

Two-Dimensional Arrays and Nested Loops – part 5

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Learning Goals

- Understand at a conceptual and practical level
 - How to copy one picture to another so that the first picture is rotated 90 degrees left or right
 - How to simplify a problem
 - How to come up with an algorithm to solve a problem
 - How to test the algorithm

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Left Rotation

- How can you copy one picture onto another so that the first picture is rotated to the left 90 degrees?



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Left Rotation

- First simplify the problem by thinking about how to copy when each pixel has a number at it
- Can you come up with an algorithm for this?

	0	1	2
0	1	2	3
1	4	5	6

	0	1
0	3	6
1	2	5
2	1	4

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Left Rotation

- Try out your algorithm on another example
 - Does it work?
- Can you translate it into code?

	0	1	2	3
0	5	6	7	8
1	1	2	3	4

	0	1
0		
1		
2		
3		

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Left Rotation

- To rotate an image left 90 degrees still copy all the pixels
 - But they go to different locations in the target
 - Column values become row values
 - target x = source y
 - target y = source width - 1 - source x

	0	1	2
0	1	2	3
1	4	5	6

	0	1
0	3	6
1	2	5
2	1	4

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Left Rotation Algorithm

- Create the target picture object
- Invoke the method on the target picture
 - Create the source picture object
 - Loop through the source x
 - Loop through the source y
 - Get the source pixel at the x and y values
 - Get the target pixel with the x equal the source y value and the y equal the source picture width – 1 minus the source x
 - Copy the color from the source pixel to the target pixel

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Left Rotation Method

```
public void copyKatieLeftRotation()
{
    String sourceFile =
        FileChooser.getMediaPath("KatieFancy.jpg");
    Picture sourcePicture = new Picture(sourceFile);
    Pixel sourcePixel = null;
    Pixel targetPixel = null;
    int targetX, targetY = 0;

    // loop through the columns
    for (int sourceX = 0;
         sourceX < sourcePicture.getWidth();
         sourceX++)
    {
```

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Copy Katie Left Rotation

```
// loop through the rows
for (int sourceY = 0;
     sourceY < sourcePicture.getHeight();
     sourceY++)
{
    // set the target pixel color to the source pixel color
    sourcePixel =
        sourcePicture.getPixel(sourceX,sourceY);
    targetX = sourceY;
    targetY = sourcePicture.getWidth() - 1 - sourceX;
    targetPixel = this.getPixel(targetX,targetY);
    targetPixel.setColor(sourcePixel.getColor());
}
}
```

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Testing Left Rotation

- String file = FileChooser.getMediaPath("7inX95in.jpg");
- Picture p = new Picture(file);
- p.show();
- p.copyKatieLeftRotation();
- p.repaint();

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Right Rotation

- How can you copy one picture onto another so that the first picture is rotated to the right 90 degrees?



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Right Rotation

- Assume that each pixel holds one number
- This is the result of a right rotation on this 2-d array
- Can you create an algorithm for this?

	0	1	2
0	1	2	3
1	4	5	6

	0	1
0	4	1
1	5	2
2	6	3

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Right Rotation

- Try out your algorithm on another example
 - Does it work?
- Can you translate it into code?

	0	1	2	3
0	5	6	7	8
1	1	2	3	4

	0	1
0		
1		
2		
3		

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Right Rotation

- To rotate an image right 90 degrees still copy all the pixels
 - But they go to different locations in the target
 - Column values become row values
 - target y = source x
 - target x = source height
 - 1 – source y

	0	1	2
0	1	2	3
1	4	5	6

	0	1
0	4	1
1	5	2
2	6	3

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Right Rotation Exercise

- Write the method to rotate the picture of Katie to the right instead of to the left
- Try out the method

```
String file = FileChooser.getMediaPath("7inX95in.jpg");
Picture p = new Picture(file);
p.show();
p.copyKatieRlghtRotation();
p.repaint();
```
- Can you make the method more general?
 - To work on any picture?

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Summary

- To copy one picture to another with the first picture rotated
 - You need to change the targetX and targetY
- You should simplify a problem
 - And try to solve it by hand
 - Then come up with an algorithm for solving it
 - And then try it on another example

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