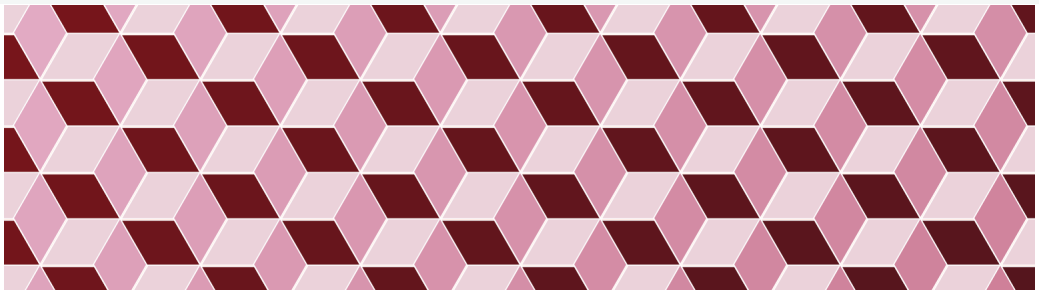

15-104 Introduction to Computing for Creative Practice

Fall 2021

09 More Loops

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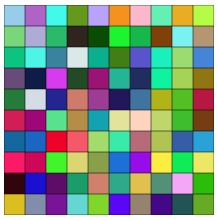
1

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?

2

Tracing Example

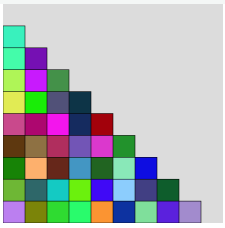
Shorter loops:

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

```
row  0 0 0 0 0 1 1 1 1 1 2 2 2 2 2 3 3 3 3 3 4 4 4 4 4 5
col  0 1 2 3 4 0 1 2 3 4 0 1 2 3 4 0 1 2 3 4 0 1 2 3 4
```

3

Nested Loops (one change)



```
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 < row; 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!
}
```

4

Tracing Example

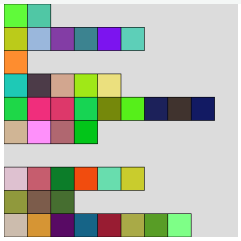
Shorter loops:

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

```
row   0 1 1 2 2 2 3 3 3 3 4 4 4 4 4 5
col   0 0 1 0 1 2 0 1 2 3 0 1 2 3 4
```

5

Nested Loops



```
var side = 40;
function setup() {
    createCanvas(400,400);
    background(220);
}
function draw() {
    for (var row = 0; row < 10; row += 1) {
        var limit = floor(random(0,11));
        for (var col = 0; col < limit; 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!
}
```

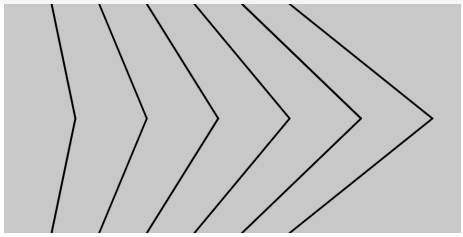
6

What is the result?

```
function setup() {
    createCanvas(480, 240);
    strokeWeight(2);
}

function draw() {
    background(200);
    for (var i = 50; i <= 300 ; i += 50) {
        line(i, 0, 1.5*i, 120);
        line(1.5*i, 120, i, 240);
    }
}
```

7

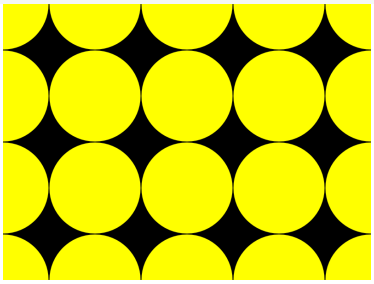
What is the result?



```
function setup() {
    createCanvas(480, 240);
    strokeWeight(2);
}

function draw() {
    background(200);
    for (var i = 50; i <= 300 ; i += 50) {
        line(i, 0, 1.5*i, 120);
        line(1.5*i, 120, i, 240);
    }
}
```

8

Draw this:



The canvas size is 400 X 300.

Each circle has a diameter of 100.

