08: Fun with Loops

The for Loop Recap

Random Turtle Walk

The Triangle Spin

The Single Line Spiral

The for Loop Recap

The for Loop

Take a moment to remind yourself what a for-loop looks like.

```
for (initialization; test; update) {
    statement(s);
}
```

Random Turtle Walk

Goal

- In this activity, our goal is to create a random turtle walk.
- We will need to understand arrays.

Arrays

- An array is a list of variables.
- An array has n items.
- The first element in an array is always zero.
- The last element in an array is always $n - 1$.
- If an array has 7 elements, what is the position of the first and last element?

Colors

What are the seven colors of the rainbow?

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What are the seven colors of the rainbow?

- Red, Orange, Yellow, Green, Blue, Indigo, and Violet.
- If this were an array, what is the position of Red?
- If this were an array, what is the position of Green?
- If this were an array, what is the position of Violet?

Colors

What are the seven colors of the rainbow?

- Red, Orange, Yellow, Green, Blue, Indigo, and Violet.
- If this were an array, what is the position of Red? 0
- If this were an array, what is the position of Green? 3
- If this were an array, what is the position of Violet? 6

As computer scientists, we always begin counting with 0.

Colors

- Imagine that there were 100 people and you had t-shirts to give away with each of the seven colors.
- Because we are computer scientists, the first person is 0. The last person is 99.
- How would you pass out t-shirts so that the colors remain relatively equal?

Solution!

- Cycle through each color when passing out the t-shirts, starting with RED to Person 0.
- Person 1 gets ORANGE.
- Person 2 gets YELLOW.
- Person 3 gets GREEN.
- Person 7 gets RED again!
- What color would person 99 get? Take a moment to think about this.

Can we represent this with math?

- Yes!
- Compute 99 divided by 7 and find the remainder.
- In this case, it's 1. The t-shirt color corresponding to 1 is ORANGE.
- Person 99 gets an ORANGE t-shirt.
- The Java symbol for remainder is "%".
- 99 % 7 is equal to 1.

New Project: Art

- Create a new project called “Art”.
- Import the TurtleLog.jar library.
- We will ask the user for an integer representing the number of sides of the desired shape and draw that shape.
- Because we are starting out, we will begin with a new shape: the triangle.
- A triangle has 3 sides.
- A triangle requires that we turn 120 degrees to the left each time we move.

Just like last time.

Modify the line containing "public class Art {" to look like this.

```
public class Art extends Sandbox
```

You will have to fix your code's imports to make the error on "Sandbox" go away.

Start Programming.

In your main method, add one line of code. It will look like this.

```
public static void main(String[] args) {
    launch(args);
}
```

Place a turtle

Create a new method called “draw”.

```
@Override
public void draw() {
    Random rng = new Random();
    Turtle turtle = new Turtle();
    add(turtle);
}
```

You will need to fix imports.

Create the array of colors

```
Color[] colors = {Color.RED, Color.ORANGE,
                  Color.YELLOW, Color.GREEN,
                  Color.BLUE, Color.INDIGO,
                  Color.VIOLET };
```

Here “Color” is a type that we haven’t discussed before. Yes, color can be represented as a variable!

Move the turtle 1000 times

```
for (int i = 0; i < 1000; i++) {
    turtle.setColor(colors[i % 7]);
    int size = rng.nextInt(100) + 50;
    int degrees = rng.nextInt(360) - 180;
    turtle.forward(size);
    turtle.left(degrees);
}
```

Watch your turtle move!

- This display will cause the turtle to move randomly and turn randomly around the screen.
- No one will have the same artwork on their screen!
- Each line should be one of the seven colors.

The Triangle Spin

Next art: Triangle Spin

To get started on this, remove the for loop and all the code inside. You will need to define the size of your triangles.

```
int size = 300;
```

Here we go.

This for loop will end in three slides. Put everything on the next few slides inside of this for loop.

```
for (int i = 0; i < 72; i++) {
    turtle.up();
    turtle.forward(size / 2);
    turtle.down();
    turtle.setColor(colors[i % 7]);
    turtle.left(150);
```

Part 2

This draws one triangle.

```
for (int s = 0; s < 3; s++) {
    turtle.forward(size);
    turtle.left(120);
}
```

Part 3

```
    turtle.left(30);
    turtle.up();
    turtle.forward(size / 2);
    turtle.down();
    turtle.left(185);
} // End the for loop
```

Watch the art work happen!

The Single Line Spiral

Next art: The Spirals.

To get sarted on this, remove the for loops and all of the code inside.

Here we go.

We will be drawing 72 spirals, each 5 degrees apart. 72 times 5 is 360. In the for loop, we select a color and draw one spiral. Notice that we do not finish this for loop.

```
for (int t = 0; t < 72; t++) {
    turtle.setColor(colors[t % 7]);
    for (int i = 0; i < 100; i++) {
        turtle.forward(i);
        turtle.left(10);
    }
```

Part 2

Now that we have drawn one spiral, pick up the pen, return home, put the pen back down, and turn 5 degrees to the left.

```
    turtle.up();
    turtle.goHome();
    turtle.down();
    turtle.left(5);
}
```

Watch the art work happen!