Drawing

2D Coordinates
Statements
Commenting
Sequential Control Flow

Chapter 3, Examples 3-1, 3-2, 3-3, 3.4, 3-5, 3-6, 3-10, 3-11
Skip Exercises 3-7, 3-8, 3-9

activate clicker:
hold ON/OFF, wait for power light to flash, enter 2-letter room code
What kind of *error* is this?

D. Not an error
What do you need to draw a picture?

- Something to draw on
- Something to draw with
- A plan of your drawing
- A method to draw shapes

Something to draw on
What do you need to draw a picture?

- Something to draw **on** (canvas)
- Something to draw **with** (pen)
- A method to draw shapes (function)
- A plan of your drawing (algorithm)
What do you need to draw a picture?

- Something to draw on (canvas)
- Something to draw with (pen)
- A method to draw shapes (function)
- A plan of your drawing (algorithm)
Setup a Drawing Canvas

```javascript
function setup() {
  createCanvas(100, 100);
  background(220);
}
```

Create a drawing area with a width and height

Make the drawing area a certain colour

*The code to make our drawing goes here*
function setup() {
    createCanvas(100, 100);
    background(220);
}

https://editor.p5js.org/cs105/sketches/NkJs2dQiM
Setup a Drawing Canvas

```javascript
function setup() {
  createCanvas(100, 100);
  background(220);
}
```

**Syntax:**
brackets are required

**Style:**
semicolons are required
Remember

- We are telling computer what & how to draw
How Do You Get Someone to Draw for You?

Exact Instructions Challenge Drawing (4:24 - 6:24)
https://www.youtube.com/watch?v=fjF2ALrdd5A
Why was it challenging?

- Did not say ...
Why was it challenging?

- Did not say ...
- **where** to draw (e.g., “a little above ...”, “mouth...”)
- **how** to draw (e.g., “reasonably sized”, “long nose...”)

CS 105 - Drawing
How do we specify a location?

- At the mall?
- In a city?
- On an ocean?
How do we specify a location?

latitude N

longitude W      longitude E

latitude S
How do we specify a location?
How do we specify a location?

e.g. (43.5° N, 80.5° W)

(43.4721517, -80.5439318)
How do we specify a location?

How To Play Battleship
https://www.youtube.com/watch?v=4gHllYLomrS
How do we specify a location?

- Rows & Columns
How do we specify a location?
General idea

- Use horizontal and vertical axis (e.g., *rows & columns*)
General idea

- Use horizontal and vertical axis (e.g., *rows & columns*)

Notice that the origin for coordinate systems can be different.
```javascript
function setup() {
    createCanvas(100, 100);
    background(220);
}
```
Pixels
Pixels Per Inch (PPI)

Apple iPhone - X

Credit: AndroidGuys, dimensions.guide
(live demos)

point\((x, y)\)

line\((x_1, y_1, x_2, y_2)\)

https://editor.p5js.org/cs105/sketches/NkJs2dQiM
Function Call Statement

point(40, 77);
Draw a point at 40th row & 77th column.
Coding Style when Calling Functions

✔ point(10, 20);

One space after commas in function arguments:
✗ point(10,20);

No space between function name and opening bracket:
✗ point (10, 20);

No space before the semicolon at the end of a statement:
✗ point(10, 20) ;

No space after opening bracket or before closing bracket:
✗ point( 10, 20 );
Which statement draws this picture?

A. `line(50, 10, 1, 80);`
B. `line(10, 50, 10, 90);`
C. `line(50, 10, 50, 90);`
D. None of the above
Reference Sheet

- We provide a language reference sheet in exams.
- Don’t memorize function *syntax*, understand their *semantics*: what functions do and what parameters mean

### Processing Reference

**Environment**
- `size(w, h)`
  - set canvas size to width w by height h, default is 100, 100
- `width` `height`
  - built-in variables for canvas size
- `cursor()` `noCursor()`
  - show or hide the mouse cursor
- `frameRate(r)`
  - set draw framerate to r
- `frameCount`
  - built-in variable for frame number

**Shape**
- `point(x, y)`
  - draw point at x, y
- `line(x1, y1, x2, y2)`
  - draw line from x1, y1 to x2, y2
- `triangle(x1, y1, x2, y2, x3, y3)`
  - draw triangle at corners x1, y1 x2, y2 x3, y3
- `quad(x1, y1, x2, y2, x3, y3, x4, y4)`
  - draw quadrilateral with corners x1, y1 x2, y2 x3, y3 x4, y4

**Stroke**
- `strokeJoin(join)`
  - where join = BEVEL, MITER, ROUND
- `strokeCap(cap)`
  - where cap = SQUARE, PROJECT, ROUND

**Fill**
- `fill(gray)`
  - fill with grayscale value
- `fill(r, g, b)`
  - fill with red, green, blue values
- `fill(r, g, b, a)`
  - fill with red, green, blue, alpha values

**Background**
- `background(gray)`
  - clear canvas and set background to grayscale value
- `background(r, g, b)`
  - clear canvas and set background to RGB values
- `background(hex)`
  - clear canvas and set background to hex color

