

```
import numpy as np
import matplotlib.pyplot as plt
from skimage.io import imread, imshow
from skimage.draw import disk
from skimage.morphology import (erosion, dilation, closing, opening,
                                area_closing, area_opening)
from skimage.color import rgb2gray
from google.colab.patches import cv2_imshow # for image display
import cv2

from google.colab import drive
drive.mount('/content/drive')
```

Mounted at /content/drive

```
img = cv2.imread("/content/drive/My Drive/colab/print.png", 0)
cv2_imshow(img)
```



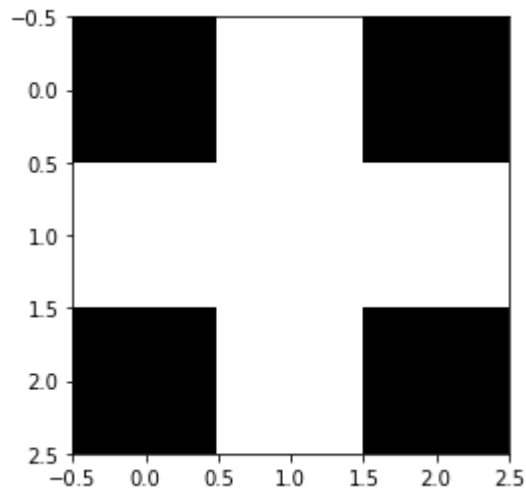
```
img2 = cv2.imread("/content/drive/My Drive/colab/threshold.png", 0)
cv2_imshow(img2)
```



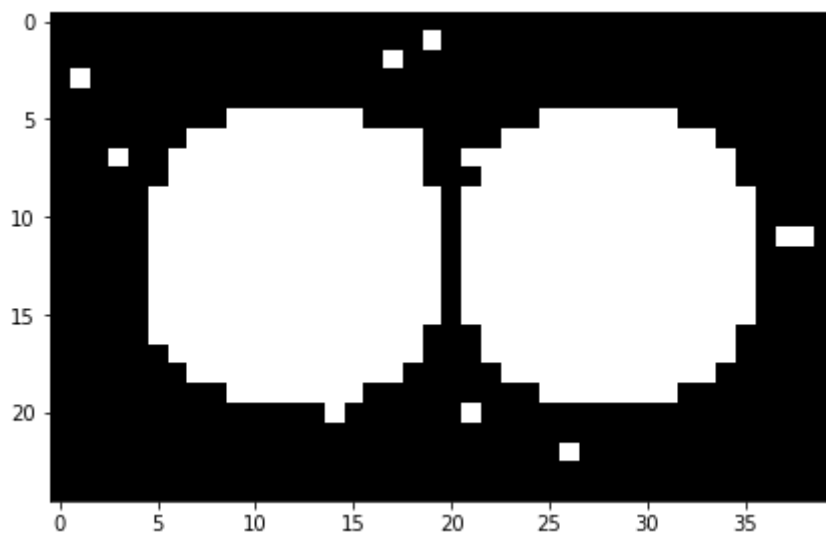
```
_,thresh = cv2.threshold(img2, np.mean(img2), 255, cv2.THRESH_BINARY_INV)  
cv2_imshow(thresh)
```



```
element = np.array([[0,1,0],
                    [1,1,1],
                    [0,1,0]])
plt.imshow(element, cmap='gray');
```

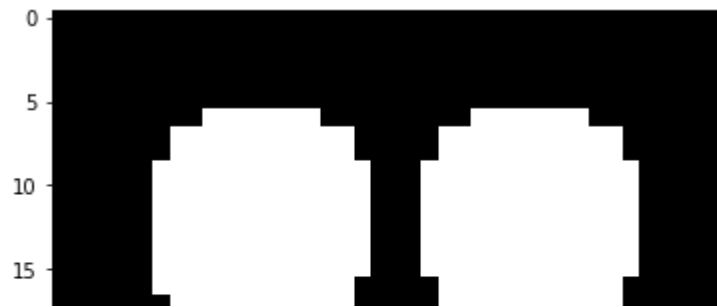


```
circle_image = np.zeros((25, 40))
circle_image[disk((12, 12), 8)] = 1
circle_image[disk((12, 28), 8)] = 1
for x in range(20):
    circle_image[np.random.randint(25), np.random.randint(40)] = 1
imshow(circle_image);
```



