Basic Input and Output

CSE 120 Winter 2019

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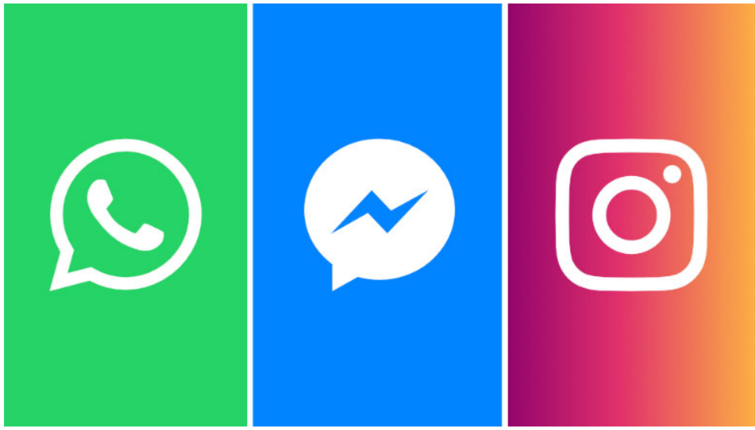
Facebook to integrate WhatsApp, Instagram and Messenger

“Until now, WhatsApp, Instagram and Messenger have been run as separate and competing products. Integrating the messaging parts might simplify Facebook's work. It wouldn't need to develop competing versions of new features, such as Stories, which all three apps have added with inconsistent results.

“Cross-platform messaging may also lead the way for businesses on one platform to message potential customers on another. And it might make it easier for Facebook to share data across the three platforms, to help its targeted advertising efforts.”

- https://www.bbc.com/news/technology-47001460



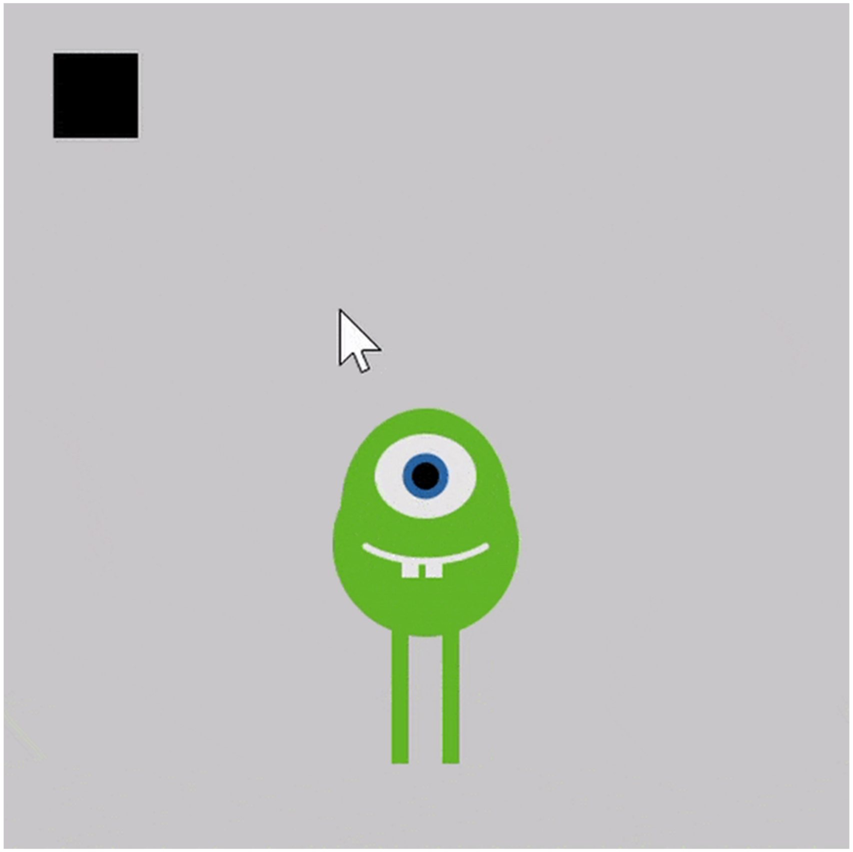
Administrivia

- Assignments:
  - Reading Check 4 due tomorrow @ 3:30 pm (1/31)
  - Jumping Monster due Friday (2/1)

    ↳ harder assignment, will take time!
- "Big Idea" this week: Digital Distribution
- Upcoming: Creativity Project, Midterm (2/11)

Jumping Monster

- Using *expressions* and *conditionals* in conjunction with *variables* and *user input* (today) to control what is drawn as well as motion:

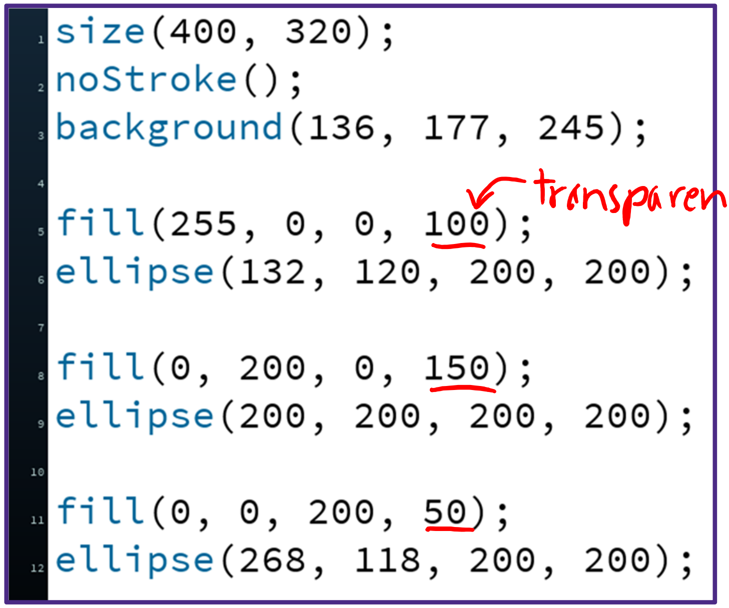


Lecture Outline

- **Other Useful Processing Tools**
- User Input and Output
  - Mouse (input)
  - Keyboard (input)
  - Text (output)

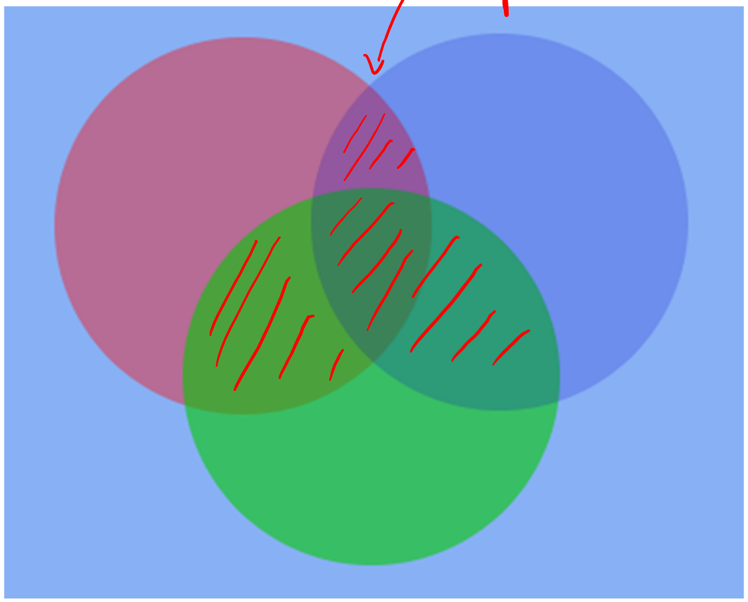
Transparency/Opacity

- You can add a 4th argument to a color!
  - This also applies to the `fill()` and `stroke()` functions
- This argument also takes an integer between 0–255
  - 0 is fully transparent (invisible)
  - 255 is fully opaque (the default)



```
size(400, 320);
noStroke();
background(136, 177, 245);

fill(255, 0, 0, 100);
ellipse(132, 120, 200, 200);

fill(0, 200, 0, 150);
ellipse(200, 200, 200, 200);

fill(0, 0, 200, 50);
ellipse(268, 118, 200, 200);
```

