Homework 1

Basic Image Manipulation

Programming language: Python 3.7.3

Library used for this homework:

- Numpy
- OpenCv: to read and write the image file

Image info: lena.bmp [512(width),512(height),3(RGB)]

Part 1:

[Code explanation]

```
lena = cv2.imread('lena.bmp')
```

Read in the lena.bmp image file using opencv. The type of the variable “lena” is “numpy.ndarray”.

```
rows,columns = lena.shape[:2]
```

Get the row number and column number of the image.

For each section in part 1, a function is created to do the work.

```
    lenaCopy = np.zeros(lena.shape,np.uint8)
    lenaCopy = lena.copy()
```

All of the function has these two lines of code. Their purpose is to create a copy of the original image. The copied image will store the new data.

```
for c in range(columns):
        for r in range(rows):
            lenaCopy[r,c] = lena[rows-r-1,c]
```

In the function upsideDown(), we took the pixel information of lena from the bottom, and stored it to a new image from the top. We ran through each column to complete the flip.

```
    for r in range(rows):
        for c in range(columns):
            lenaCopy[r,c] = lena[r,columns-c-1]
```

As for right-side-left flip, the leftmost pixel was swapped to the rightmost pixel. It kept swapping till the whole row was flipped. We went through the image pixels from top to bottom.

```
for r in range(rows):
       for c in range(columns):
          lenaCopy[r,c] = lena[c,r]
```

To flip diagonally, the pixel at [a,b] needs to switch with the pixel at [b,a].

[Here are the results]

(A) upside-down lena.bmp

(B) right-side-left lena.bmp

(C) diagonally flip lena.bmp

Part 2:

(D) rotate lena.bmp 45 degrees clockwise

(E) shrink lena.bmp in half

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