Problem Set 3 Exercise #27: Black and White Image

Reference: Lecture 9 notes

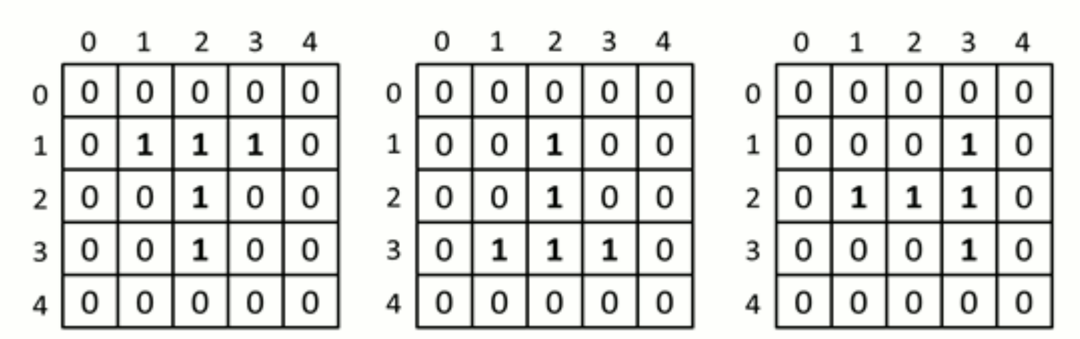
Learning objective: Two-dimensional array

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

(a) Sample image

	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

(b) Sample image flipped

	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

(c) Sample image rotated

Write two functions:

```
void flip(int img[N][N], int size)
```

and

```
void rotate(int img[N][N], int size)
```

to perform these two operations on the **`size`** × **`size`** image **`img`**. Here **`N`** is a symbolic constant (of value 10) that indicates the maximum possible size of the input image. The resulting image should be stored in **`img`**.

Complete the skeleton program **black_and_white.c** for the above task.

Sample run #1:

```
Enter the size of 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 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
Rotated 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
```