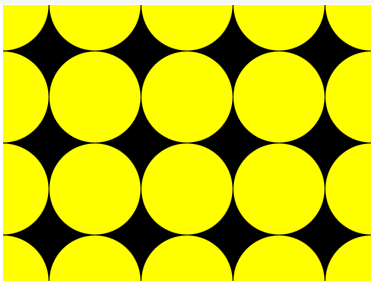
The background is black.

The circles are yellow.

Write a list of the centers of all of the circles.
What pattern(s) do you see? How many loops will you need?

9

Draw this:



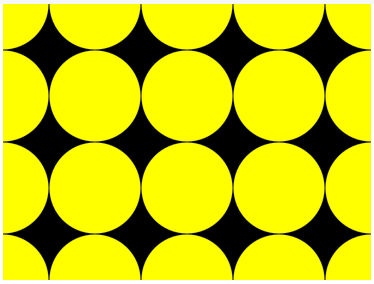
```
(  0,   0)          (  0, 200)
(100,   0)          (100, 200)
(200,   0)          (200, 200)
(300,   0)          (300, 200)
(400,   0)          (400, 200)

(  0, 100)          (  0, 300)
(100, 100)          (100, 300)
(200, 100)          (200, 300)
(300, 100)          (300, 300)
(400, 100)          (400, 300)
```

y changes less frequently, so
y should be the outer loop

x changes more frequently, so
x should be the inner loop

10

Draw this:



```
function setup() {
    createCanvas(400, 300);
    background(0);
}

function draw() {
    fill(255, 255, 0);  // yellow
    for (var y = 0; y <= 300; y += 100) {
        for (var x = 0; x <= 400; x += 100) {
            circle(x, y, 100);
        }
    }
}
```

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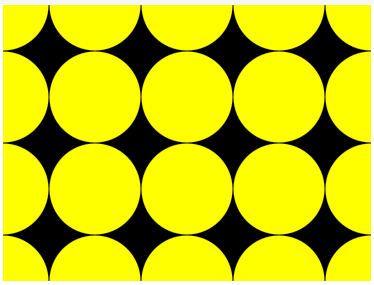
Draw this:



```
function setup() {
    createCanvas(400, 300);
    background(0);
}

function draw() {
    fill(255, 255, 0);  // yellow
    for (var row = 0; row <= 3; row += 1)
        for (var col = 0; col <= 4; col += 1) {
            circle(col*100, row*100, 100);
        }
    }
}
```

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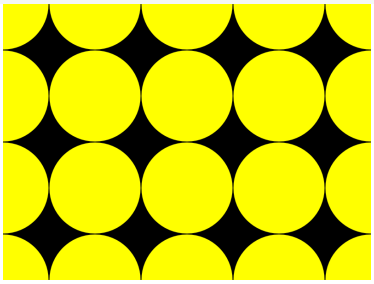
Draw this:



```
function setup() {
    createCanvas(400, 300);
    background(0);
}

function draw() {
    fill(255, 255, 0);  // yellow
    for (var row = 0; row < 4; row += 1)
        for (var col = 0; col < 5; col += 1) {
            circle(col*100, row*100, 100);
        }
    }
}
```

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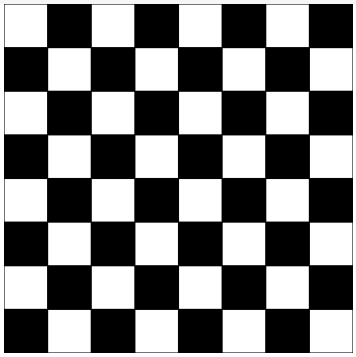
Chess Board



```
var grayvalue = 255;

function setup() {
    createCanvas(320, 320);
}

function draw() {
      // to be completed
}
```

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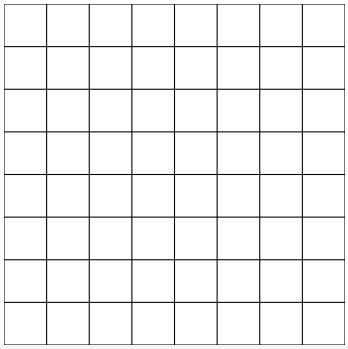
Chess Board

```
function draw() {
    rectMode(CENTER);
    for (var y = 20; y <= 300; y += 40) {
        for (var x = 20; x <= 300; x += 40) {
            fill(grayvalue);
            rect(x, y, 40, 40);
        }
    }
}
```