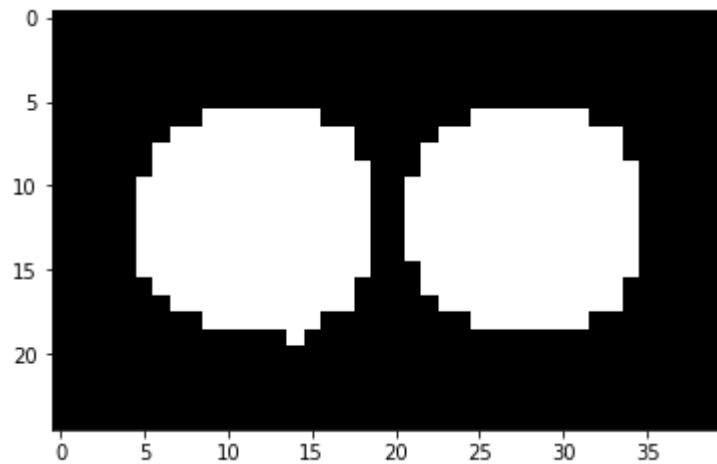
```
plt.imshow(erosion(circle_image, element), cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f0914d61450>
```



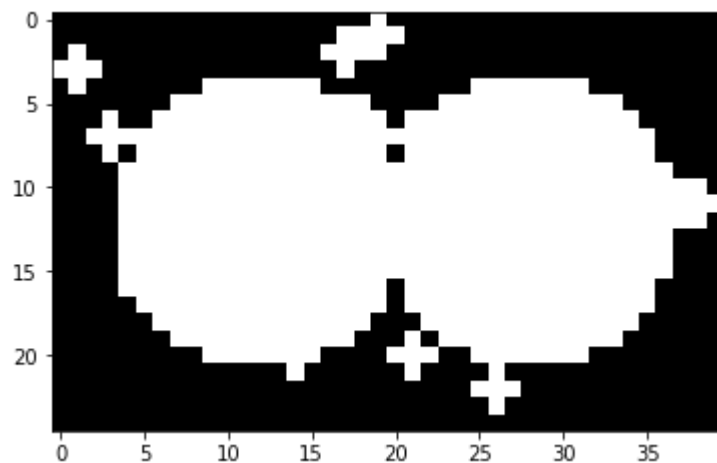
```
plt.imshow(erosion(circle_image, element), cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f0914e10350>
```



```
plt.imshow(dilation(circle_image, element), cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f0914d45f50>
```



```
def multi_dil(im, num, element=element):  
    for i in range(num):  
        im = dilation(im, element)  
    return im
```

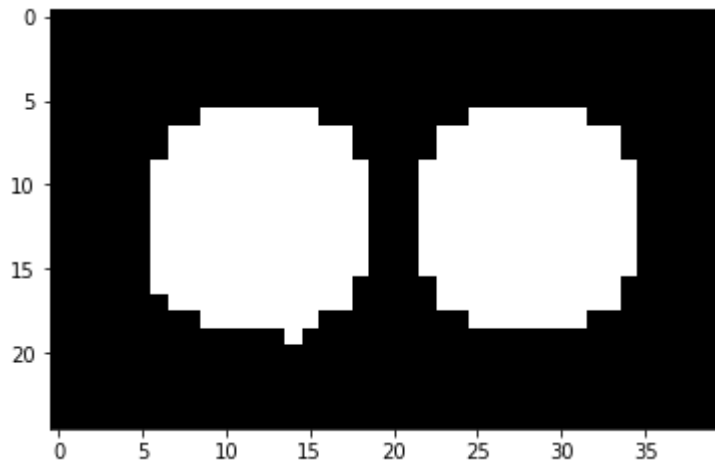
```

    return im
def multi_ero(im, num, element=element):
    for i in range(num):
        im = erosion(im, element)
    return im

