Functions

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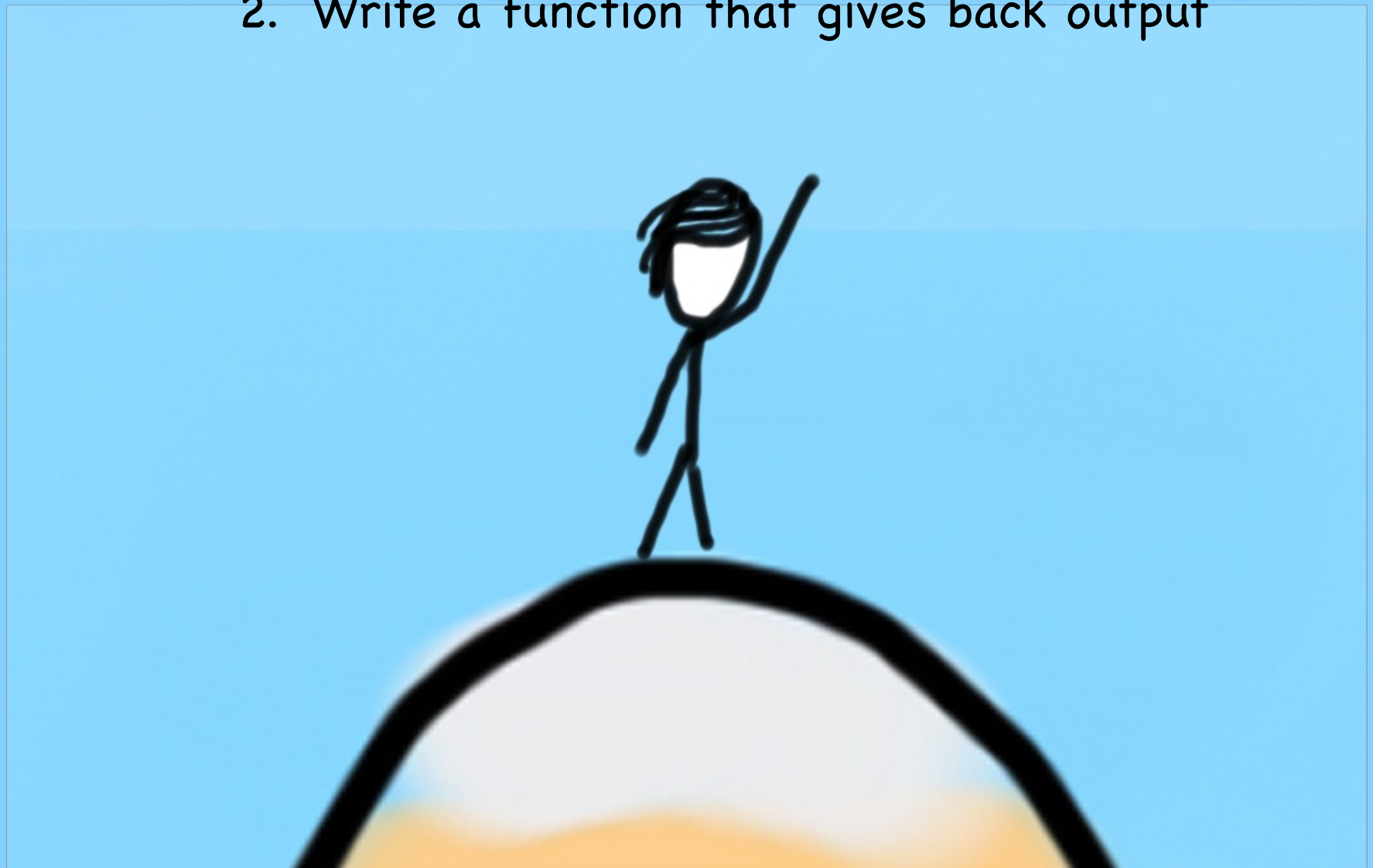
CS106A, Stanford University

Learn How To:

1. Write a function that takes in input
2. Write a function that gives back output



Calling functions

```
turn_right()
```

```
move()
```

```
input("string please! ")
```

```
print("hello world")
```

```
float("0.42")
```

```
canvas.create_rectangle(0, 0, 100, 100, "red")
```

```
math.sqrt(25)
```


