

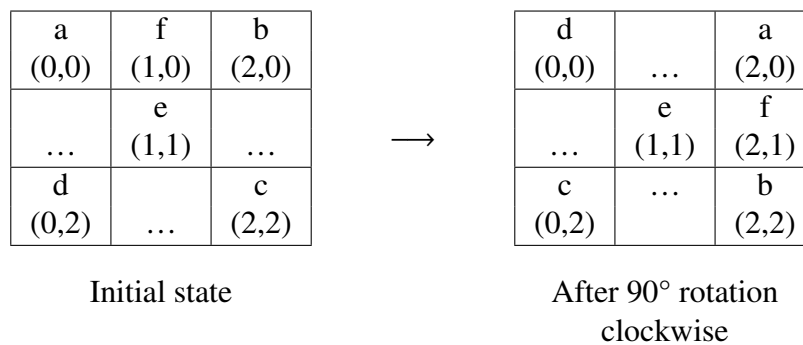
# Matrix Transformation Notes

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## 1 Rotation

Make a model of how the various kinds of points move when a matrix is rotated:



It may be useful to tabulate these single-point movements, to make your function easier to check:

type	label	location	location
corner	a	(0,0)	(2,0)
corner	b	(2,0)	(2,2)
corner	c	(2,2)	(0,2)
corner	d	(0,2)	(0,0)
center	e	(1,1)	(1,1)
non-corner, non-center	f	(1,0)	(2,1)

This rotation can be effected by applying the following code to every point in the matrix:

```
def rotate_point(x, y, side_length):  
    return ((side_length - 1 - y), x)
```

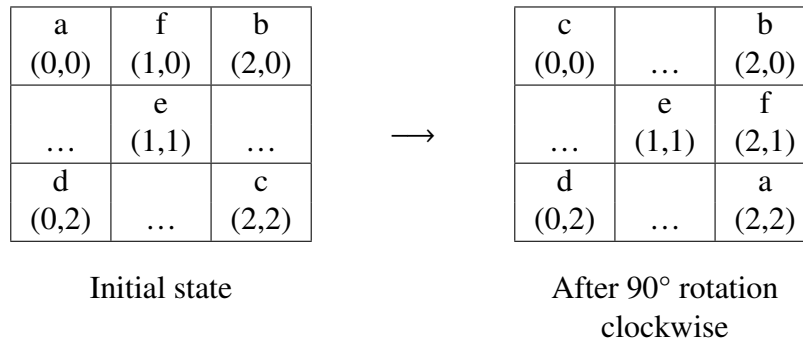
In the example above, `side_length = 3`. Check the results of the function against the various edge cases.

Similarly, the following will bring about counterclockwise rotation:

```
def rotate_point(x, y, side_length):
    return (y, (side_length - 1 - x))
```

## 2 Flipping

Flipping is a different kind of transformation from rotation, because it turns the “face” of the matrix away from us. We can flip along a row (“vertically”), a column, or a diagonal. Let’s use the diagonal running from lower left to upper right. As before, make a model:



Tabulate for reference:

type	label	location	location
corner	a	(0,0)	(2,2)
corner	b	(2,0)	(2,0)
corner	c	(2,2)	(0,0)
corner	d	(0,2)	(0,2)
center	e	(1,1)	(1,1)
non-corner, non-center	f	(1,0)	(2,1)

Note that the points forming the diagonal on which we are flipping do not change position. All the other points move to a place symmetrically opposite their place of origin across the diagonal.

```
def flip_on_diag_lowerleft_to_upperright(x, y, side_length):
    # points change place only if not on this diagonal
    if x + y != side_length:
        return side_length - 1 - y, side_length - 1 - x
    return x, y
```