transparent

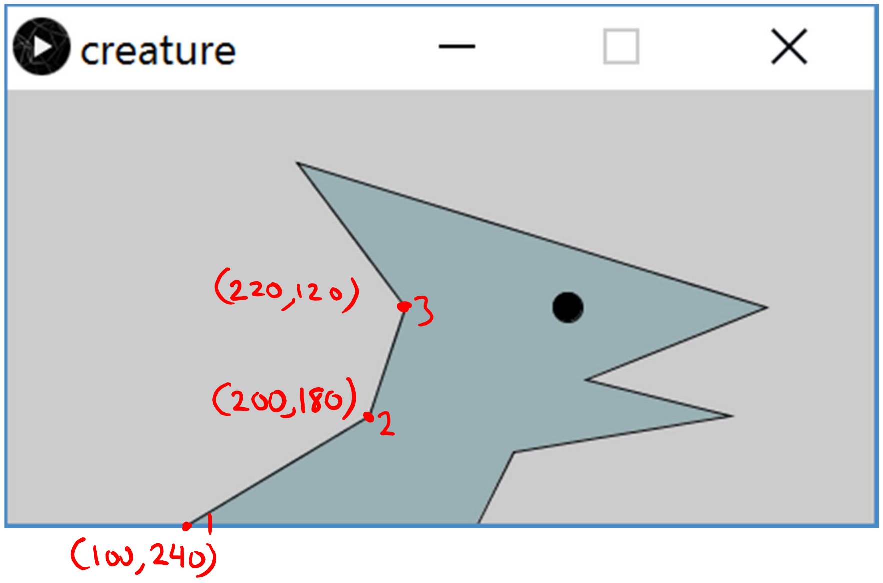


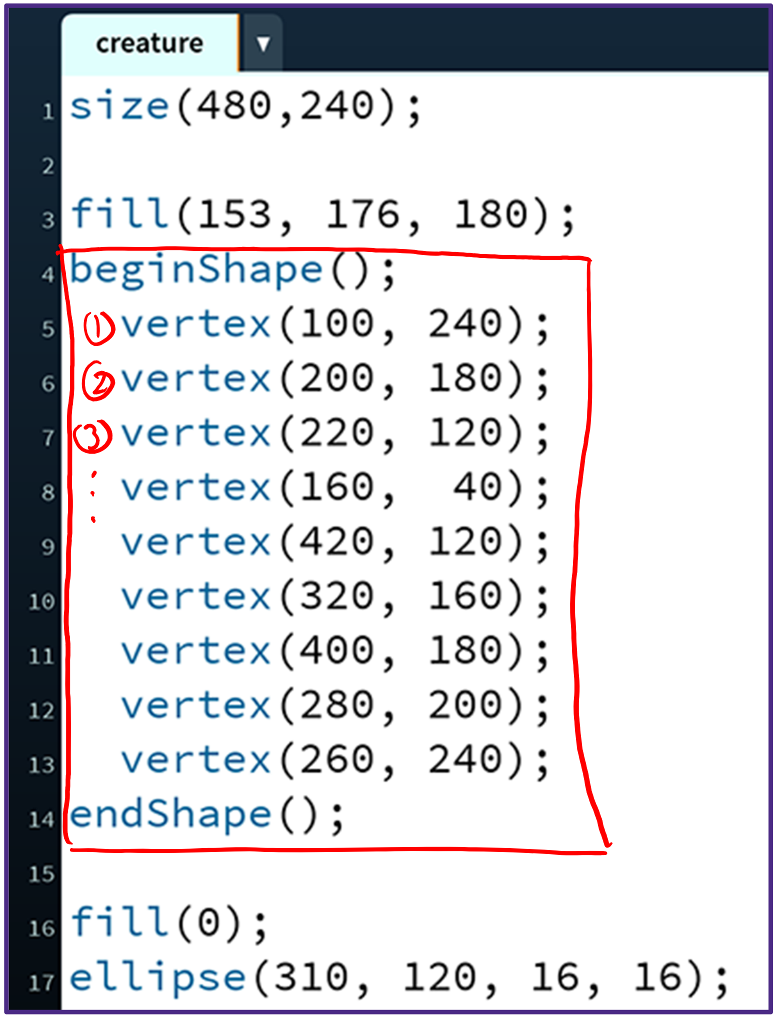
can now see overlapping parts

Custom Shapes

- Define vertices between `beginShape()` and `endShape()`
  - If planning to reuse, best to create in a separate function

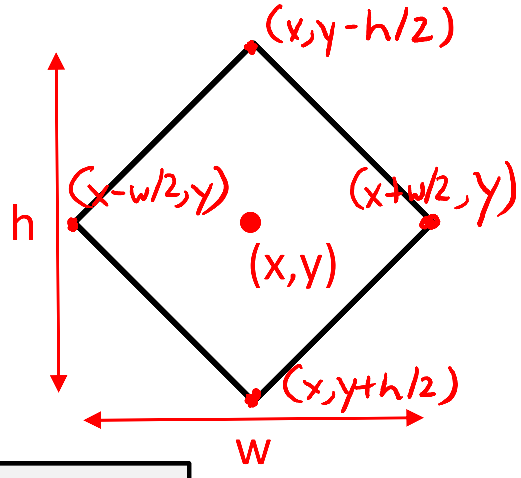
so can use like rect(), ellipse(), etc.





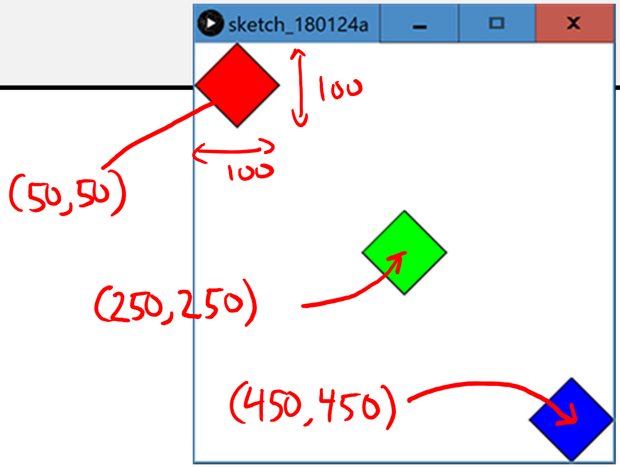
```
size(480,240);

fill(153, 176, 180);
beginShape();
 vertex(100, 240);
 vertex(200, 180);
 vertex(220, 120);
 vertex(160,  40);
 vertex(420, 120);
 vertex(320, 160);
 vertex(400, 180);
 vertex(280, 200);
 vertex(260, 240);
endShape();

fill(0);
ellipse(310, 120, 16, 16);
```

Functions Practice: Diamond



- Fill in the code to produce:

```
void diamond( float x, float y, float w, float h ) {
    beginShape();
        vertex( x , y-h/2 );
        vertex( x+w/2 , y );
        vertex( x , y+h/2 );
        vertex( x-w/2 , y );
        vertex( x , y-h/2 );
    endShape();
}
```



```
void draw() {
    fill(255,0,0);
    diamond(50,50,100,100);
    fill(0,255,0);
    diamond(250,250,100,100);
    fill(0,0,255);
    diamond(450,450,100,100);
}
```

Lecture Outline

- Other Useful Processing Tricks
- **User Input and Output ***
  - Mouse
  - Keyboard
  - Text

* We will look at a subset of the available Processing commands. For a full list, see the Processing Reference.

