CSE 4128
Lab 5

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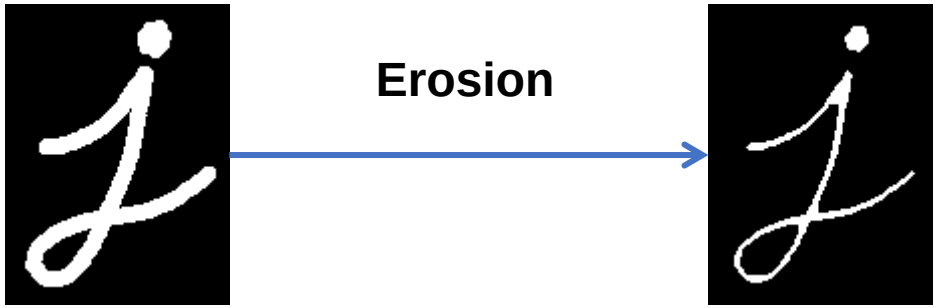
Erosion

```
import cv2 as cv
import numpy as np
img = cv.imread('j.png',0)
kernel = np.ones((5,5),np.uint8)
erosion = cv.erode(img, kernel, iterations = 1)
```

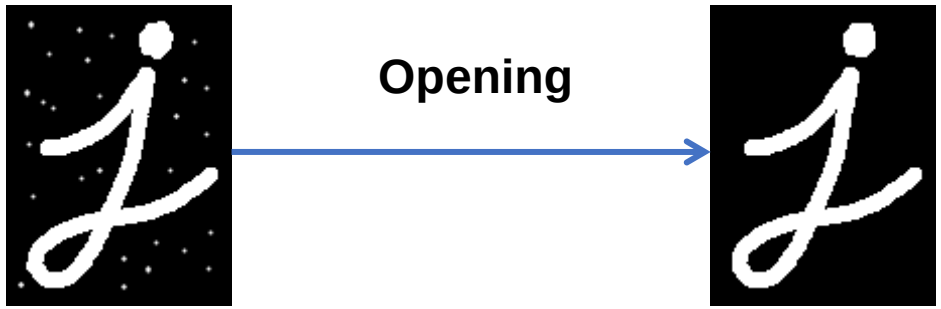


Dilation

```
import cv2 as cv
import numpy as np
img = cv.imread('j.png',0)
kernel = np.ones((5,5),np.uint8)
dilation = cv.dilate(img, kernel, iterations = 1)
```

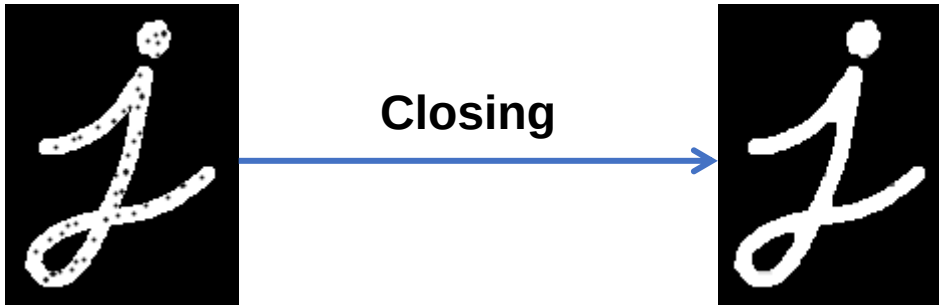
Opening

```
import cv2 as cv
import numpy as np
img = cv.imread('j.png',0)
kernel = np.ones((5,5),np.uint8)
opening = cv.morphologyEx(img, cv.MORPH_OPEN, kernel)
```



Closing

```
import cv2 as cv
import numpy as np
img = cv.imread('j.png',0)
kernel = np.ones((5,5),np.uint8)
closing = cv.morphologyEx(img, cv.MORPH_CLOSE, kernel)
```



