Functions in Processing

CSE 120 Winter 2019

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Amazon scraps secret AI recruiting tool that showed bias against women

"[Amazon's] machine-learning specialists uncovered a big problem: their new recruiting engine did not like women. The team had been building computer programs since 2014 to review job applicants' resumes with the aim of mechanizing the search for top talent."

"But by 2015, the company realized its new system was not rating candidates for software developer jobs and other technical posts in a gender-neutral way. That is because Amazon's computer models were trained to vet applicants by observing patterns in resumes submitted to the company over a 10-year period. Most came from men, a reflection of male dominance across the industry."

- https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK08G

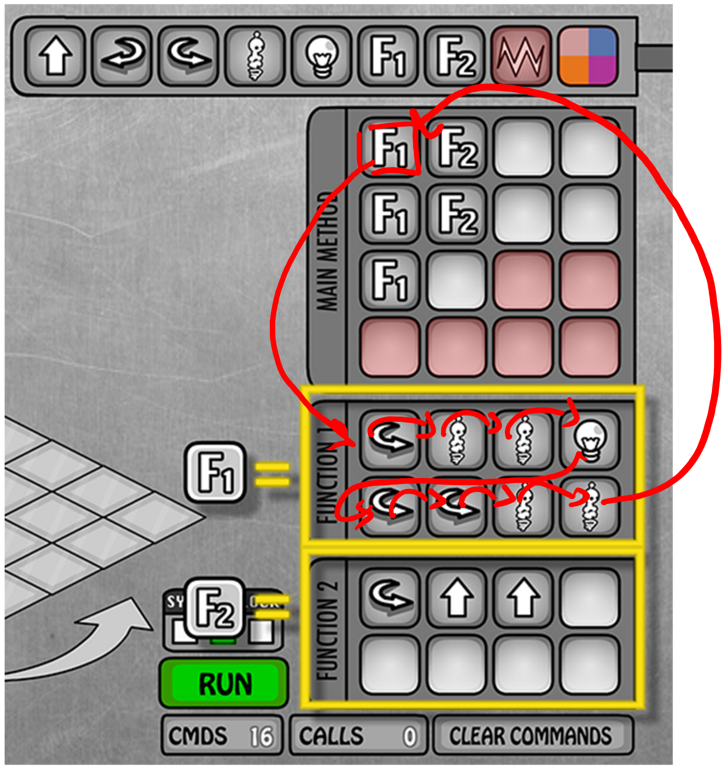
Administrivia

- Assignments:
  - Lego Family [submit] due tonight (1/23)
  - Website Setup [checkoff] due tomorrow (1/24)
  - Reading Check 3 due tomorrow @ 3:30 pm (1/24)
- Editing your portfolio from home
  - Download and install Cyberduck & VS Code
  - Re-do Steps 3 & 4 from the website setup
- Make sure to take advantage of office hours and Piazza!

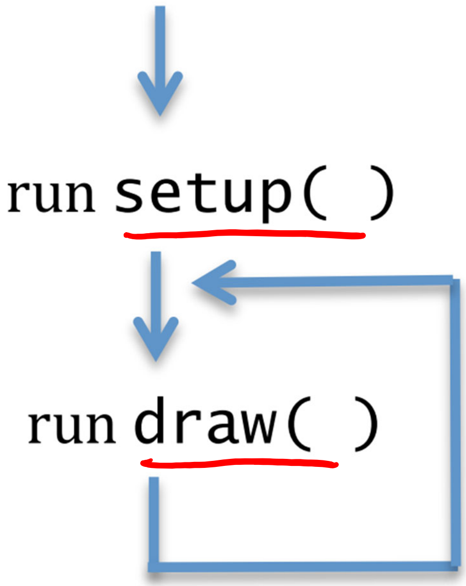
Functions (So Far)

- Used for **abstraction**
  - *Detail Removal:* subtasks with intuitive names
  - *Generalization:* don't repeat code

Lightbot:



Processing:



- `line()`, `rect()`, …
- `min()`, `max()`

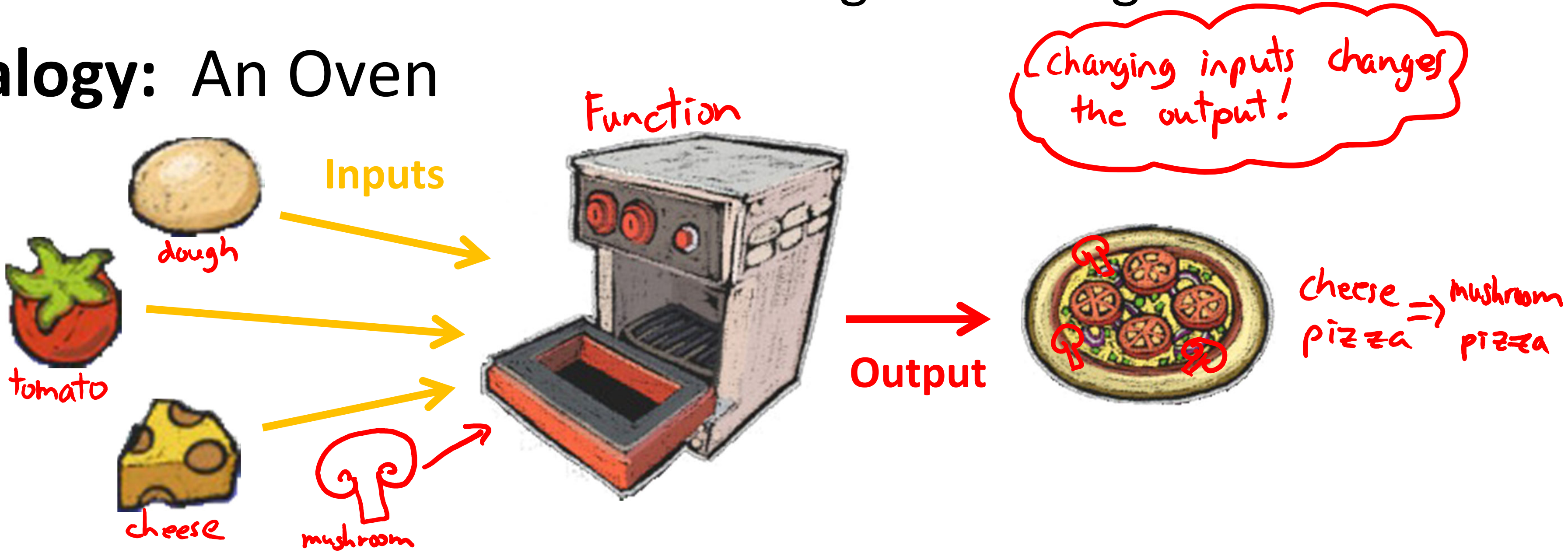
Program Execution with Functions

- Functions "break" the normal sequential execution model
  - line(50,50,100,100)
  - When function is called, begin execution of function code
  - When end of function is reached, jump back to where function was called from
    - The keyword associated with this is `return`

- **Analogy:** Song lyrics with a repeated chorus
  - Example: Survivor – Eye of the Tiger
    - Verse 1, Verse 2, Chorus, Verse 3, CHORUS, Verse 4, CHORUS, Outro

Data Passing with Functions

- It takes in zero or more inputs, completes some task(s), and then returns a value
  - Functions can do more in Processing than in Lightbot!
- **Analogy:** An Oven


Changing inputs changes the output!
Function
Inputs
dough
tomato
cheese
mushroom
Output
cheese pizza => mushroom pizza

- **Analogy:** Song lyrics with that change *slightly*
  - *Parameterized* Example: Old MacDonald
    - Chorus(cow,moo), Chorus(pig,oink), Chorus(duck,quack)

House-Drawing Function

```
void setup() {
  size(500, 500);
}

void draw() {
  drawHouse(70, 10);
}

void drawHouse(int x, int y) {
  triangle(x, y, x-40, y+40, x+40, y+40);  // roof
  rect(x-40, y+40, 80, 80);                // walls
  rect(x+10, y+80, 20, 40);                // door
  return;
}
```

values passed into the function

Return Type

return type

```
void drawHouse(int x, int y) {
  triangle(x, y, x-40, y+40, x+40, y+40);  // roof
  rect(x-40, y+40, 80, 80);                // walls
  rect(x+10, y+80, 20, 40);                // door
  return;
}
```