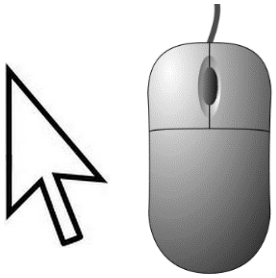
Reminder: System Variables

- Special variables that hold values related to the state of the program, often related to user input
  - You don't need to declare these variables
  - These variables will update automatically as the program runs
  - Colored **pink/magenta-ish** in the Processing environment

- We've used some of these already:
  - `width`, `height`, `frameCount`

- We'll see a lot more today

The Mouse



- System variables:
  - current frame
    - `mouseX` – x-coordinate of mouse in current frame
    - `mouseY` – y-coordinate of mouse in current frame
  - previous frame
    - `pmouseX` – x-coordinate of mouse in previous frame
    - `pmouseY` – y-coordinate of mouse in previous frame
  - `mousePressed` – is a button currently being pressed?

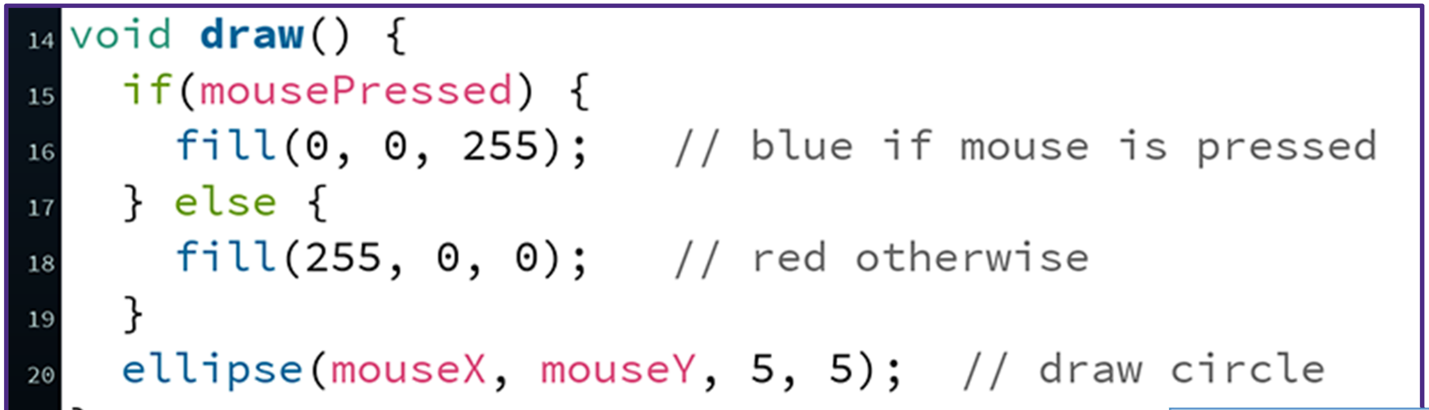
boolean → true / false

can be confusing.

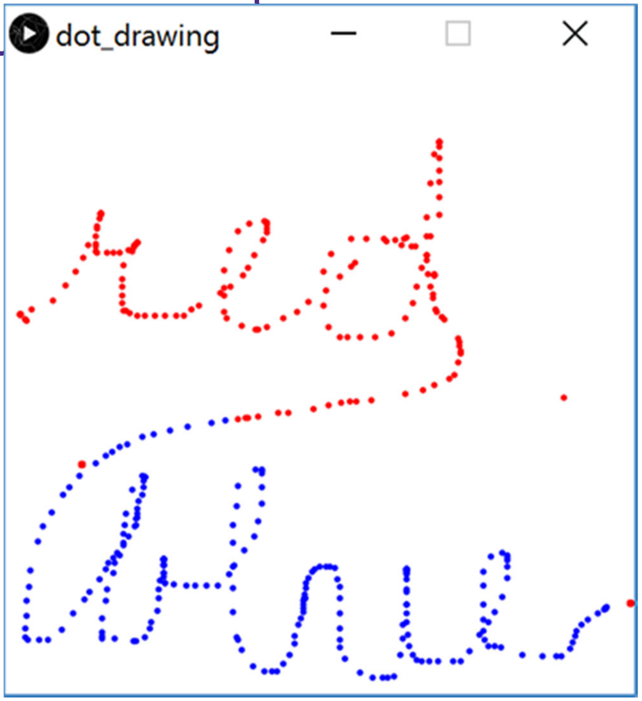
you should only be using one of these.

- Built-in functions:
  - ☆ `mousePressed()` – called very time a button is pressed
  - `mouseReleased()` – called every time a button is released

Example: Drawing Dots

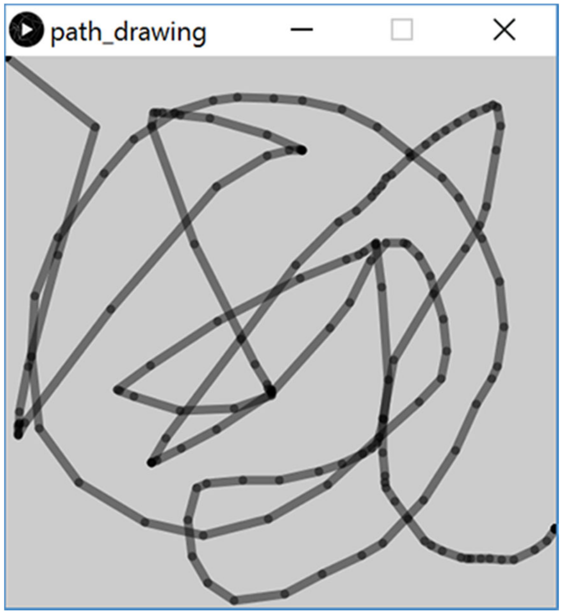


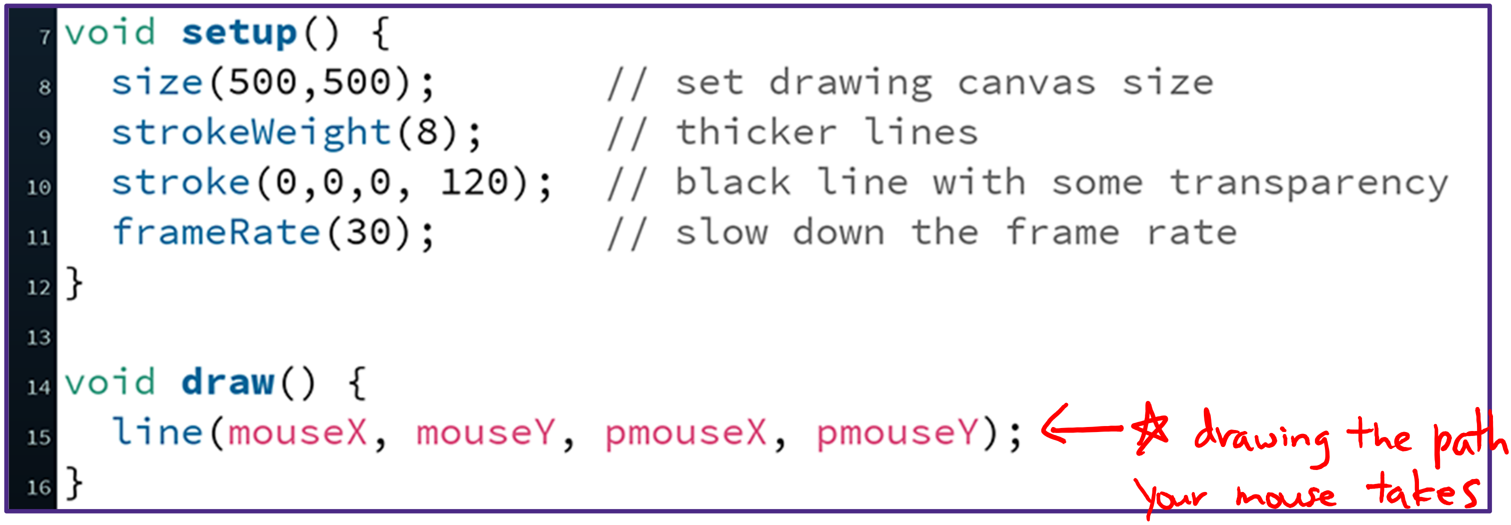
```
void draw() {
  if(mousePressed) {
    fill(0, 0, 255);    // blue if mouse is pressed
  } else {
    fill(255, 0, 0);    // red otherwise
  }
  ellipse(mouseX, mouseY, 5, 5);  // draw circle
}
```