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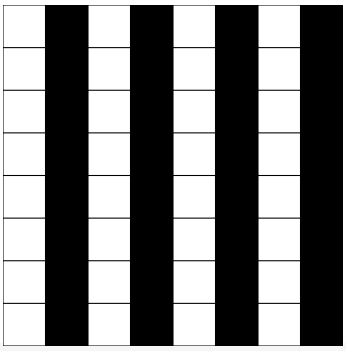
Chess Board

```
function draw() {
    rectMode(CENTER);
    for (var y = 20; y <= 300; y += 40) {
        for (var x = 20; x <= 300; x += 40) {
            fill(grayvalue);
            rect(x, y, 40, 40);
            grayvalue = 255 – grayvalue;
        }
    }
}
```

This instruction flips grayvalue from 0 to 255 or from 255 to 0. Do you see why?



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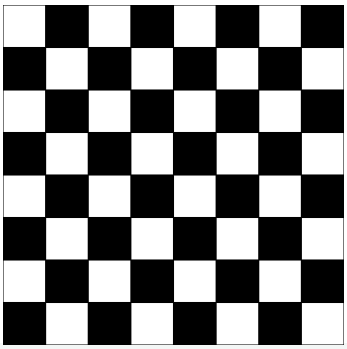
Chess Board

```
function draw() {
    rectMode(CENTER);
    for (var y = 20; y <= 300; y += 40) {
        for (var x = 20; x <= 300; x += 40) {
            fill(grayvalue);
            rect(x, y, 40, 40);
            grayvalue = 255 – grayvalue;
        }
        grayvalue = 255 – grayvalue;
    }
}
```



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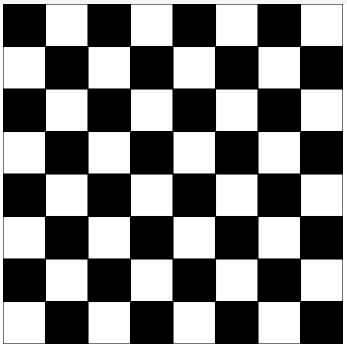
Another Way

```
function setup() {
    createCanvas(320, 320);
}
function draw() {
    rectMode(CORNER);
    for (var row = 0; row < 8; row += 1) {
        for (var col = 0; col < 8; col += 1) {
            fill( ((row+col) % 2) * 255 );
            rect(col*40, row*40, 40, 40);
        }
    }
}
```



Modulo operator x % y (for x > 0, y >0): Divide x by y and keep the remainder.
When y = 2, there are only two remainders, 0 (for even x) and 1 (for odd x).
So the two fills are 0*255 = 0 (black) when row+col is even
and 1*255 = 255 (white) when row+col is odd.

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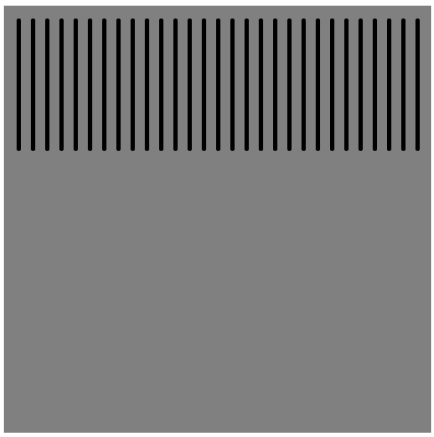
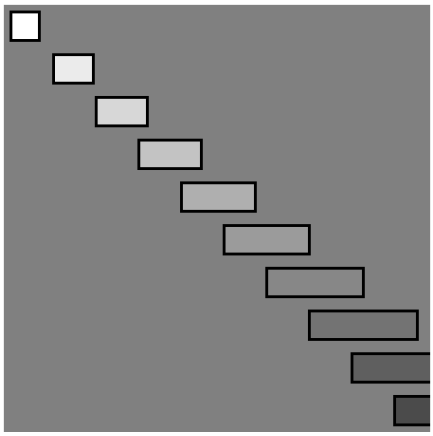
Try This





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