- What the function sends back to whoever called it
  - Can be any of the datatypes: `int`, `float`, `color`, etc.
  - If not returning anything, then we use `void`

Function Name

function name

```
void drawHouse(int x, int y) {
  triangle(x, y, x-40, y+40, x+40, y+40);   // roof
  rect(x-40, y+40, 80, 80);                 // walls
  rect(x+10, y+80, 20, 40);                 // door
  return;
}
```

- Does not matter to computer, but does to humans
  - Should describe what the function does
- Subject to same naming constraints as variables
- No two functions (or variables) can have the same name ← confuses the computer

Parameters

parameters

```
void drawHouse(int x, int y) {
  triangle(x, y, x-40, y+40, x+40, y+40);   // roof
  rect(x-40, y+40, 80, 80);                 // walls
  rect(x+10, y+80, 20, 40);                 // door
  return;
}
```

- Required part of every function definition
  - Must be surrounded by parentheses
  - If no parameters, parentheses are left empty ( )

- Datatype and name for every parameter must be specified you are essentially declaring variables
  - Separate parameters with commas

Function Body

body

start of body

end of body

```
void drawHouse(int x, int y) {
  triangle(x, y, x-40, y+40, x+40, y+40);  // roof
  rect(x-40, y+40, 80, 80);                // walls
  rect(x+10, y+80, 20, 40);                // door
  return; (jump back to where this function was called)
}
```

- Body is enclosed in curly braces { }
  - Parameters are variables that are used inside the body
- Body of a function is indented for better readability
  - Processing uses two spaces by default
  - Can use Edit → "Auto Format" to clean yours up automatically

Lightbot Functions

- Lightbot functions had a different syntax, but similar parts:

function name parameters body

```
F.turn_around(){Right, Right}.
```

Functions Worksheet

```
void setup() {
  size(500, 500);
}

void draw() {
  drawHouse(70, 10);
}

void drawHouse(int x, int y) {
  triangle(x, y, x-40, y+40, x+40, y+40);  // roof
  rect(x-40, y+40, 80, 80);                // walls
  rect(x+10, y+80, 20, 40);                // door
  return;
}
```

function call

function name

return type

parameters

body

- Make sure you *explain* why you see what you see!

Donatello as a Function

```
// draw Donatello
void drawDon() {
  fill(0, 100, 0);              // dark green
  rect(x_pos, 182, 40, 15);     // top of head

  fill(88,44,141);              // purple
  rect(x_pos, 197, 40, 6);      // bandana mask

  fill(0, 100, 0);              // dark green
  rect(x_pos, 203, 40, 20);     // bottom of head

  fill(219, 136, 0);            // dark yellow
  rect(x_pos, 223, 40, 50);     // shell

  fill(0, 100, 0);              // dark green
  rect(x_pos, 273, 40, 45);     // lower body
}
```

easier to understand, removes details of drawing Donatello from draw()

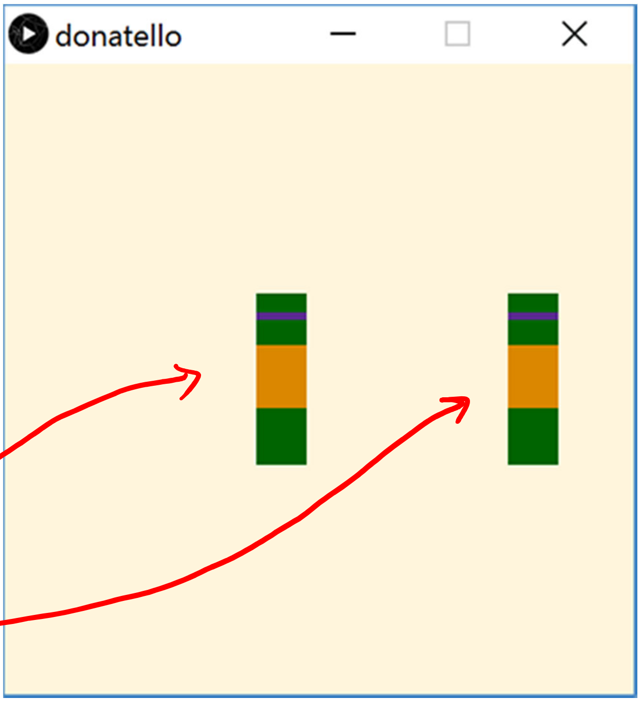
calling drawDon() always reads from the same x-pos variable