Skeletons

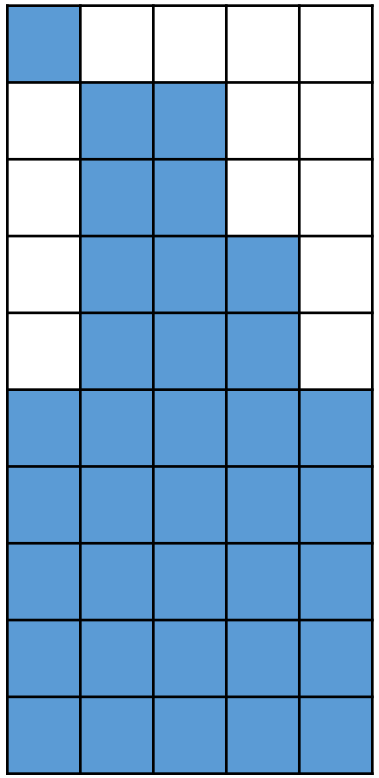
$$S(A) = \bigcup_{k=0}^{K} S_k(A)$$

$$S_k(A) = (A \ominus kB) - (A \ominus kB) \circ B$$

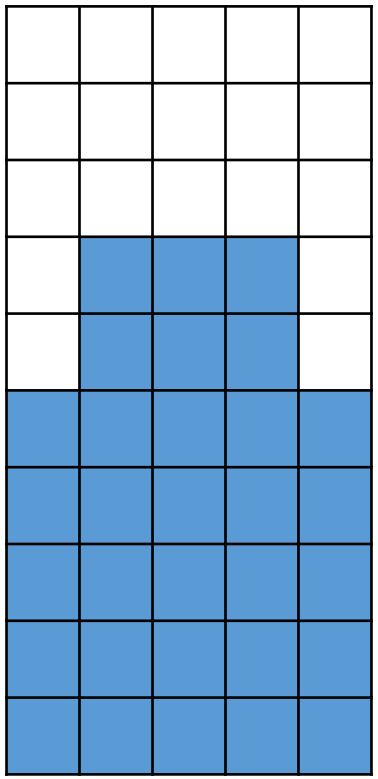
$$(A \ominus kB) = ((\ldots((A \ominus B) \ominus B) \ominus \ldots) \ominus B)$$

