

**Environment:** Python 3.6 with OpenCV

**Benchmark:** lena.bmp

### Part 1: Write a program to manipulate lena.bmp

**Usage:** `$> python3 hw1.py`

#### Description:

- (a) Upside-down: assign pixel  $(\text{ImgHeight}-1-i, j)$  to pixel  $(i, j)$  in the new image
- (b) Right-side-left: assign pixel  $(i, \text{ImgWidth}-1-j)$  to pixel  $(i, j)$  in the new image
- (c) Diagonally mirroring: assign pixel  $(\text{ImgHeight}-1-i, \text{ImgWidth}-1-j)$  to pixel  $(i, j)$  in the new image

#### Principal code fragment:

```
# Upside-down
for i in range(img.shape[0]):
    for j in range(img.shape[1]):
        new_img[i, j] = img[img.shape[0] - 1 - i, j]

# Right-side-left
for i in range(img.shape[0]):
    for j in range(img.shape[1]):
        new_img[i, j] = img[i, img.shape[1] - 1 - j]

# Diagonally mirroring
for i in range(img.shape[0]):
    for j in range(img.shape[1]):
        new_img[i, j] = img[img.shape[0] - 1 - i, img.shape[1] - 1 - j]
```

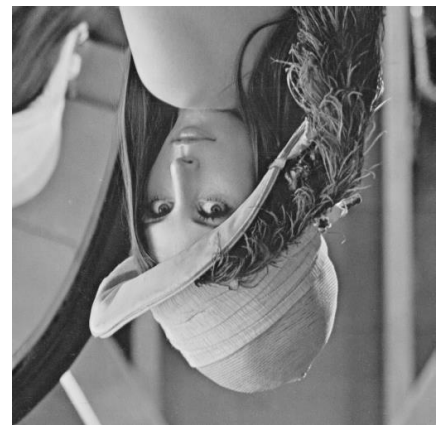
#### Resulting images:



(a) Upside-down



(b) Right-side-left



(c) Diagonally mirrored

## Part2: Use Photoshop to manipulate lena.bmp

**Image processing software:** Microsoft PowerPoint 2016

### Task Description:

- (a) Rotate lena.im 45 degrees clockwise
- (b) Shrink lena.im in half
- (c) Binarize lena.im at 128 to get a binary image

### Method Description:

The above tasks can be carried out with Microsoft PowerPoint basic functionalities. First import lena.bmp.

- (a) Rotation: 右鍵 → 設定圖片格式 → 大小與屬性 → 旋轉 → 輸入 45°
- (b) Shrink: 右鍵 → 設定圖片格式 → 大小與屬性 → 調整高度 → 輸入 50% (鎖定長寬比)
- (c) Binarization: 右鍵 → 設定圖片格式 → 圖片 → 重新著色 → 黑白 50%

After manipulation, save image by right-clicking and click 另存為圖片.

### Resulting images:



(a) 45 degrees clockwise rotation



(c) Binarized



Original lena.bmp



(b) Shrunked lena.bmp (in half)