```

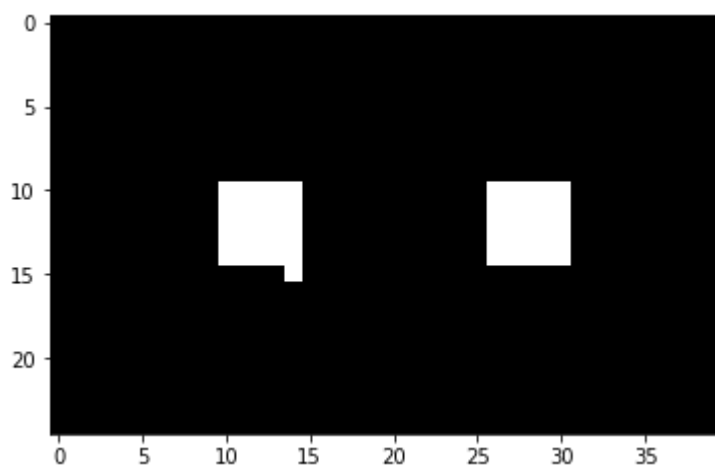
```
plt.imshow(multi_ero(circle_image, 1, element), cmap='gray')
```

↳ <matplotlib.image.AxesImage at 0x7f0914c27310>



```
plt.imshow(multi_ero(circle_image, 5, element), cmap='gray')
```

<matplotlib.image.AxesImage at 0x7f0914ae24d0>

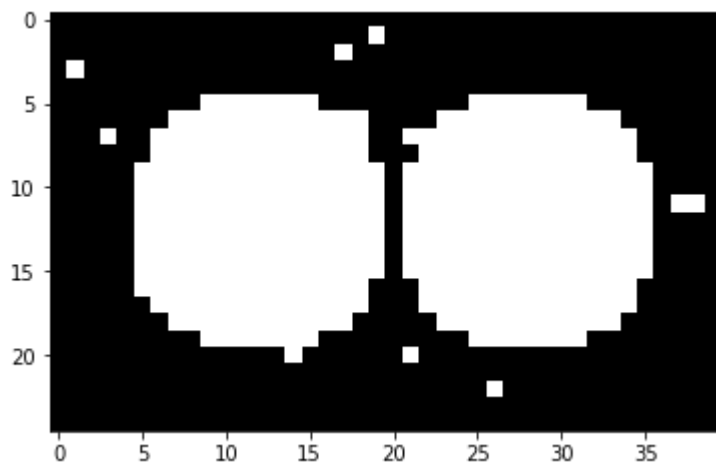


```
plt.imshow(multi_dil(circle_image, 2, element), cmap='gray')
```

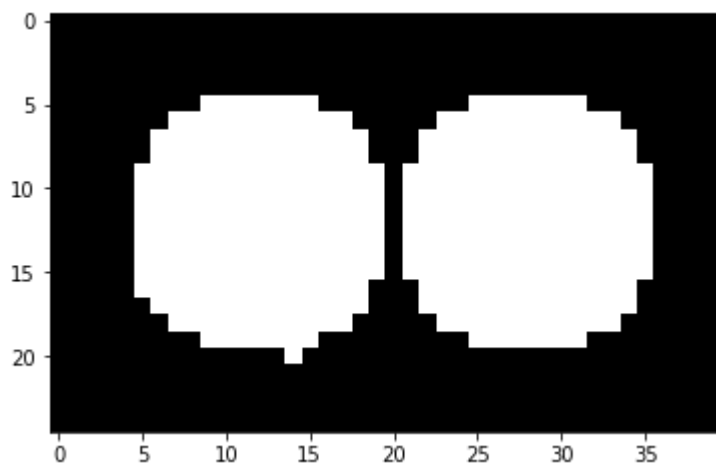
```
<matplotlib.image.AxesImage at 0x7f091739bb10>
```



```
plt.imshow(circle_image, cmap='gray');
```



```
plt.imshow(opening(circle_image, element), cmap='gray');
```



