APPLIED PHYSICS 186
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Activity 8
morphological operations

This activity utilized the set theory. In here, we focus on the Erosion and Dilation given respectively by the notations below [1].

$$A \ominus B = \{z \mid (B)_z \subseteq A \quad (1)$$

$$A \oplus E = \{ z \mid (\hat{E})z \cap A \neq \emptyset \quad (2)$$

Eq. (1) can be regarded as a translation operation where set A is translated according to the structuring element B but the final results shall be in the domain of A. It is analogous to a geological erosion where set A is the land formation, and the type of erosion is dictated by the elements in Set B [2]. Meanwhile, the Dilation notation in Eq. (2) does the opposite, If we expect the set to be reduced when applied with erosion, the desired set is enlarged once we apply dilation, which of course is still dependent on the structuring element [2]. Shown in the succeeding two pages are the hand-drawn expectation when implementing erosion and dilation.

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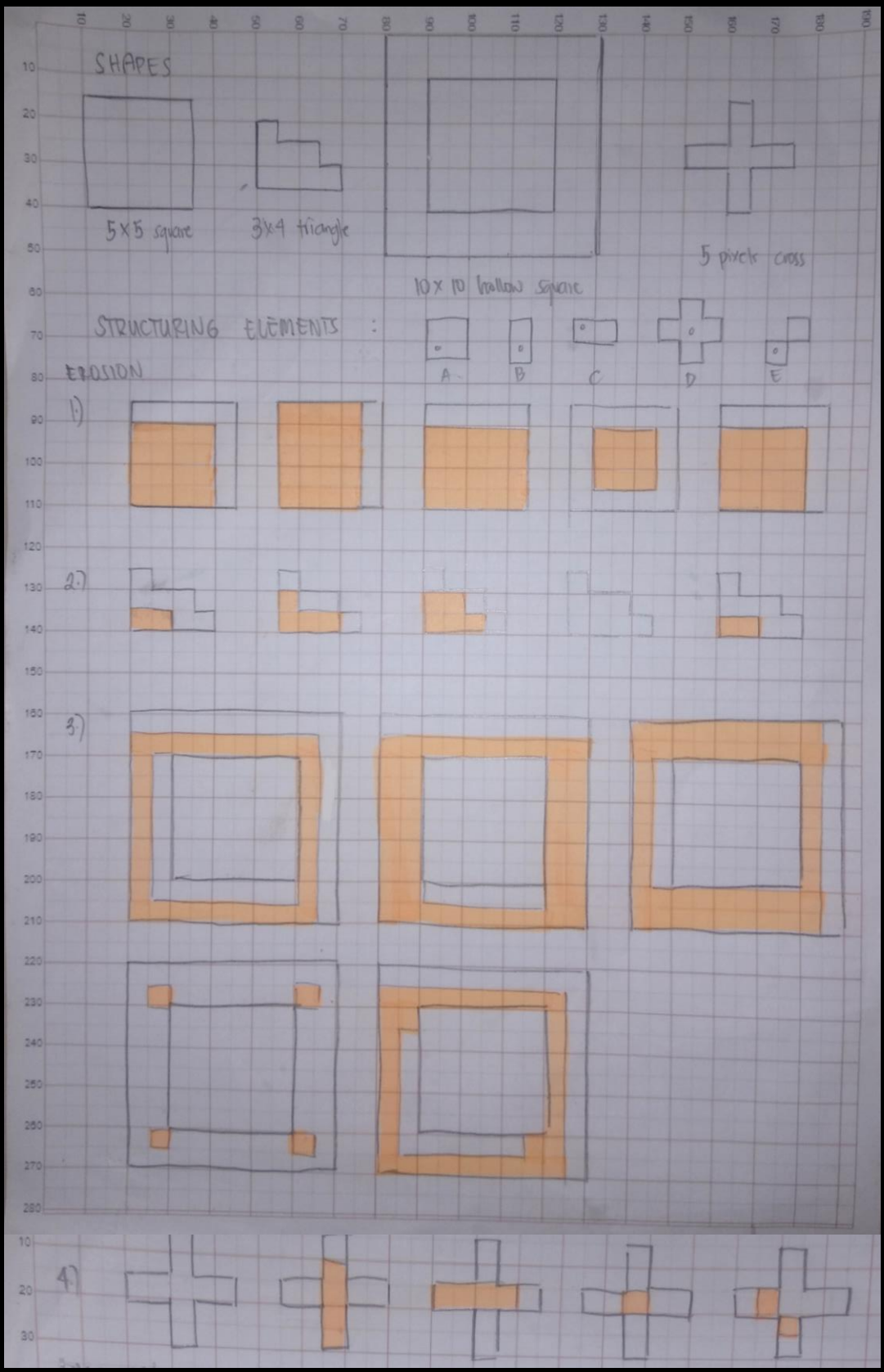
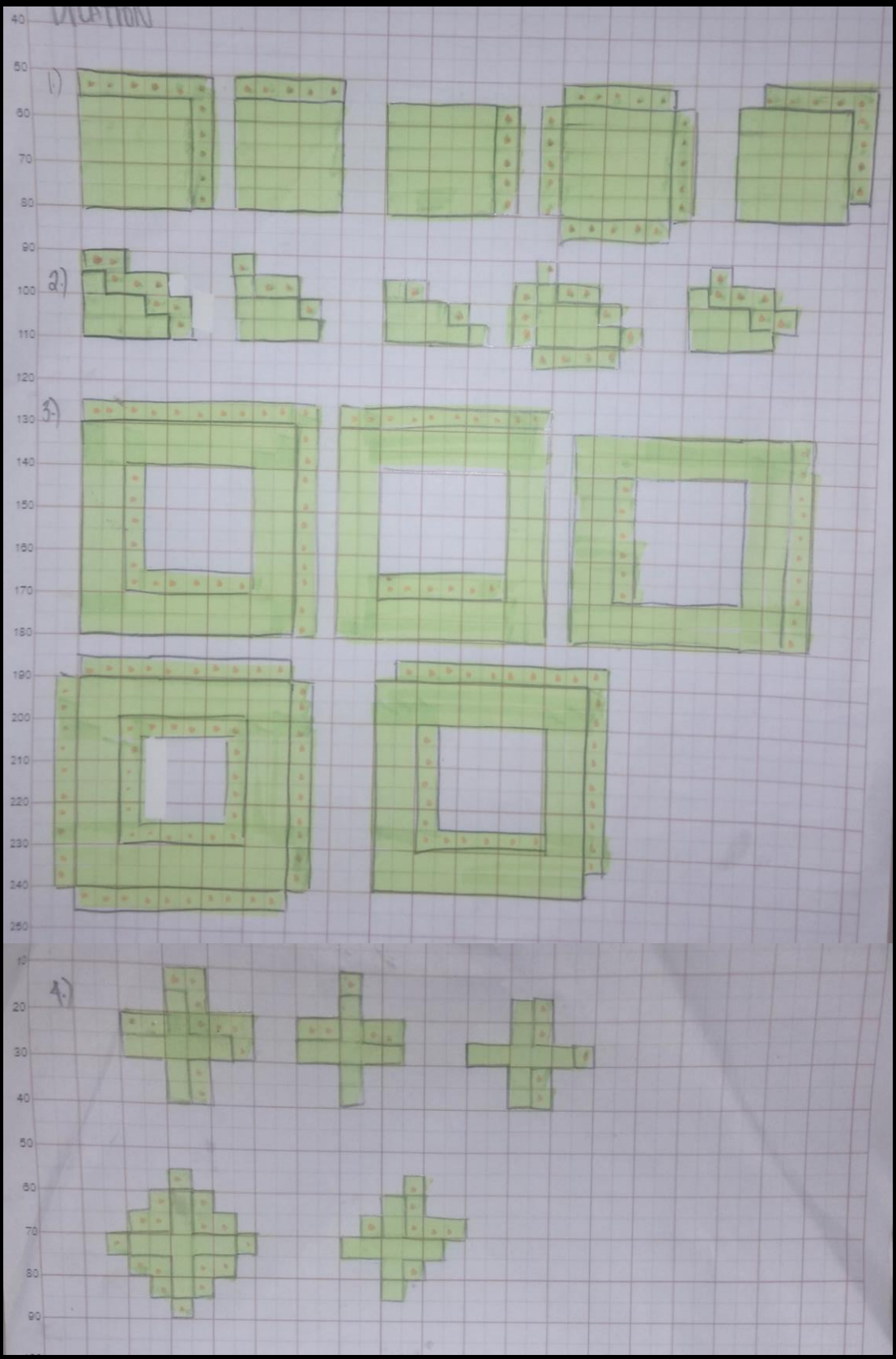
2015-04622