$$K = \max\{k | (A \ominus kB) \neq \emptyset\}$$

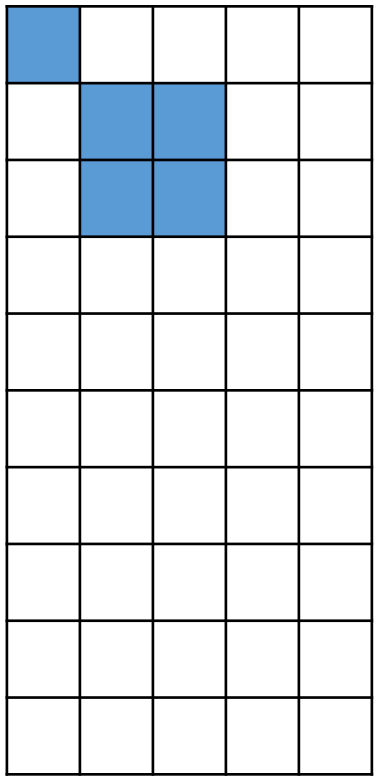
$A \ominus kB$



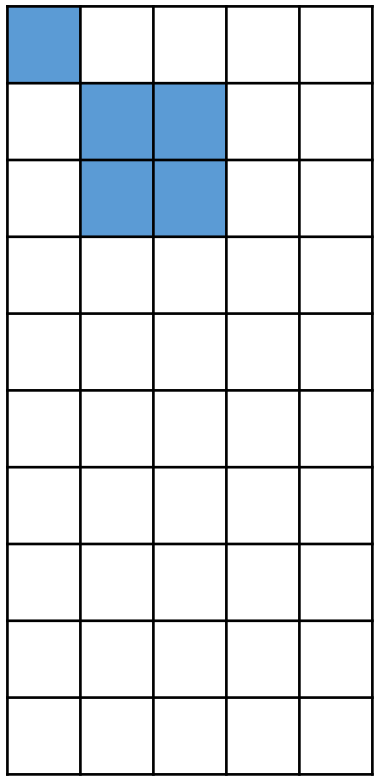
$(A \ominus kB) \circ B$



$S_k(A)$

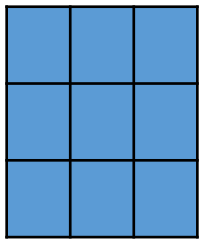


$\bigcup_{k=0}^{K} S_k(A)$

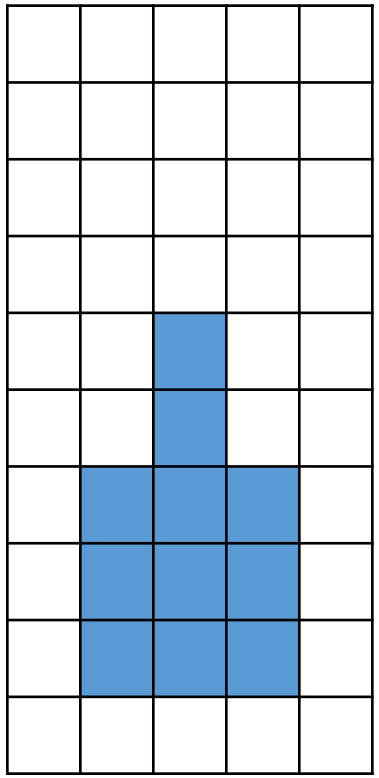


k=0

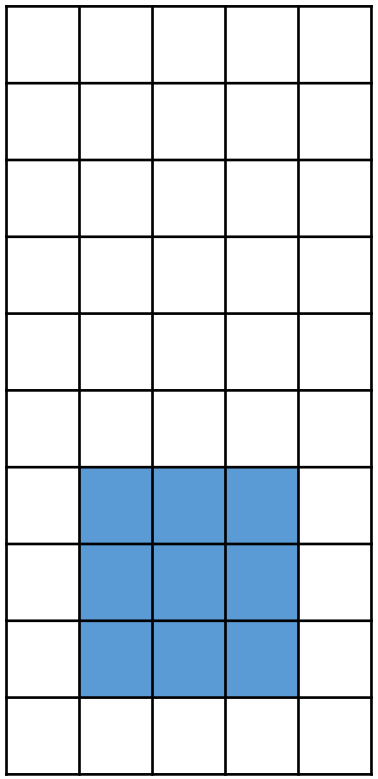
B



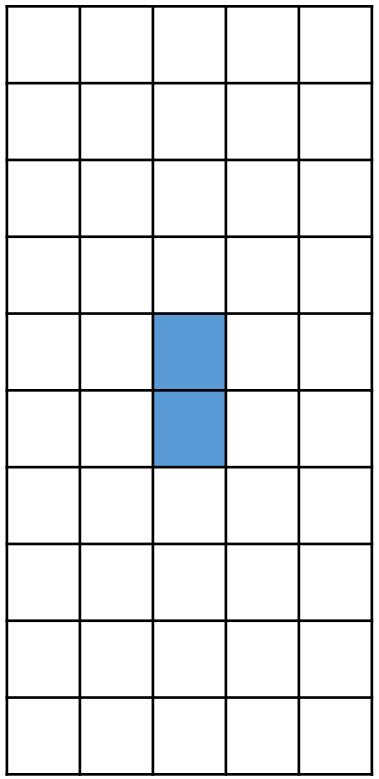
$A \ominus kB$



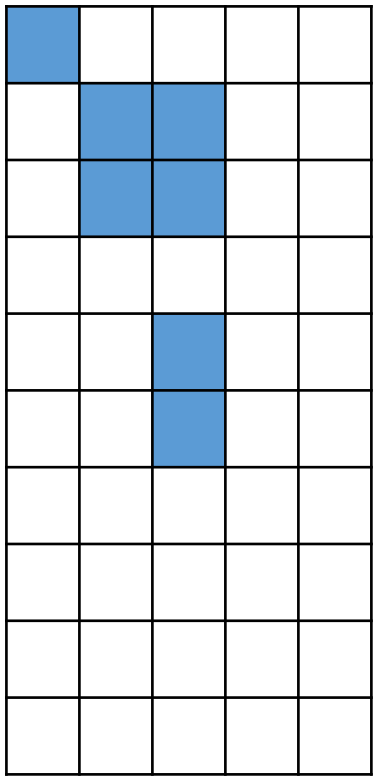