Example: Path Drawing

- We just wrote a *dot*-drawing program
- We can additionally use `pmouseX` and `pmouseY` to create a *path*-drawing program

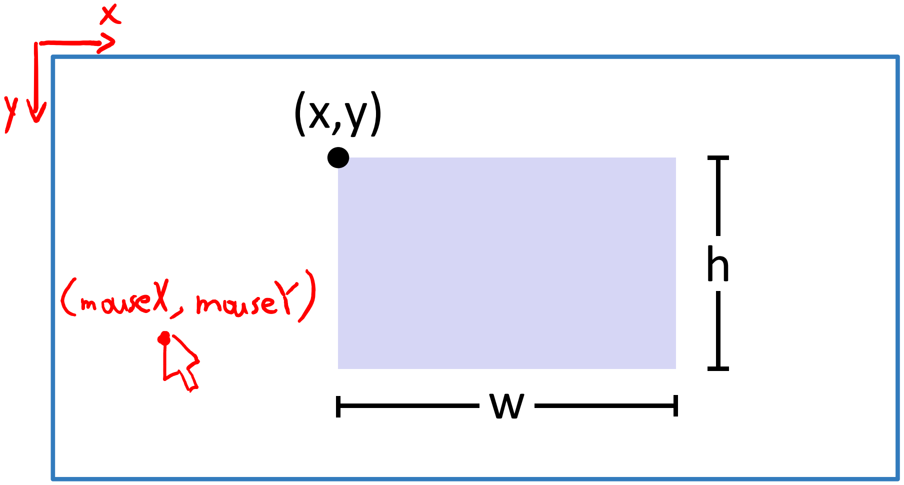


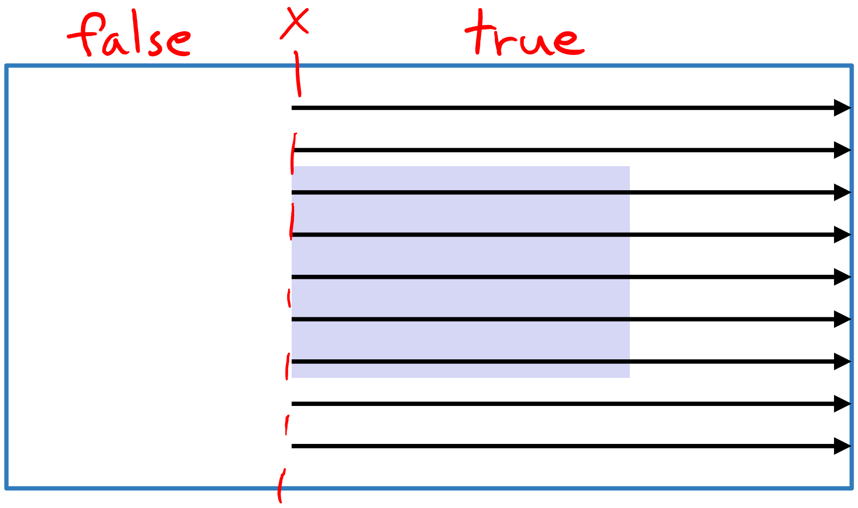


```
void setup() {
  size(500,500);          // set drawing canvas size
  strokeWeight(8);        // thicker lines
  stroke(0,0,0, 120);     // black line with some transparency
  frameRate(30);          // slow down the frame rate
}

void draw() {
  line(mouseX, mouseY, pmouseX, pmouseY);
}
```

