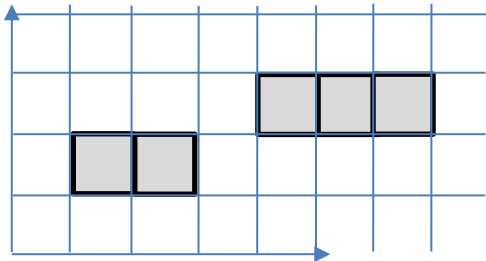


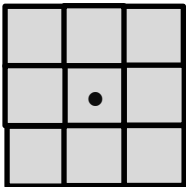
HW #3

1. The following binary image B =

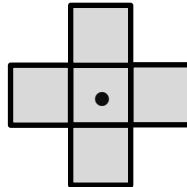


is operated on by structuring elements S1 and S2

S1=

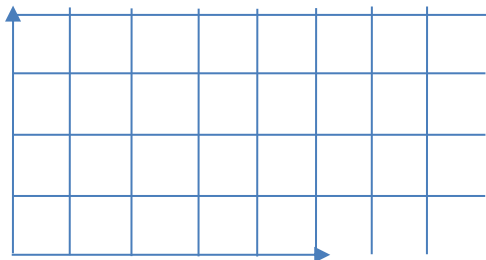


S2=

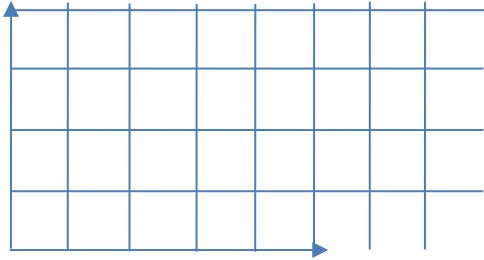


Assume that any pixels outside the region shown are 0. This is equivalent to assuming that B is embedded in a (potentially infinitely) larger image that is all 0.

- a. What is obtained by dilating B by S1 and then eroding that result by S2?



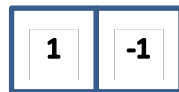
- b. What is obtained by dilating B by S2 and then eroding that result by S1?



2. Show that convolution is associative, that is

$$f(\vec{x}) * (g(\vec{x}) * h(\vec{x})) = (f(\vec{x}) * g(\vec{x})) * h(\vec{x})$$

3. What is the Discrete Fourier Transform of the simple x -direction mask, assuming that the 1 value is at the origin?



Use the 1-D DFT formula on p. 118 of Szeliski. You should be able to express the result as [constants] $\times e^{[\text{something}]} \times \sin[\text{something}]$.

4. Use OpenCV or Matlab to smooth an image using the following operations:
- Box Filter with $W = 5$ in both directions,
 - Gaussian with $\sigma=3$, and
 - Median Filter using a 5×5 window (see Szeliski p. 108)

Show the original image – your choice! – and the 3 smoothed images.

Answer the following: What happens if you change the window size?