EROSION


SHAPES
5×5 square
3×4 triangle
10×10 hollow square
5 pixels cross
STRUCTURING ELEMENTS :
A
B
C
D
E
EROSION
1)
2)
3)
4)

DILATION



EROSION

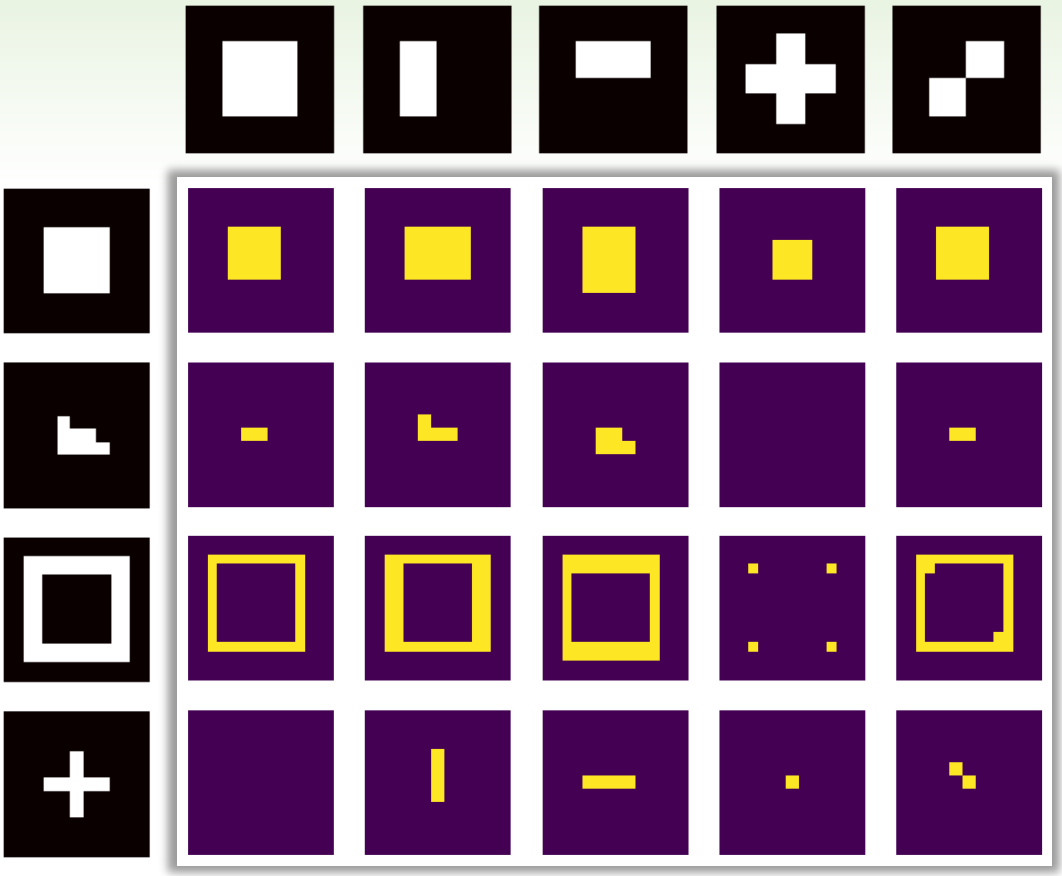


Figure 1. Simulation of Erosion. The objects on the leftmost column are the shapes (set A) and the objects on the top are the structuring elements (set B). The resulting eroded images as expected, were smaller.

From the results in Fig. 1, the structuring elements in fact dictated the erosion. A horizontally oriented rectangle caused a horizontal translation which in turn reduced the horizontal length of the shape. Thus the result is a narrower version. A vertical rectangle structured a square into a shape with shorter vertical lengths due to the vertical translation. The cross narrowed all the sides, while the diagonal structuring element introduced a diagonal translation. The same principle is obeyed and observed in the rest of the shapes and simulations matched the hand-drawn expectations of erosion.

An opposite behavior as a result of dilation is shown in Fig. 2. In here, the shape was expanded in accordance to the structuring element. The resulting image is similar to taking the intersection of set A and set B [2].