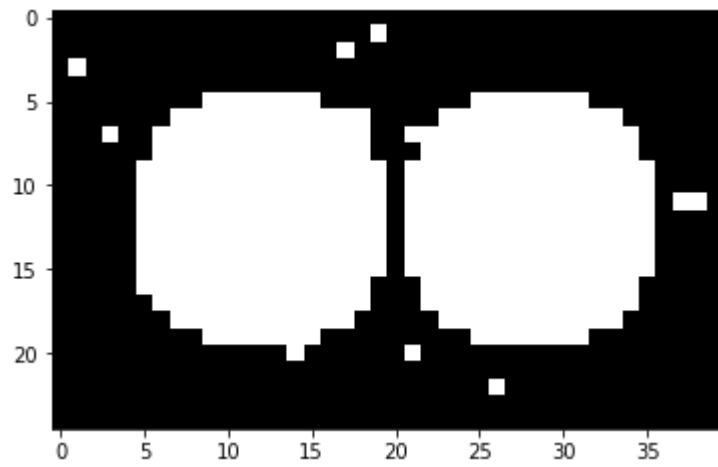
```
erod = erosion(circle_image, element)  
dil = dilation(erod, element)  
plt.imshow(dil, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f0914992910>
```



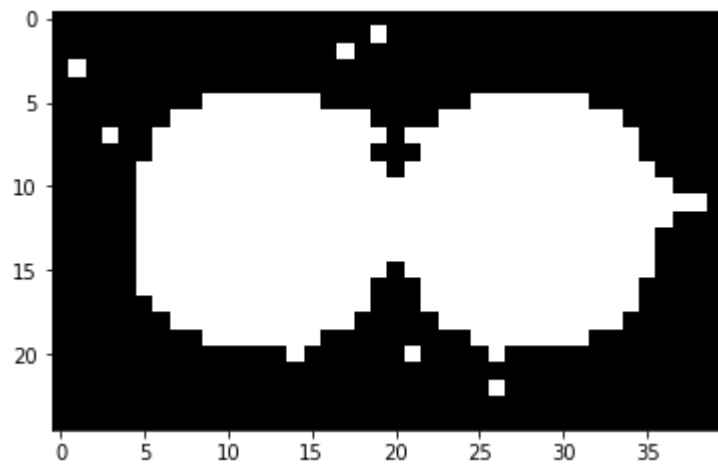
```
plt.imshow(circle_image, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f09148f0a10>
```



```
plt.imshow(closing(circle_image, element), cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f0914984950>
```

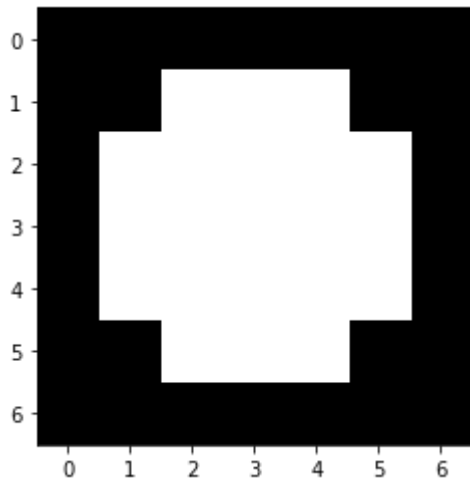


```
plt.imshow(img, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f0015210710>
element = np.array([[0,0,0,0,0,0,0],
                    [0,0,1,1,1,0,0],
                    [0,1,1,1,1,1,0],
                    [0,1,1,1,1,1,0],
                    [0,1,1,1,1,1,0],
                    [0,1,1,1,1,1,0],
                    [0,0,1,1,1,0,0],
                    [0,0,0,0,0,0,0]])
```