**Conversion**
- `int(n)`
  - convert n to an int
- `float(n)`
  - convert n to a float

**Math**
- `degrees(r)`
  - convert r radians to degrees
- `radians(d)`
  - convert d degrees to radians
- `map(v, start1, stop1, start2, stop2)`
  - remaps v in range start1 to stop1 to a number in range start2 to stop2
- `random(high)`
  - random number from 0 to high, or from low to high
- `randomSeed(seed)`
  - set seed to a constant number to make sequence of numbers repeatable

**Distance**
- `dist(x1, y1, x2, y2)`
  - returns distance from x1, y1 to x2, y2
- `constrain(v, low, high)`
  - constrains v to between low and high

**Color**
- `colorMode(HSB, h, s, b, a)`
  - sets the color mode to HSB
- `noFill()`
  - set fill to nothing
- `noStroke()`
  - set stroke to nothing
- `colorMode(HSB, h, s, b, a)`
  - sets the color mode to HSB
(live demos)

triangle(x1, y1, x2, y2, x3, y3)

quad(x1, y1, x2, y2, x3, y3, x4, y4)

https://editor.p5js.org/cs105/sketches/NkJs2dQiM
sailboat

https://editor.p5js.org/cs105/sketches/iCmF693Ps
Commenting Code

- Code comments provide information that is not otherwise available from reading the code
- Comments are often a message to your “future self”
  - in CS 105, comments are a message to lab instructors, marking TAs, professor, etc.

```plaintext
// draws a sailboat

// left sail
triangle(48, 10, 48, 60, 15, 60);

// right sail
triangle(50, 10, 50, 60, 75, 60);
```
(live demos)

rect(?, ?, ...)

ellipse(?, ?, ...)

https://editor.p5js.org/cs105/sketches/NkJs2dQiM
rect(x, y, width, height)

ellipse(x, y, width, height)

https://editor.p5js.org/cs105/sketches/NkJs2dQiM
man with hat

https://editor.p5js.org/cs105/sketches/DEetu9rg
cat

https://editor.p5js.org/cs105/sketches/6gWGb-lkv
Spray Paint Sequential Control Flow
- [http://youtu.be/ghHxTjXAnM4](http://youtu.be/ghHxTjXAnM4)
Trace Through: Sequential Control Flow

```javascript
// sequential control flow demo
function setup() {
    createCanvas(100, 100);
    background(220);
    line(99, 0, 0, 99);
    ellipse(50, 50, 40, 40);
    rect(25, 25, 50, 50);
}
```
// sequential control flow demo

function setup() {
  createCanvas(100, 100);
  background(220);
  line(99, 0, 0, 99);
  ellipse(50, 50, 40, 40);
  rect(25, 25, 50, 50);
  HALT
}
// sequential control flow demo

function setup() {
  createCanvas(100, 100);
  background(220);
  line(99, 0, 0, 99);
  ellipse(50, 50, 40, 40);
  rect(25, 25, 50, 50);
  HALT }

// sequential control flow demo
function setup() {
  createCanvas(100, 100);
  background(220);
  line(99, 0, 0, 99);
  ellipse(50, 50, 40, 40);
  rect(25, 25, 50, 50);
  HALT }

// sequential control flow demo

function setup() {
  createCanvas(100, 100);
  background(220);
  line(99, 0, 0, 99);
  ellipse(50, 50, 40, 40);
  rect(25, 25, 50, 50);
  HALT }

// sequential control flow demo
function setup() {
  createCanvas(100, 100);
  background(220);
  line(99, 0, 0, 99);
  ellipse(50, 50, 40, 40);
  rect(25, 25, 50, 50);
  HALT
}
// sequential control flow demo

function setup() {
  createCanvas(100, 100);
  background(220);
  line(99, 0, 0, 99);
  ellipse(50, 50, 40, 40);
  rect(25, 25, 50, 50);

  HALT
}
// sequential control flow demo

```javascript
function setup() {
  createCanvas(100, 100);
  background(220);
  line(99, 0, 0, 99);
  ellipse(50, 50, 40, 40);
  rect(25, 25, 50, 50);
  HALT
}
```
// sequential control flow demo
function setup() {
  createCanvas(100, 100);
  background(220);
  line(99, 0, 0, 99);
  ellipse(50, 50, 40, 40);
  rect(25, 25, 50, 50);
  HALT
}
Which code draws this picture?

A. ellipse(50, 50, 30, 30);
   ellipse(50, 50, 80, 80);

B. ellipse(50, 50, 80, 80);
   ellipse(50, 50, 30, 30);

C. Either A and B

D. Neither A or B
car (extra example)

[Link to sketch]

https://editor.p5js.org/cs105.sketches/1-uBo1P3v

car
Coding Train Video: Basics of Drawing

- [https://thecodingtrain.com/Tutorials/1-p5js-basics/1.3-basics-of-drawing.html](https://thecodingtrain.com/Tutorials/1-p5js-basics/1.3-basics-of-drawing.html)

In this video, I teach you about the basics of drawing shapes in a web browser using the p5.js library.