Homework 1

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Part 1

a. Upside-down

Description: Reverse the entire array.

```
12    # Q(a)
13    img_a = img_arr[::-1]
14    img_a = Image.fromarray(img_a)
15    # img_a.show()
```

b. Right-side-left

Description: Invert the column.

```
17    # Q(b)
18    img_b = img_arr[:, ::-1]
19    img_b = Image.fromarray(img_b)
20    # img_b.show()
```

c. Diagonally flip

Description: Transpose the array.

```
22    # Q(c)
23    img_c = np.zeros([512, 512], dtype=img_arr.dtype)
24    for row in range(img_arr.shape[0]):
25        for col in range(img_arr.shape[1]):
26            img_c[row][col] = img_arr[col][row]
27
28    img_c = Image.fromarray(img_c)
```

Part 2

d. Rotate 45 degrees clockwise

Description: Use the Image Module to rotate the image.

```
36    # Q(d)
37    img_d = img.rotate(315, expand=True)
38    # img_d.show()
```

e. Shrink in half

Description: Using the Image Module to shrink the image in half.

```
40    # Q(e)
41    img_e = img.resize((int(img.size[0] / 2), int(img.size[1] / 2)))
42    # img_e.show()
```

f. Binarize at 128 to get a binary image

Description: Using the OpenCV Module to threshold the image.

```
44    # Q(f)
45    _, img_f = cv2.threshold(np.array(img), 128, 255, cv2.THRESH_BINARY)
46    img_f = Image.fromarray(img_f)
47    # img_f.show()
```