$(A \ominus kB) \circ B$



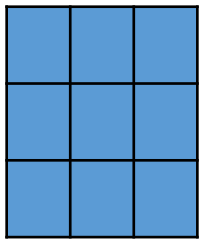
$S_k(A)$



$\bigcup_{k=0}^{K} S_k(A)$

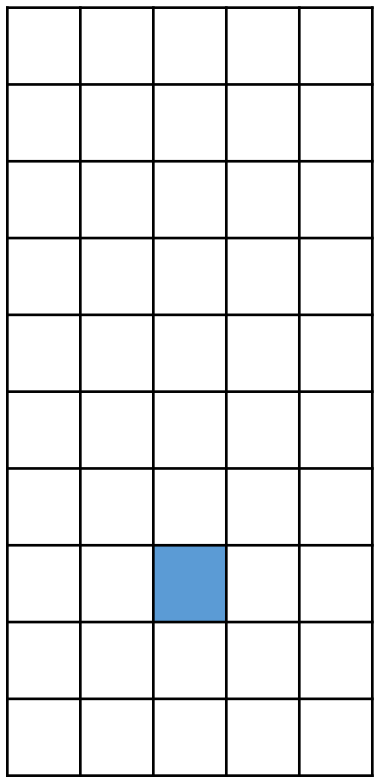


B

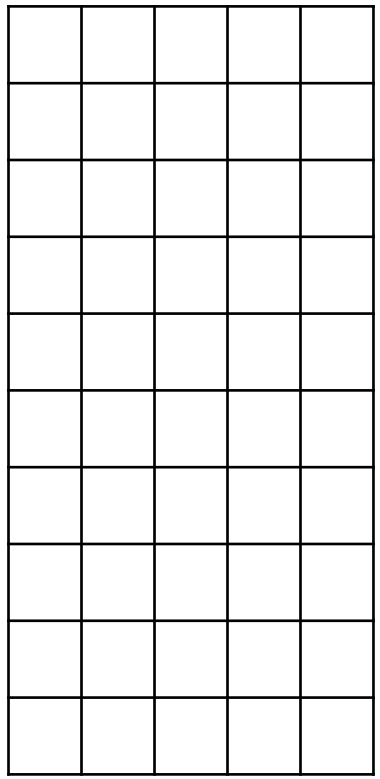


k=1

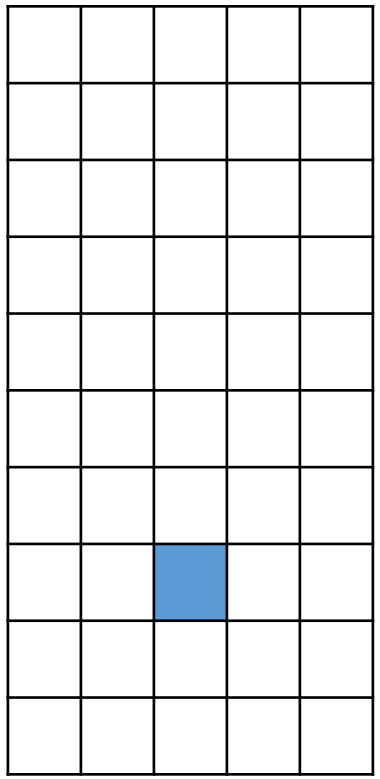
$A \ominus kB$



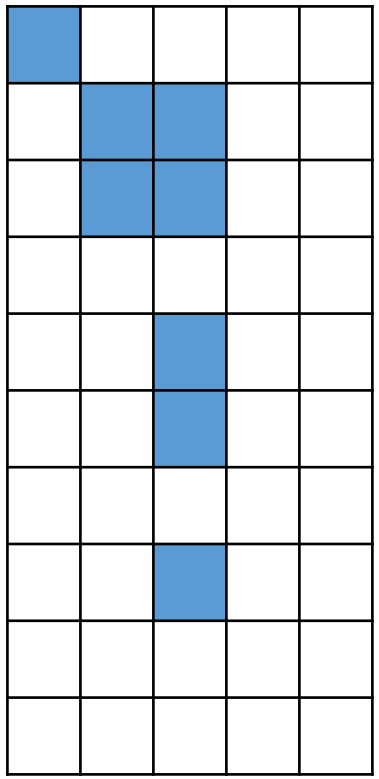
$(A \ominus kB) \circ B$



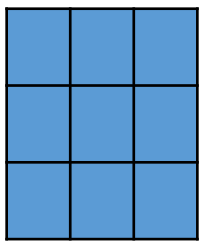
$S_k(A)$



$\bigcup_{k=0}^{K} S_k(A)$



B



k=2