In the simulations, I used the erosion and dilation functions of the *skimage morphological operations package.* On understanding the concept and to countercheck the results that I have, I constantly check on the AP186 blog of Sir Bartz. The discussions were very helpful when understanding how the set notation operates and how simulations produced such results.

DILATION

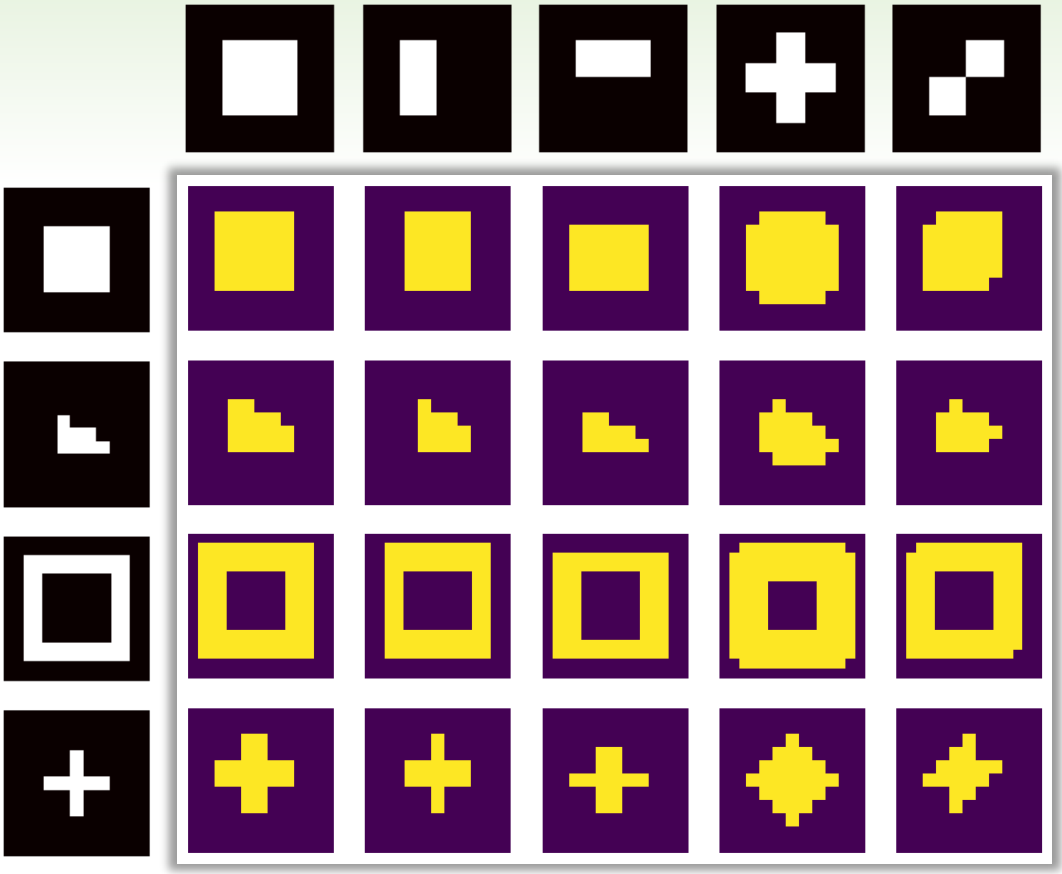


Figure 1. Simulation of Dilation. The objects on the leftmost column are the shapes (set A) and the objects on the top are the structuring elements (set B). The resulting dilated images as expected, were larger.

This week was the hellest of all weeks I've had so far and so I'm just passing this activity three days after the due date. Exams and other requirements piled up last Thursday and Friday, and I tutored on Saturdays and Sundays which is why I wasn't able to finish writing the report on time.

To be honest, I wasn't really absorbing this lesson and focused on producing/replicating the output in [2]. Although I got the figures and results right, I can't say that I explained the concepts well. Besides, I'm way too late, but hey, at least I still tried and submitted. For this report, **I'm giving myself a score of 8. I don't know how much I should deduct my score due to tardiness. It's up to the checker to deduct my score.**

References:

[1] M. Soriano, "Morphological Operations," 2019.

[2] M. Bartolome, "Activity #8 – Morphological Operations," 2014.