Nested Loops & Arrays
CSE 120 Spring 2017

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Administrivia

Assignments:
- Creativity Planning due Tuesday (4/18)
  - Find a partner, come up with *two* proposed programs
- Portfolio Update 1 due Tuesday (4/18)
- Binary Practice (4/21)
- Creativity Assignment (4/24)

Midterm in class on Wednesday, 4/26
- 1 sheet of notes (2-sided, letter, handwritten)
- Fill-in-the-blank(s), short answer questions, maybe simple drawing
Outline

- Student Work Showcase
- For-Loop Review
- Nested Loops
- Arrays
  - Arrays and Loops
Custom Logo

Cadey Kwon
Lego Family

Sarah Liu
Outline

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- For-Loop Review
- Nested Loops
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  - Arrays and Loops
For-Loop Review

- Loops control a sequence of *repetitions*
  - Do the same thing (or similar things) over and over again

- **Examples**: What is changing?
Example: Circle Loop

```java
size(400, 400);
noFill();
for(int d = 450; d > 0; d = d - 10) {
    ellipse(width/2, height/2, d, d);
}
```
Example: Line Gradient

```
size(400, 400);
background(255);
strokeWeight(5);

for(int i = 0; i < 400; i = i + 8){
  stroke(i);
  line(i, 0, i, 400);
}
```
Example: Looping with User Interaction?

- Draw lines from left side of screen to the horizontal position of the mouse
Example: Draw Lines to mouseX

```java
void setup() {
  size(400, 400);
  strokeWeight(4);
}

void draw() {
  background(204);

  for(int i = 10; i < mouseX; i = i + 8){
    line(i, 10, i, 390);
  }
}
```
Outline

- Student Work Showcase
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- Arrays
  - Arrays and Loops
Nested Loops

- Generally a for-loop has a single loop variable that changes with each iteration.

- What if you need/want more things to change?
  - Can nest loops – *i.e.* put a loop inside of another loop.
Example: Dot Grid

```java
size(400, 400);

for(int y = 20; y <= height-20; y = y + 5){
    for(int x = 20; x <= width-20; x = x + 5){
        point(x, y);
    }
}
```
Example: 2D Gradient

```java
size(400, 400);
noStroke();

for(int y = 0; y < width; y = y + 10){
    for(int x = 0; x < height; x = x + 10){
        fill((x+y)*0.5);
        rect(x, y, 10, 10);
    }
}
```
Outline

- Student Work Showcase
- For-Loop Review
- Nested Loops
- **Arrays**
  - Arrays and Loops
Arrays

- “Structures” that store many values of the same datatype
  - Help us group related data

- Arrays store large amounts of data that you can access using a single variable name
  - Accessing arrays with loops is very convenient
Arrays

“Structures” that store many values of the same datatype

- **Element**: a single value in the array
- **Index**: a number that specifies the location of a particular element of the array
  - Start from 0
- **Length**: total number of elements in the array

**Example:**

<table>
<thead>
<tr>
<th>Index</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>1</td>
<td>49</td>
</tr>
<tr>
<td>2</td>
<td>-2</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>17</td>
</tr>
</tbody>
</table>

Length of 5
Arrays in Processing

- **Declaration:** `type[] name`
  - *e.g.* `int[]` is array of integers, `color[]` is array of colors

- **Creation:** `new type[num]`
  - *e.g.* `int[] intArr = new int[5];`
  - Default value for *all* elements is “zero-equivalent” (0, 0.0, `false`, black)
  - Remember that actual indices are from 0 to `num-1`

- **Initialization:** `{elem0, elem1, ..., elemN};`
  - *e.g.* `int[] intArr = {12, 49, -2, 5, 17};`
Arrays in Processing

- **Use element:** `name[index]`
  - In *expression*, uses value of that index of the array
  - In *assignment*, modifies value of that index of the array

- **Get length:** `name.length`

- **Example:**
  ```java
  int[] intArr = {12, 49, -2, 5, 17};
  println(intArr[0]);  // prints 12 to console
  intArr[2] = intArr.length;  // changes -2 to 5
  ```

<table>
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<tr>
<th>Index</th>
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<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>12</td>
<td>49</td>
<td>-2</td>
<td>5</td>
<td>17</td>
</tr>
</tbody>
</table>
Example: Lots of Plusses
Example: Index of Smallest Number

- **Algorithm:**
  - Keep track of the *index* of the smallest number seen so far
    - Start with index 0
  - Check each *element* 1-by-1; if number is smaller, then update the smallest index

```c
// returns the index of the smallest number in a list
int find_smallest(float[] list) {
    int smallest = 0;
    for(int i = 1; i < list.length; i=i+1) {
        if(list[i] < list[smallest]) {
            smallest = i;
        }
    }
    return smallest;
}
```