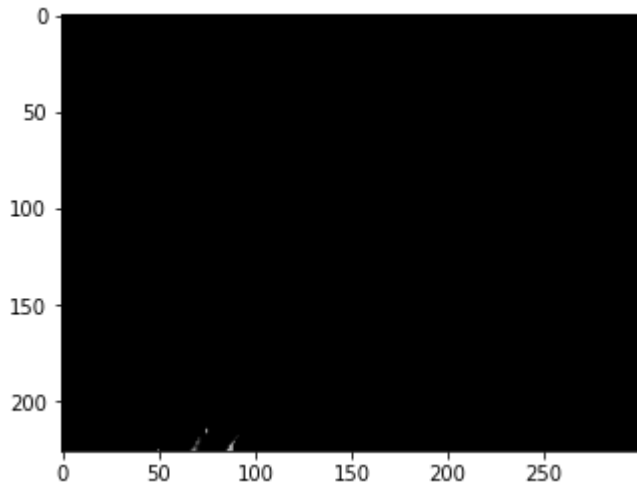
```
150
```

```
plt.imshow(element, cmap='gray');
```



```
multi_eroded = multi_ero(img, 2, element)
plt.imshow(multi_eroded, cmap='gray')
```

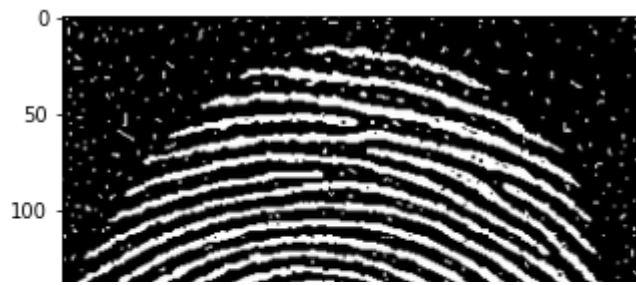
```
<matplotlib.image.AxesImage at 0x7f09151f8fd0>
```



```
img1 = erosion(img, element)
plt.imshow(img, cmap='gray')
```

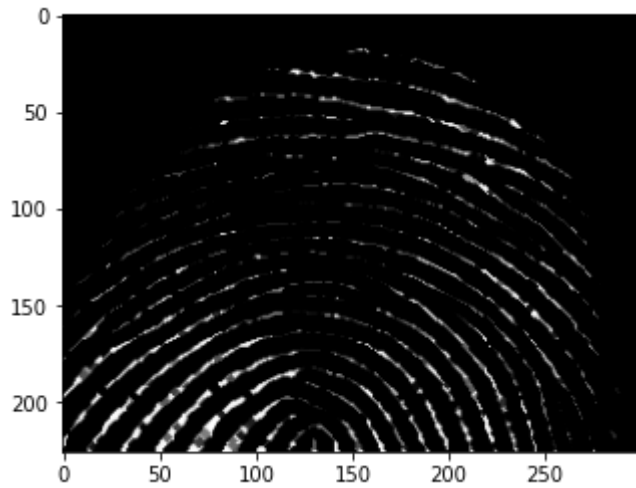


```
<matplotlib.image.AxesImage at 0x7f09153e2110>
```



```
multi_eroded = multi_ero(img, 2, element)  
plt.imshow(multi_eroded, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f0914f868d0>
```



```
opened = opening(multi_eroded)  
plt.imshow(opened, cmap='gray')
```

```
<matplotlib.image.AxesImage at 0x7f091563dfd0>
```

