Homework 1

Part 1: Write a program to do the following requirement.

原圖

處理lena.bmp

```
from PIL import Image
lena=Image.open('./lena.bmp')
width, height = lena.size
```

```
lena_arr=list(lena.getdata())
lena_arr = [lena_arr[i:i + width] for i in range(0, len(lena_
```

儲存圖片

```
def save_image(data,filename):
    flat_data=[pixel for row in data for pixel in row]
    img=Image.new('L',(width, height))
    img.putdata(flat_data)
    img.save(filename)
```

(a) upside-down lena.bmp

```
HW1_a=lena_arr[::-1]
save_image(HW1_a, "HW1_a.bmp")
```

(b) right-side-left lena.bmp

```
HW1_b = [row[::-1] for row in lena_arr]
save_image(HW1_b, "HW1_b.bmp")
```


(c) diagonally flip lena.bmp

```
HW1_c=[[lena_arr[j][i]for j in range (height) ]for i in range
save_image(HW1_c, "HW1_c.bmp")
```

Part2. Write a program or use software to do the following requirement.

讀取圖片

```
from PIL import Image
lena=Image.open('./lena.bmp')
width, height = lena.size
```
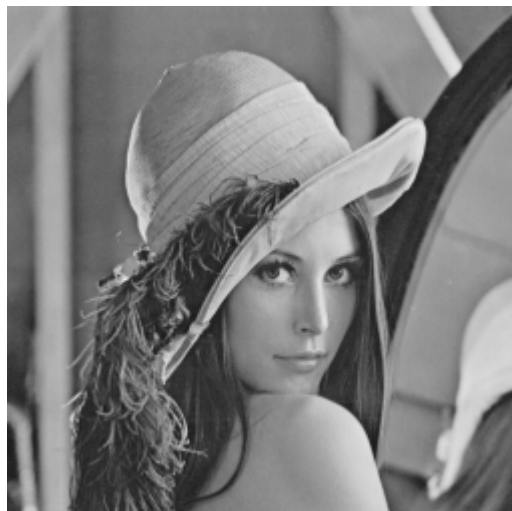
(d) rotate lena.bmp 45 degrees clockwise

```
HW1_d = lena.rotate(45)
HW1_d.save('hw1_d.bmp')
```

(e) shrink lena.bmp in half

```
HW1_e = lena.resize((width // 2, height // 2))
HW1_e.save('HW1_e.bmp')
```

- (f) binarize lena.bmp at 128 to get a binary image

```
threshold = 128
binarize = lena.point(lambda p: 255 if p >= threshold else 0)
binarize.save('HW1_f.bmp')
```