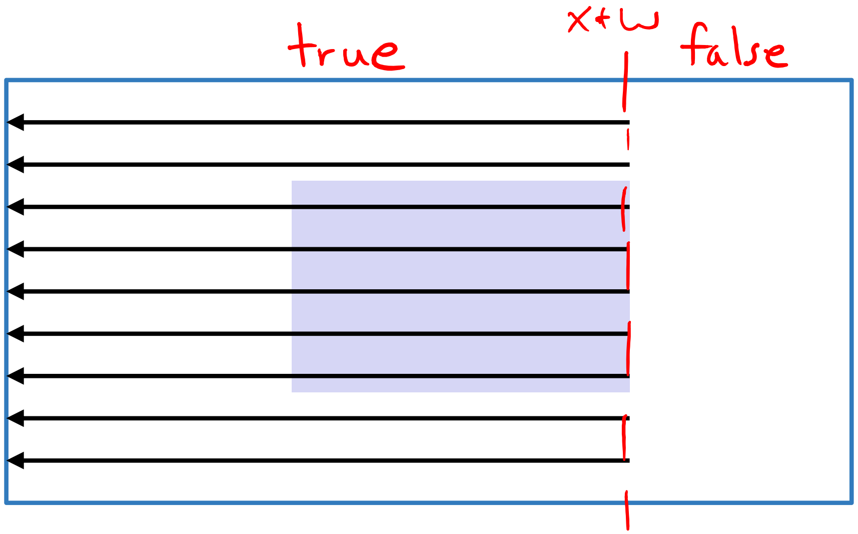
← ★ drawing the path your mouse takes

Hovering Over a Rectangle



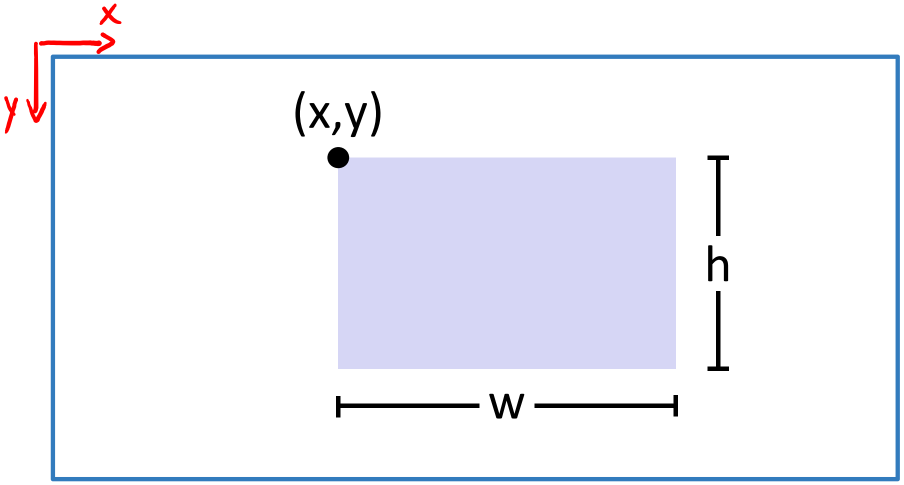


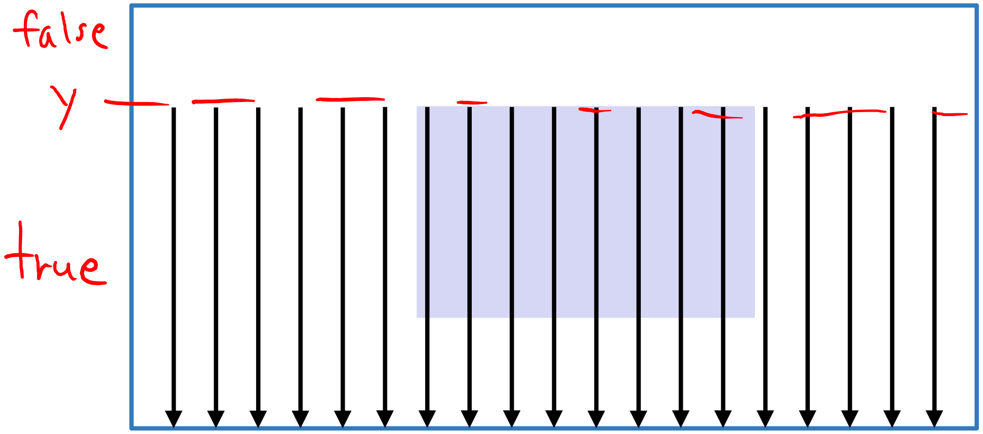
```
if(mouseX >= x)
```

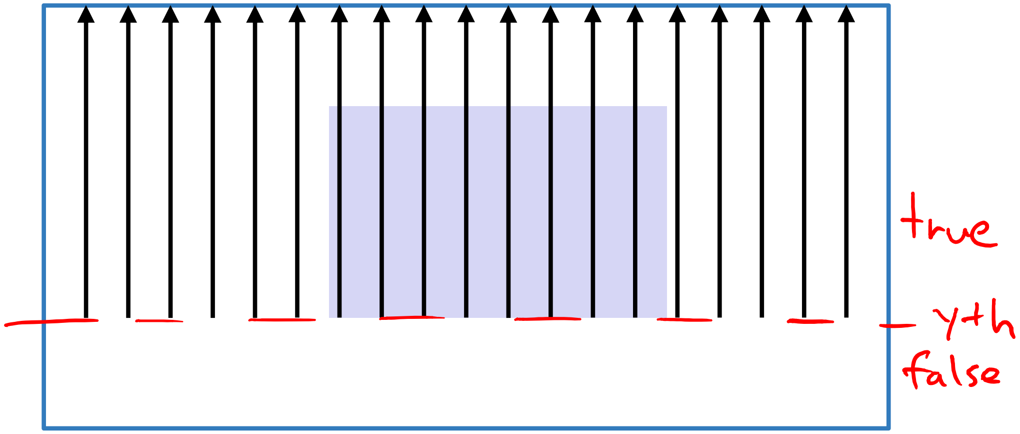


```
if(mouseX <= x + w)
```

Hovering Over a Rectangle



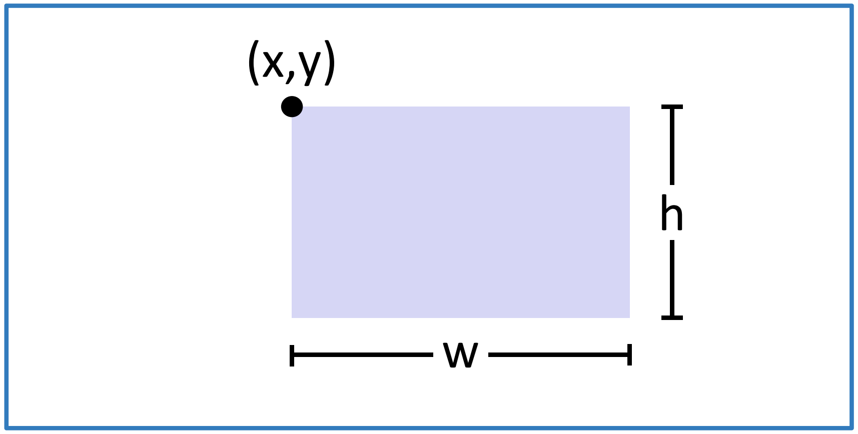


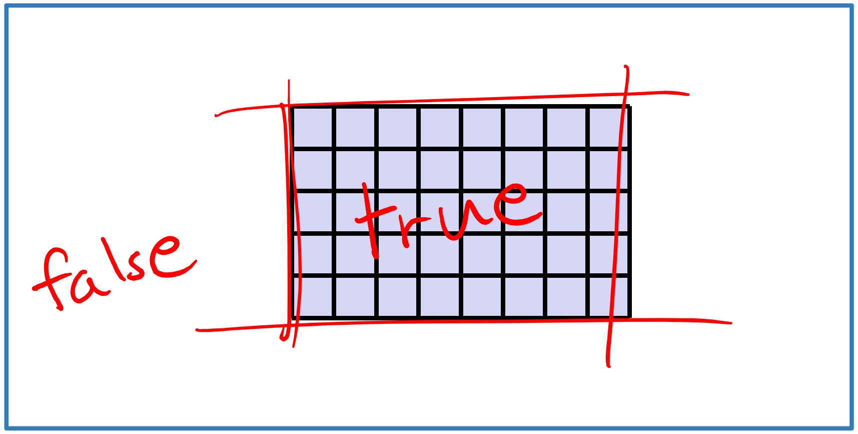


```
if(mouseY >= y)
```

```
if(mouseY <= y + h)
```

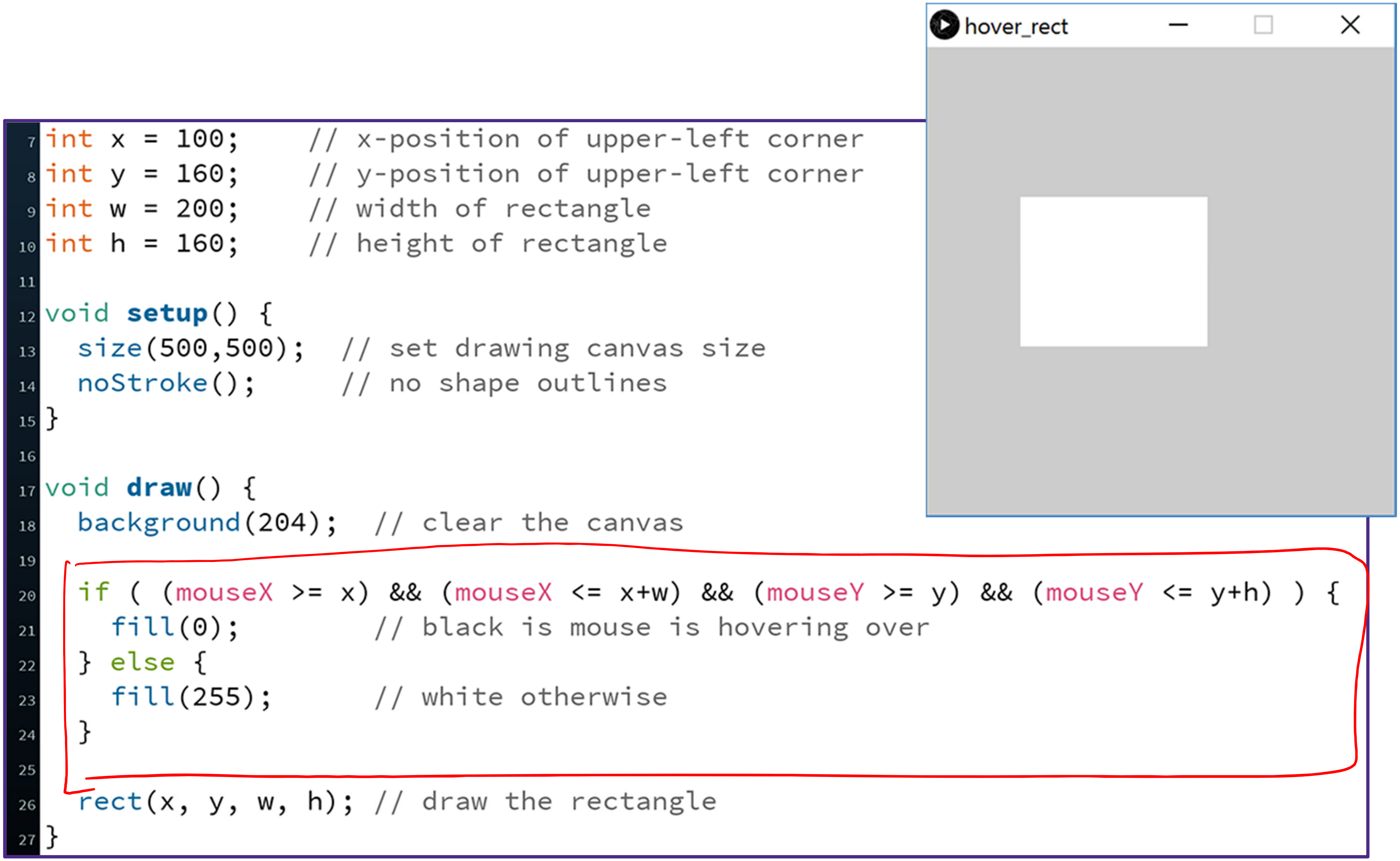
Hovering Over a Rectangle





```
if( (mouseX >= x)         &&
    (mouseX <= x + w)     &&
    (mouseY >= y)         &&
    (mouseY <= y + h)  )
```

