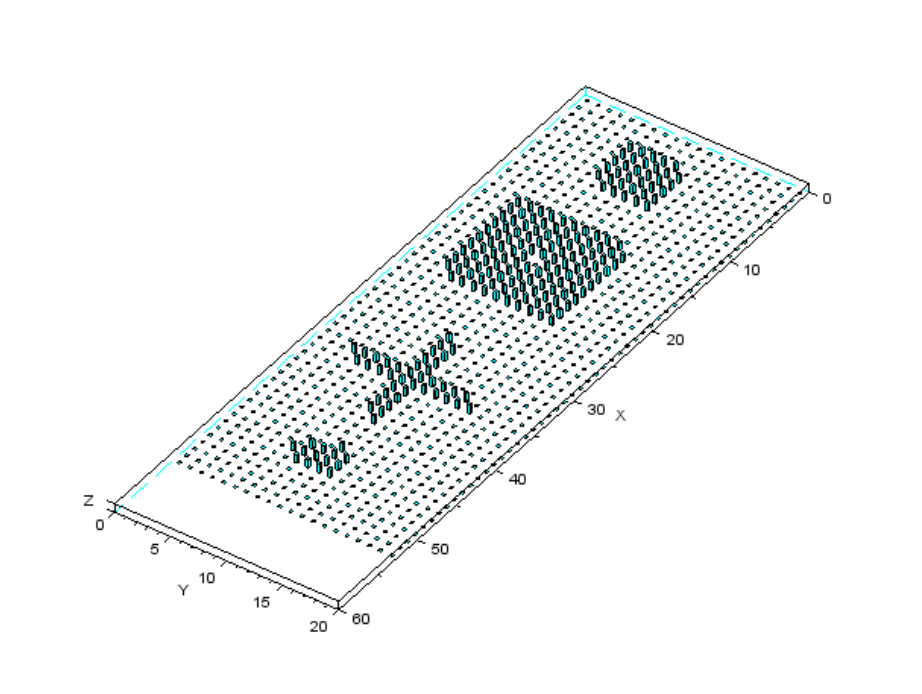


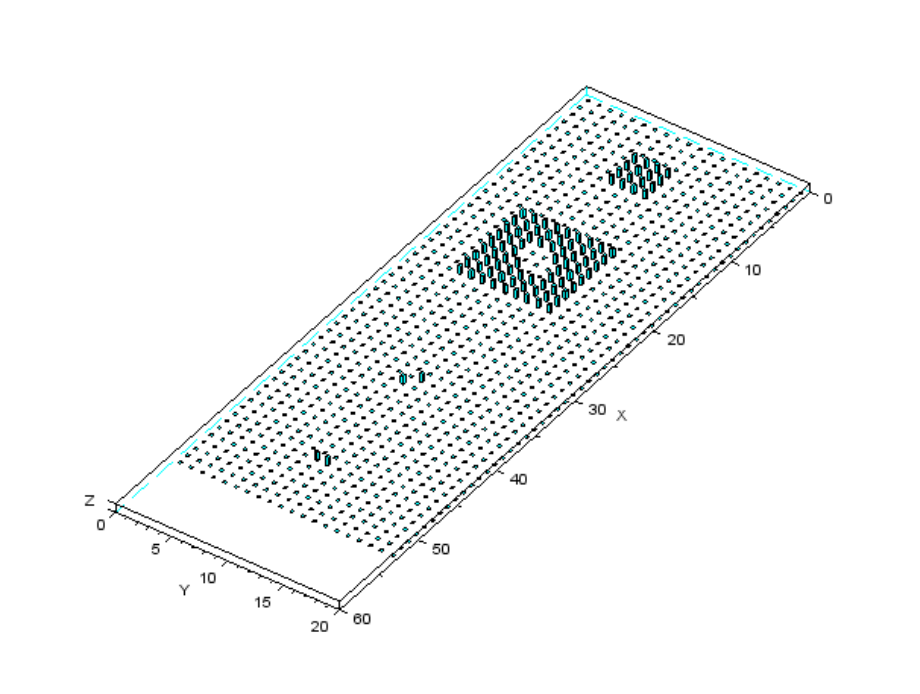
Dilation with cross (left) and Erosion with cross (right):





Dilation with diagonal (left) and Erosion with diagonal (right):





How did I do:

- Got everything corrected including the ones that I corrected from the previous errors EXCEPT for one image.

- My hand drawn erosion of the square with hollow by a cross did not include the four corners of the hollow square. They are included because those places matches the structure element. My mistake!