Donatello Function *Parameterized*

- Can now call `drawDon()` function with different arguments (stored in parameter `x_don`):

```
// draw Donatello
void drawDon(int x_don) {
  fill(0, 100, 0);         // dark green
  rect(x_don,182,40,15);   // top of head
  ...
```

```
void draw() {
  background(255, 245, 220);
  drawDon(200);
  drawDon(400);
}
```



- We can also add parameter `color mask` to draw the other Teenage Mutant Ninja Turtles!

Parameters vs. Arguments

```
// draw TMNT with parameters
void draw() {
  background(255, 245, 220);
  drawTurtle(200, color(88, 44, 141)); // donatello
  drawTurtle(400, color(255, 0, 0));   // raphael
}
                  arguments

                  parameters
// parameterized ninja turtle drawing function
void drawTurtle(int x, color mask) {
  fill(0, 100, 0);          // dark green
  rect(x, 182, 40, 15);     // top of head

  fill(mask);               // apply mask color
  rect(x, 197, 40, 6);      // bandana mask
  ...
```

- Implicit parameter/variable initialization with argument values

Parameters vs. Arguments

- When you define a function, you specify the parameters
  - Parameters are *internal* variables/boxes for functions
  - Use parameters for values that you want to be different on different calls to this function

- When you call a function, you pass arguments
  - The order of the arguments must match the order of the parameters

- We define a function once, but can call it as many times as we want (and in different ways)!

arguments

Solving Problems

- Understand the problem
  - What is the problem description?
  - What is specified and what is *un*specified?
  - What has been given to you (*e.g.* starter code)?
- Break the task down into less complex subtasks

different x, same y

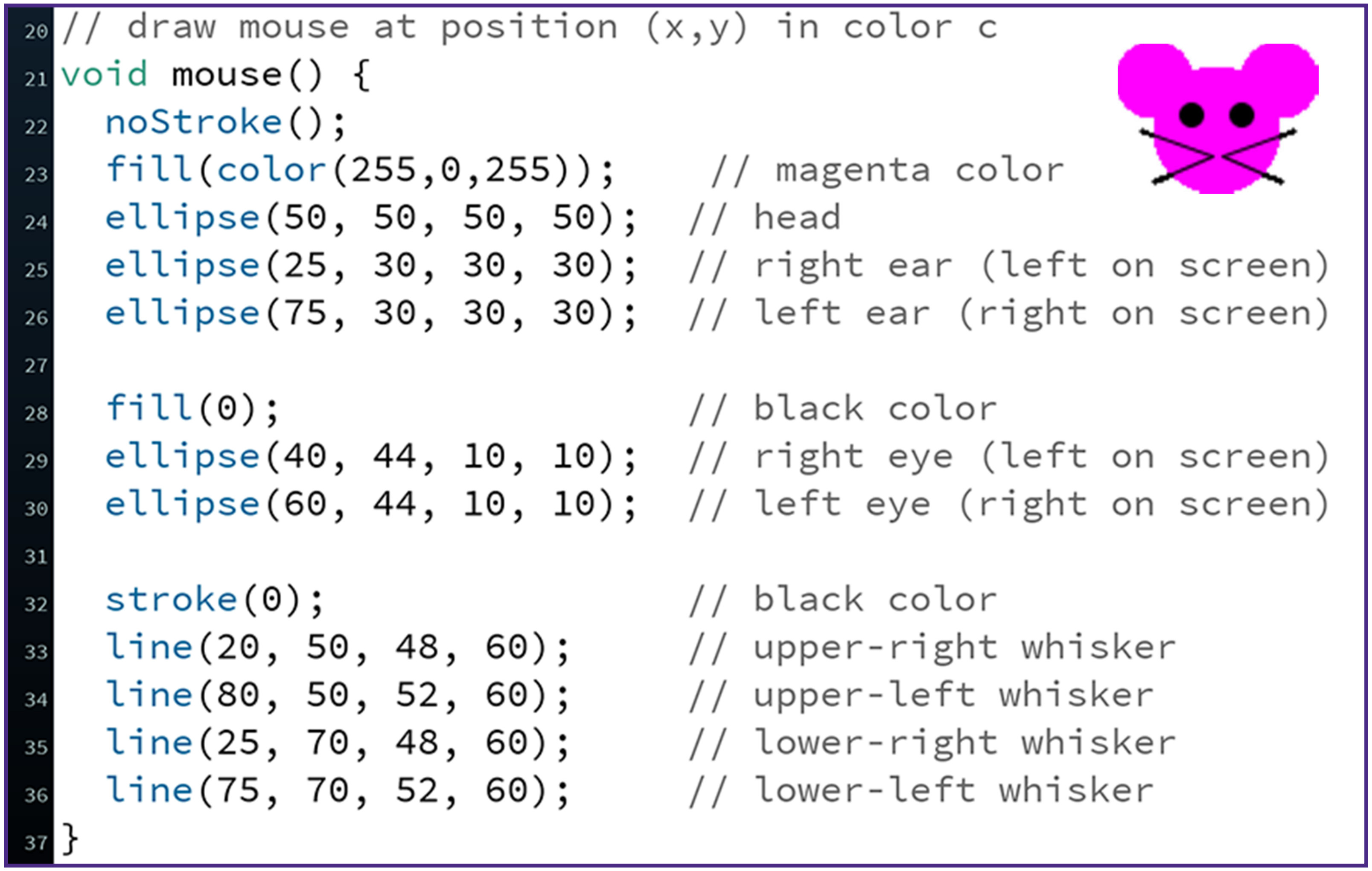
- Example: Make a function that draws a row of five mice with their ears touching/overlapping. The mice should all be the same color except for the middle one, which should be red.