Hovering Over a Rectangle



```
int x = 100;     // x-position of upper-left corner
int y = 160;     // y-position of upper-left corner
int w = 200;     // width of rectangle
int h = 160;     // height of rectangle

void setup() {
  size(500,500);   // set drawing canvas size
  noStroke();      // no shape outlines
}

void draw() {
  background(204);   // clear the canvas

  if ( (mouseX >= x) && (mouseX <= x+w) && (mouseY >= y) && (mouseY <= y+h) ) {
    fill(0);           // black is mouse is hovering over
  } else {
    fill(255);         // white otherwise
  }

  rect(x, y, w, h); // draw the rectangle
}
```

The Keyboard

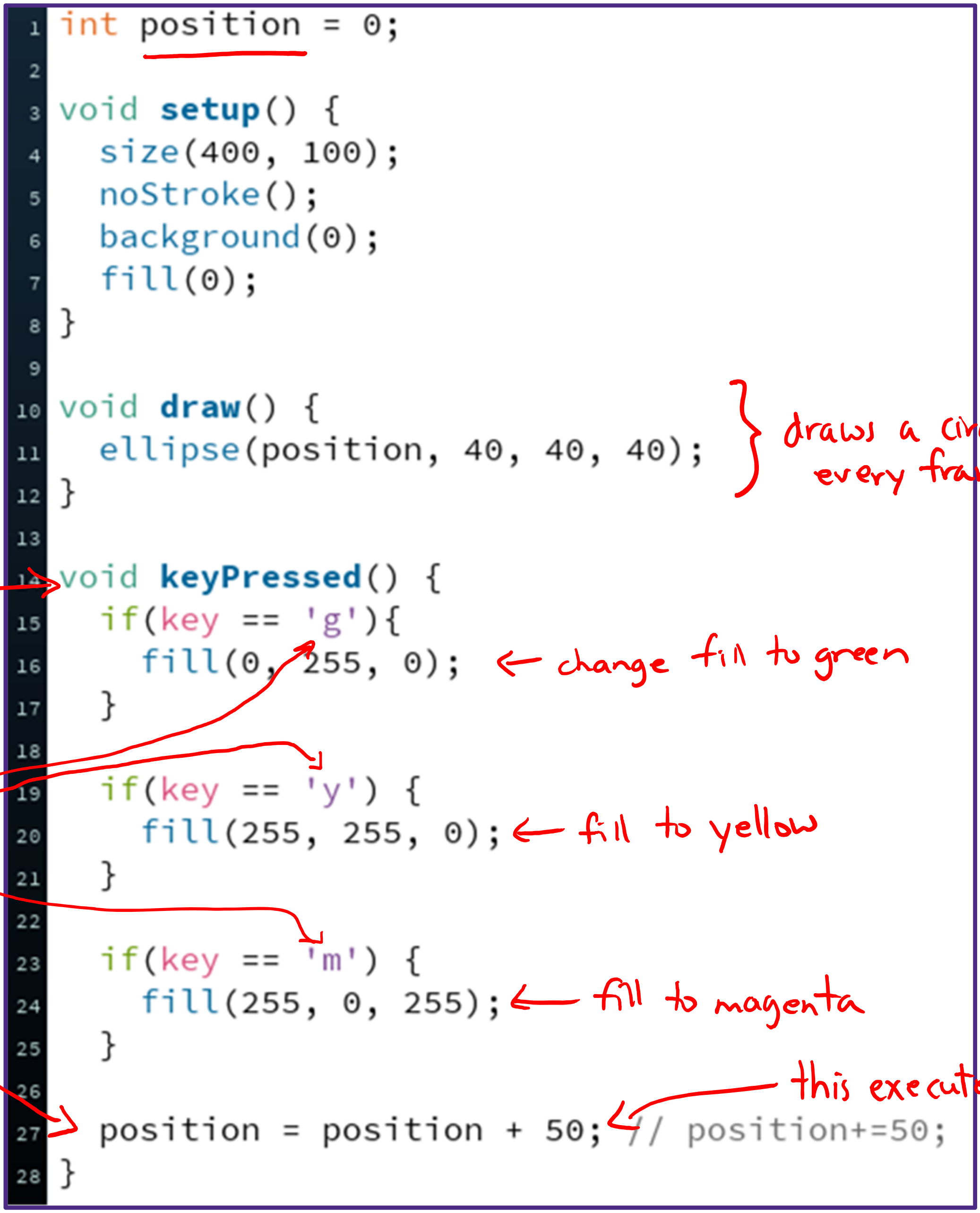
- System variables:
  - `key` – stores the ASCII value of the last key press
  - `keyCode` – stores codes for non-ASCII keys (*e.g.* UP, LEFT)
  - `keyPressed` – is any key currently being pressed?

again, recommended to only use one or the other for each program

- Built-in functions:
  - `keyPressed()` – called every time a key is pressed

- New datatype: `char`
  - Stores a single character (really just a number)
  - Should be surrounded by *single* quotes
  - *e.g.* `char letter = 'a';` actually the ASCII value for 'a'

Example: What does this code do?



```
int position = 0;

void setup() {
  size(400, 100);
  noStroke();
  background(0);
  fill(0);
}

void draw() {
  ellipse(position, 40, 40, 40);
}

void keyPressed() {
  if(key == 'g'){
    fill(0, 255, 0);
  }

  if(key == 'y') {
    fill(255, 255, 0);
  }

  if(key == 'm') {
    fill(255, 0, 255);
  }

  position = position + 50; // position+=50;
}
```

