

Problem Set 3 Exercise #26: Black and White Image

Reference: Lecture 8 notes

Learning objectives: Two-dimensional array; Algorithm design

Estimated completion time: 60 minutes

Problem statement:

[CS1010 AY2013/14 Semester 1 Exam, Q5]

A square black-and-white image can be represented as a matrix of 1s (black pixels) and 0s (white pixels). An image can be manipulated in many ways, two of which are *flip* and *rotate*. When an image is flipped, it becomes upside-down. When an image is rotated, it is rotated 90 degrees clockwise. Figure (a) below shows a sample 5*5 image while (b) and (c) show the resulting image of flipping and rotating the sample image respectively.

	0	1	2	3	4
0	0	0	0	0	0
1	0	1	1	1	0
2	0	0	1	0	0
3	0	0	1	0	0
4	0	0	0	0	0

	0	1	2	3	4
0	0	0	0	0	0
1	0	0	1	0	0
2	0	0	1	0	0
3	0	1	1	1	0
4	0	0	0	0	0

	0	1	2	3	4
0	0	0	0	0	0
1	0	0	0	1	0
2	0	1	1	1	0
3	0	0	0	1	0
4	0	0	0	0	0

(a) Sample image

(b) Sample image flipped

(c) Sample image rotated

Write a program **PS3_Ex26_BlackWhiteImage.java**. Your program should contain the following two static methods:

```
void flip(int[][] img)
```

and

```
void rotate(int[][] img)
```

to perform these two operations on the image **img** respectively. The resulting image should still be stored in **img**.

Sample run #1:

```
Enter the size of the image: 5
Enter image:
0 0 0 0 0
0 1 1 1 0
0 0 1 0 0
0 0 1 0 0
0 0 0 0 0
Enter choice:
(1) flip
(2) rotate
1
Original image:
0 0 0 0 0
0 1 1 1 0
0 0 1 0 0
0 0 1 0 0
0 0 0 0 0
Flipped image:
0 0 0 0 0
0 0 1 0 0
0 0 1 0 0
0 1 1 1 0
0 0 0 0 0
```

Sample run #2:

```
Enter the size of the image: 5
Enter image:
0 0 0 0 0
0 1 1 1 0
0 0 1 0 0
0 0 1 0 0
0 0 0 0 0
Enter choice:
(1) flip
(2) rotate
2
Original image:
0 0 0 0 0
0 1 1 1 0
0 0 1 0 0
0 0 1 0 0
0 0 0 0 0
Flipped image:
0 0 0 0 0
```

0	0	0	1	0
0	1	1	1	0
0	0	0	1	0
0	0	0	0	0