different colors

main subtask: draw a mouse

something like: void mouse (int x_pos, color c)

Parameter Example

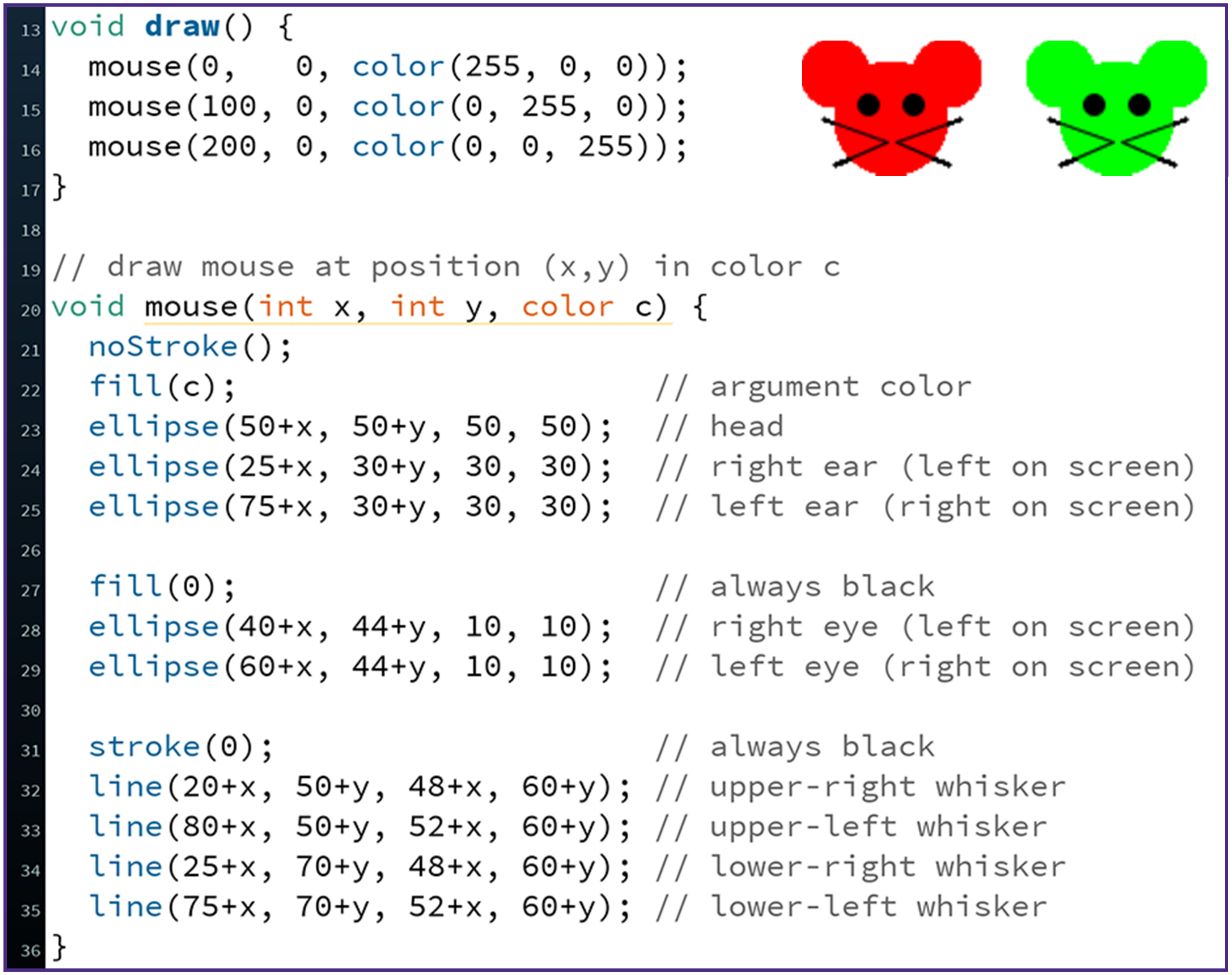


```
// draw mouse at position (x,y) in color c
void mouse() {
  noStroke();
  fill(color(255,0,255));     // magenta color
  ellipse(50, 50, 50, 50);   // head
  ellipse(25, 30, 30, 30);   // right ear (left on screen)
  ellipse(75, 30, 30, 30);   // left ear (right on screen)

  fill(0);                   // black color
  ellipse(40, 44, 10, 10);   // right eye (left on screen)
  ellipse(60, 44, 10, 10);   // left eye (right on screen)

  stroke(0);                 // black color
  line(20, 50, 48, 60);      // upper-right whisker
  line(80, 50, 52, 60);      // upper-left whisker
  line(25, 70, 48, 60);      // lower-right whisker
  line(75, 70, 52, 60);      // lower-left whisker
}
```