draws a circle at (position,40) every frame

runs anytime a key is pressed

← change fill to green

these are chars

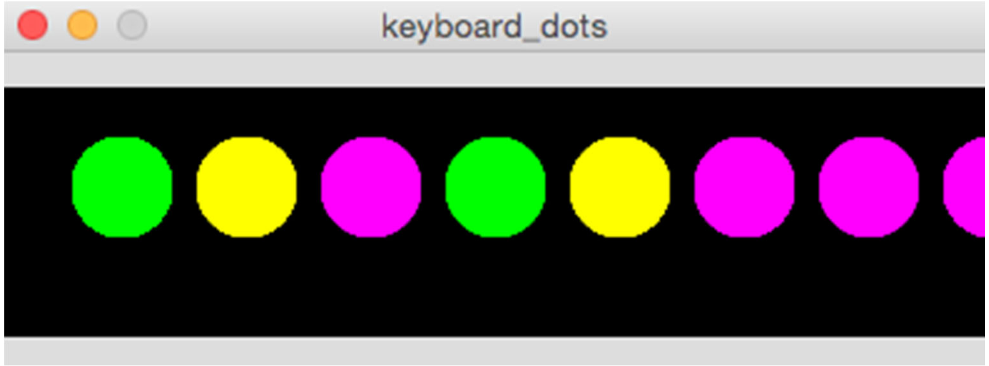
← fill to yellow

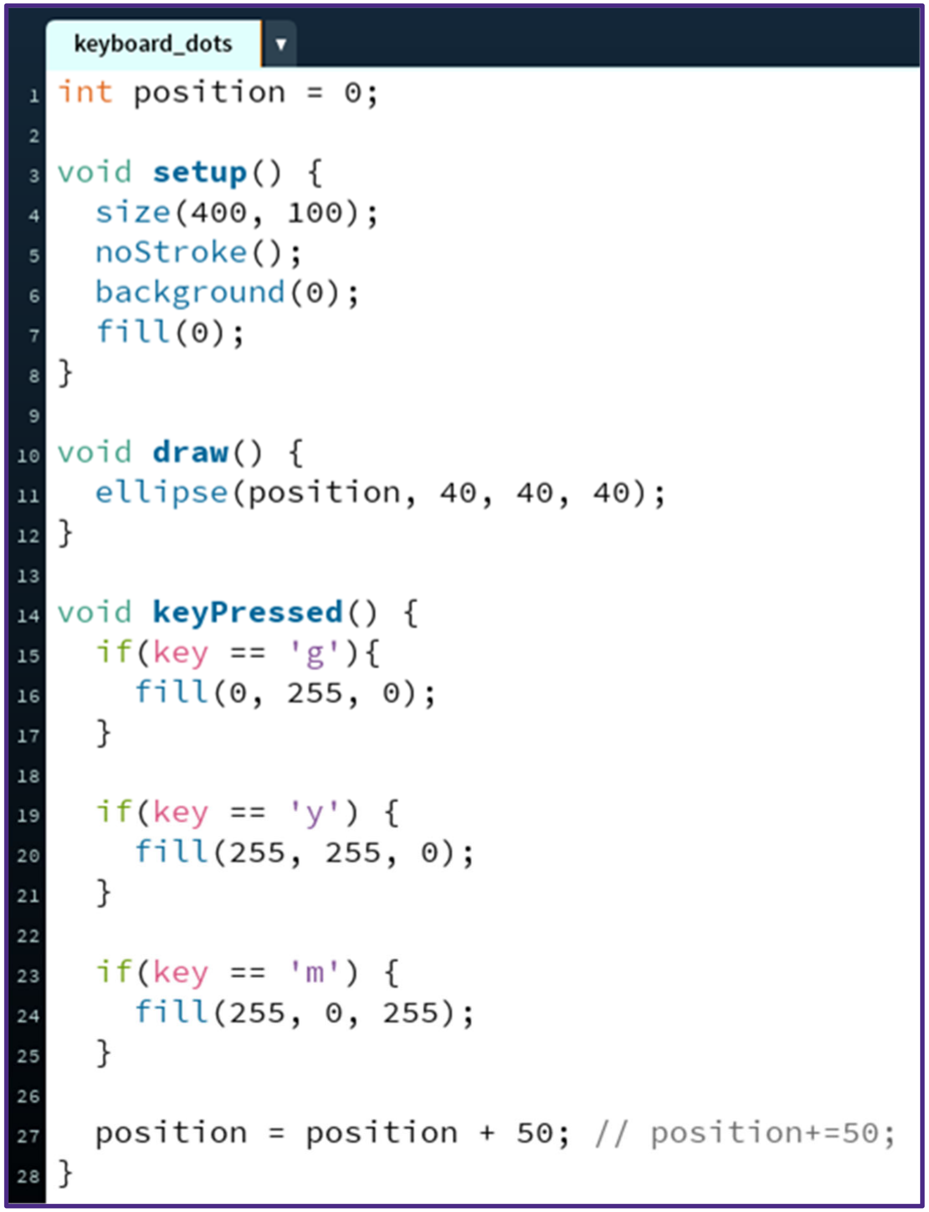
← fill to magenta

draw next circle at new position

this executes no matter which key is pressed!

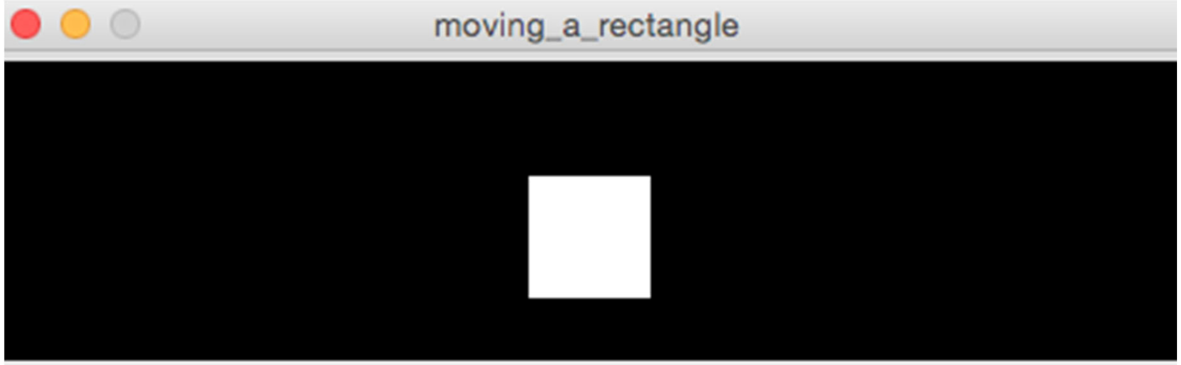
Example: Keyboard Dots



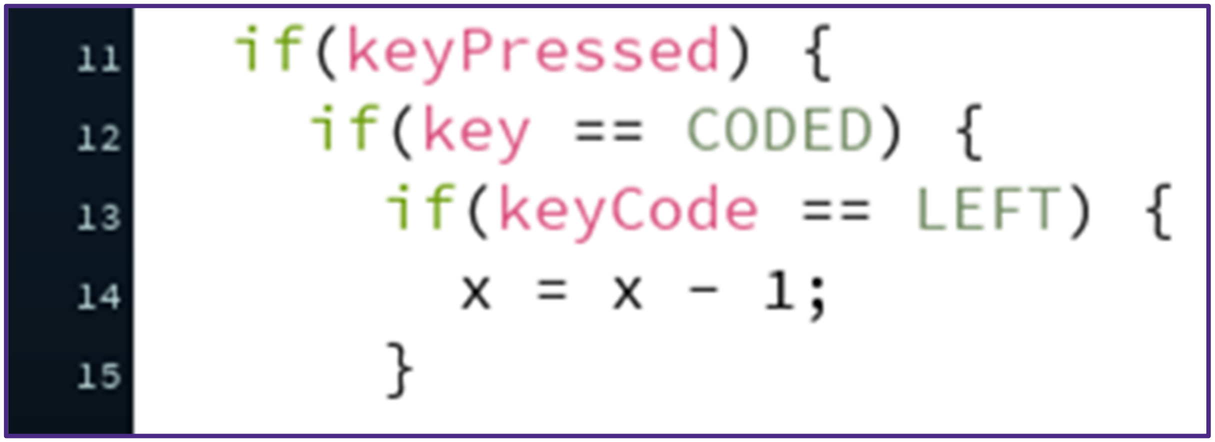


```
int position = 0;

void setup() {
  size(400, 100);
  noStroke();
  background(0);
  fill(0);
}

void draw() {
  ellipse(position, 40, 40, 40);
}

void keyPressed() {
  if(key == 'g'){
    fill(0, 255, 0);
  }

  if(key == 'y') {
    fill(255, 255, 0);
  }

  if(key == 'm') {
    fill(255, 0, 255);
  }

  position = position + 50; // position+=50;
}
```

