

## 15-104 Introduction to Computing for Creative Practice

*Fall 2020*

08 Loops

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## Draw Lots of Lines (source: Shiffman)

```
function setup() {
  createCanvas(480, 270);
  background(200);
}
function draw() {
  stroke(0);
  line(50,60,50,80);
  line(60,60,60,80);
  line(70,60,70,80);
  line(80,60,80,80);
  line(90,60,90,80);
  line(100,60,100,80);
  line(110,60,110,80);
  line(120,60,120,80);
  line(130,60,130,80);
  line(140,60,140,80);
  line(150,60,150,80);
  line(160,60,160,80);
  line(170,60,170,80);
  line(180,60,180,80);
  line(190,60,190,80);
  line(200,60,200,80);
}
```

What patterns can you see here?

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## Finding Patterns

```

var y = 60; // Vertical location of each line
var x = 50; // Initial horizontal location for first line
var spacing = 10; // How far apart is each line
var len = 20; // Length of each line

line(x, y, x, y + len);
// Add spacing so the next line appears 10 pixels to the right
x = x + spacing;

// Continue this process for each line, repeating over and over
line(x, y, x, y + len);
x = x + spacing;

...

```

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## Much Shorter Program with a Loop

```

function setup() {
  createCanvas(480, 270);
  background(200);
}
function draw() {
  var y = 60;
  var spacing = 10;
  var len = 20;
  for (var x = 50; x <= 200; x += spacing) {
    line(x, y, x, y + len);
  }
}

```

Equivalent to:

```

line(50,60,50,80);
line(60,60,60,80);
line(70,60,70,80);
...
line(190,60,190,80);
line(200,60,190,80);

```

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## for Loop

Format:

```
for ( loop_initialization ; loop_condition ; loop_update ) {
    code to repeat
}
```

*loop\_initialization*: defines loop variable that will update with each iteration

*loop\_condition*: defined what condition must be true for the loop to continue to repeat

*loop\_update*: defines any updates that must happen (particularly to the loop variable) at the end of each iteration before the *loop\_condition* is tested again.

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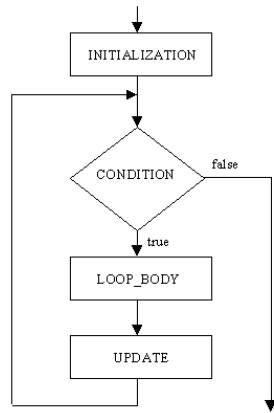
## Understanding a loop

```
for (var x = 50; x <= 200; x += spacing) {
    line(x, y, x, y + len);
}
```

1. Set the (local) loop variable **x** equal to 50.
2. If **x** is less than or equal to 200, then run the body of the loop.  
If not, then exit the loop and continue with the first instruction after the loop.
3. Once one iteration of the body of the loop is completed, update the loop variable by adding **spacing** to it.
4. Go back to step 2.

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## Understanding a loop



Questions:

What is the minimum number of times a loop can repeat?

What is the maximum number of times a loop can repeat?

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## Understanding a loop

Zero iterations:


```
for (var x = 50; x <= 40; x += spacing) {
  line(x, y, x, y + len);
}
```

Infinite Loop:

```
for (var x = 50; x >= 50; x += spacing) {
  line(x, y, x, y + len);
}
```

When using loops, it really helps to print out the loop variable to the console sometimes!

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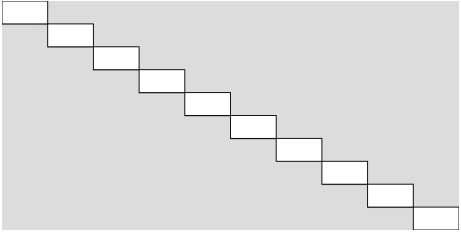


## Staircase


```
function setup() {
  createCanvas(500, 250);
  background(220);
}

function draw() {
  var w = width/10;
  var h = height/10;
  var y = 0;

  for (var x = 0; x < width; x += w) {
    rect(x, y, w, h);
    y += h;
  }
}
```



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## Formalities

```
for (var i = 0 ; i < n ; i += 1) {
  // loop body
}
```


This is how programmers typically write a loop that runs  $n$  times where  $i$  is the loop counter. ( $n > 0$ )

The variable  $i$  cannot be used outside of the loop since it is defined locally (within the loop structure).

The loop counter does not need to be used in the loop body.

Loops can be used within loops!

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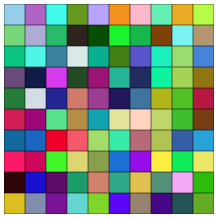


## Nested Loops

```


var side = 40;
function setup() {
  createCanvas(400,400);
  background(220);
}
function draw() {
  for (var row = 0; row < 10; row += 1) {
    for (var col = 0; col < 10; col += 1) {
      fill(random(0,256), random(0,256), random(0,256));
      rect(col*side, row*side, side, side);
    }
  }
  noLoop(); // not related to the for loop!
}

```



Why are row and col flipped in the rect statement?

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## Tracing Example

Shorter loops:

```

for (var row = 0; row < 5; row += 1) {
  for (var col = 0; col < 4; col += 1) {
    ...
  }
}

```

row	0	0	0	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4
col	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3	0	1	2	3

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