Parameter Example

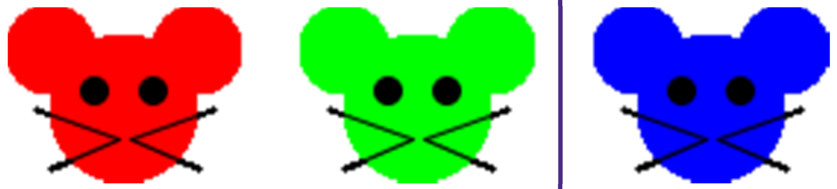


```
void draw() {
  mouse(0,   0, color(255, 0, 0));
  mouse(100, 0, color(0, 255, 0));
  mouse(200, 0, color(0, 0, 255));
}

// draw mouse at position (x,y) in color c
void mouse(int x, int y, color c) {
  noStroke();
  fill(c);                           // argument color
  ellipse(50+x, 50+y, 50, 50);   // head
  ellipse(25+x, 30+y, 30, 30);   // right ear (left on screen)
  ellipse(75+x, 30+y, 30, 30);   // left ear (right on screen)

  fill(0);                           // always black
  ellipse(40+x, 44+y, 10, 10);   // right eye (left on screen)
  ellipse(60+x, 44+y, 10, 10);   // left eye (right on screen)

  stroke(0);                         // always black
  line(20+x, 50+y, 48+x, 60+y); // upper-right whisker
  line(80+x, 50+y, 52+x, 60+y); // upper-left whisker
  line(25+x, 70+y, 48+x, 60+y); // lower-right whisker
  line(75+x, 70+y, 52+x, 60+y); // lower-left whisker
}
```



Looking Forward

- Portfolio
  - Don’t forget to add Taijitu, Logo Design, and Lego Family!
- Animal Functions
  - Start in lab on Thursday, due Monday (1/28)
  - Design your own animal (like the frog shown here)

Example from CSE120 Wi18 student