Example: Moving a Rectangle

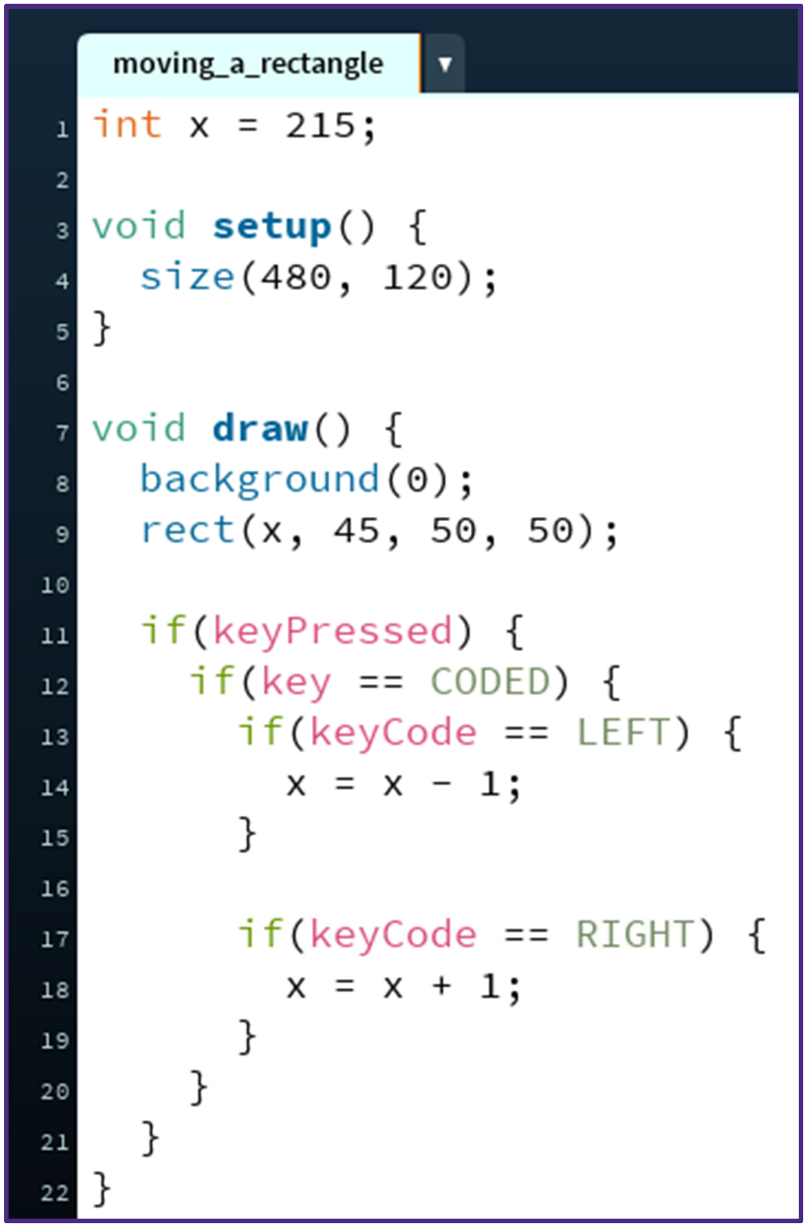


- **Note:** non-character keys, such as the arrow keys (UP, DOWN, LEFT, RIGHT) are *coded* keys



```
  if(keyPressed) {
    if(key == CODED) {
      if(keyCode == LEFT) {
        x = x - 1;
      }
```

Example: Moving a Rectangle



```
int x = 215;

void setup() {
  size(480, 120);
}

void draw() {
  background(0);
  rect(x, 45, 50, 50);

  if(keyPressed) {
    if(key == CODED) {
      if(keyCode == LEFT) {
        x = x - 1;
      }

      if(keyCode == RIGHT) {
        x = x + 1;
      }
    }
  }
}
```

Text Output

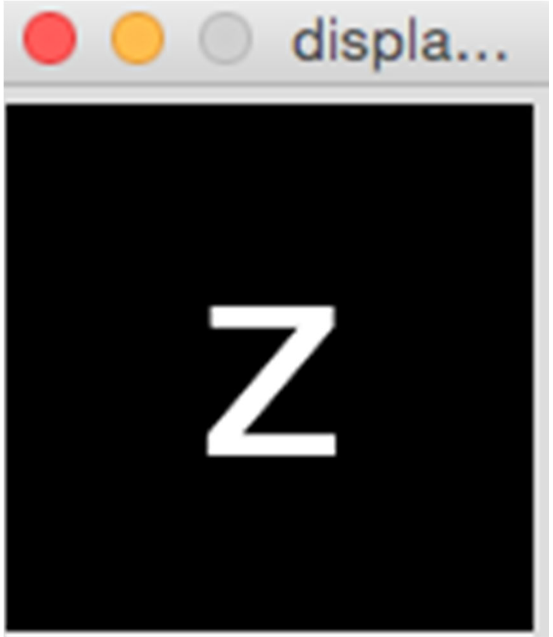
char 'h' ← 1 character only
vs.
String "hello" ← many characters in sequence

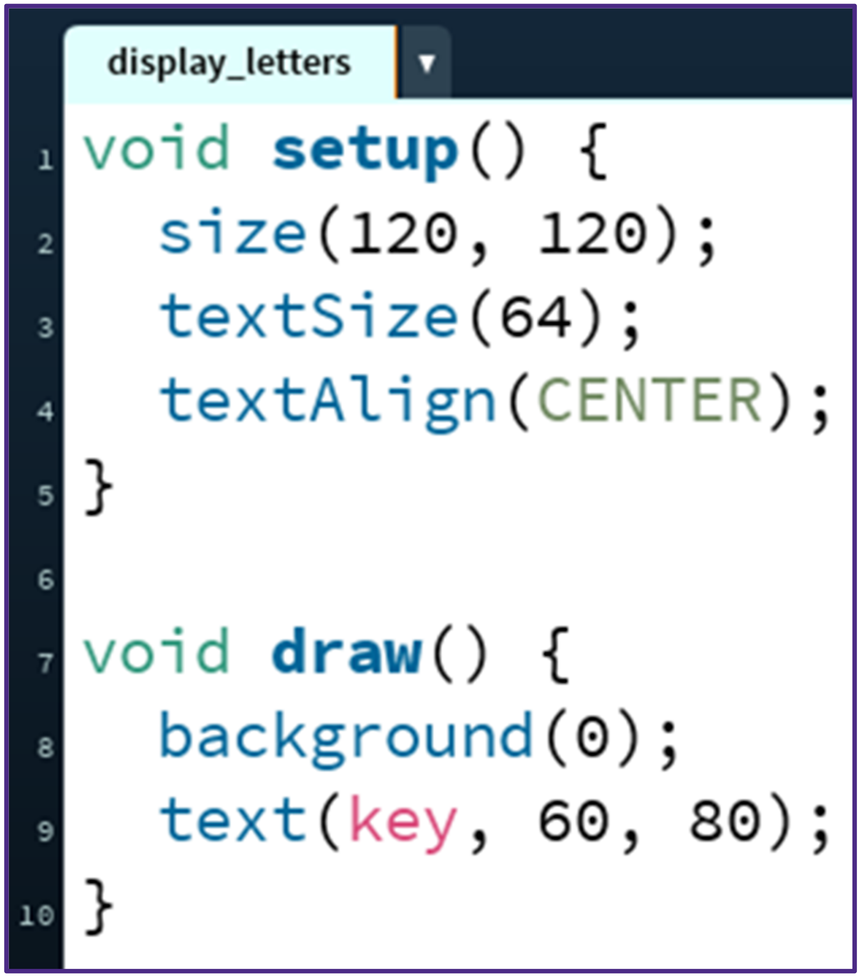
- `println(yourText);`
  - Prints `yourText` to the *console*, which is the black area below your Processing code
  - Useful for debugging

- `text(yourText, x, y);`
  - Prints `yourText` on the drawing canvas, starting with the *bottom-left* corner at coordinate `(x,y)`
  - Change the size of your text using `textSize(size);`

- `yourText` should be between *double* quotes
  - We will talk more about the datatype `String` later

Example: Displaying Typed Keys





```
void setup() {
  size(120, 120);
  textSize(64);
  textAlign(CENTER);
}

void draw() {
  background(0);
  text(key, 60, 80);
}
```

Looking Forward

- Next week is the Creativity Assignment
  - In pairs, you will be asked to brainstorm TWO Processing projects *of your choice*
  - You will implement and submit ONE of your two projects
  - The point is to use the tools available to you to make something fun and creative!
  - Planning document due Tuesday (2/5)
  - Actual programs due next Friday (2/8)

- Portfolio Update 1 is due Wednesday (2/6)
  - Taijitu, Logo Design, Lego Family, Animal Functions
  - Ask your TAs for assistance if you encounter problems!