Calling functions

```
turn_right()
```

```
move()
```

```
result = input("string please!")
```

```
print("hello world")
```

```
float("0.42")
```

```
canvas.create_rectangle(0, 0, 100, 100, "red")
```

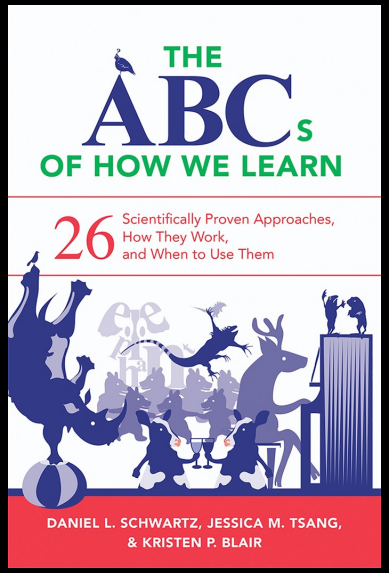
```
result = math.sqrt(25)
```


Defining a function

```
def turn_right():
    turn_left()
    turn_left()
    turn_left()
```

Big difference with python functions:
Python functions can **take in data**, and can **return data**!

Contrasting Case



Thanks Dan Schwartz

Defining a function

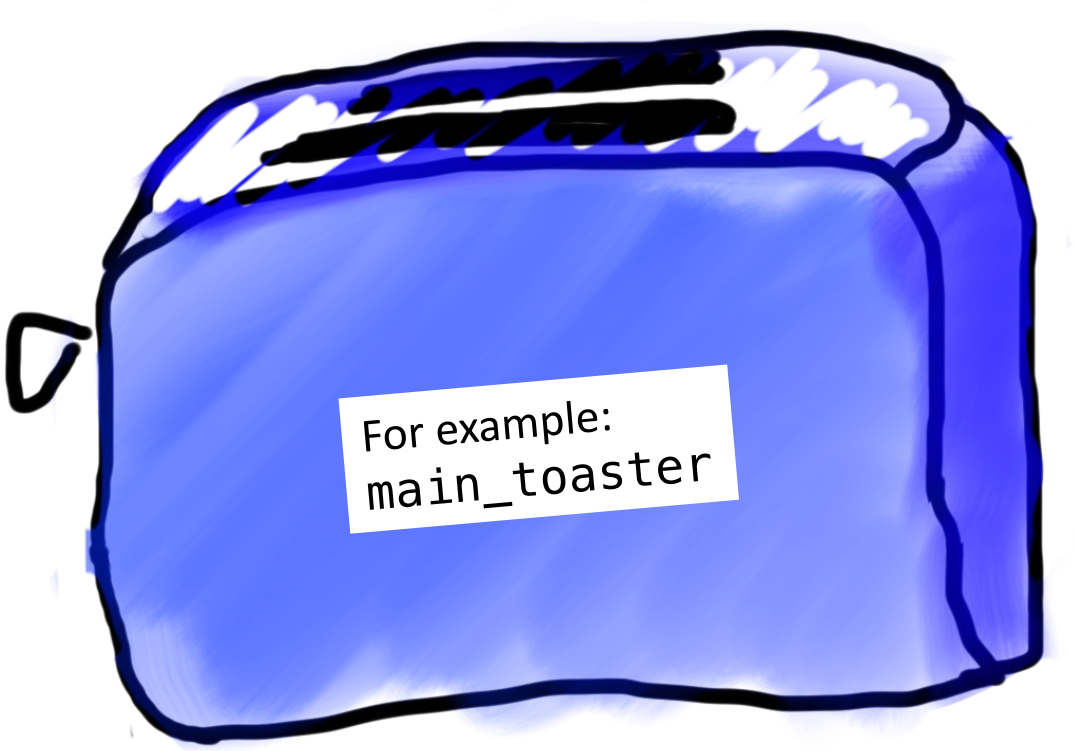
```
def turn_right():
    turn_left()
    turn_left()
    turn_left()
```

```
def move_n(n_moves):
    for i in range(n_moves):
        move()
```

```
def main():
    turn_right()
    move_n(10)
```

Big difference with python functions:
Python functions can **take in data**, and can **return data**!

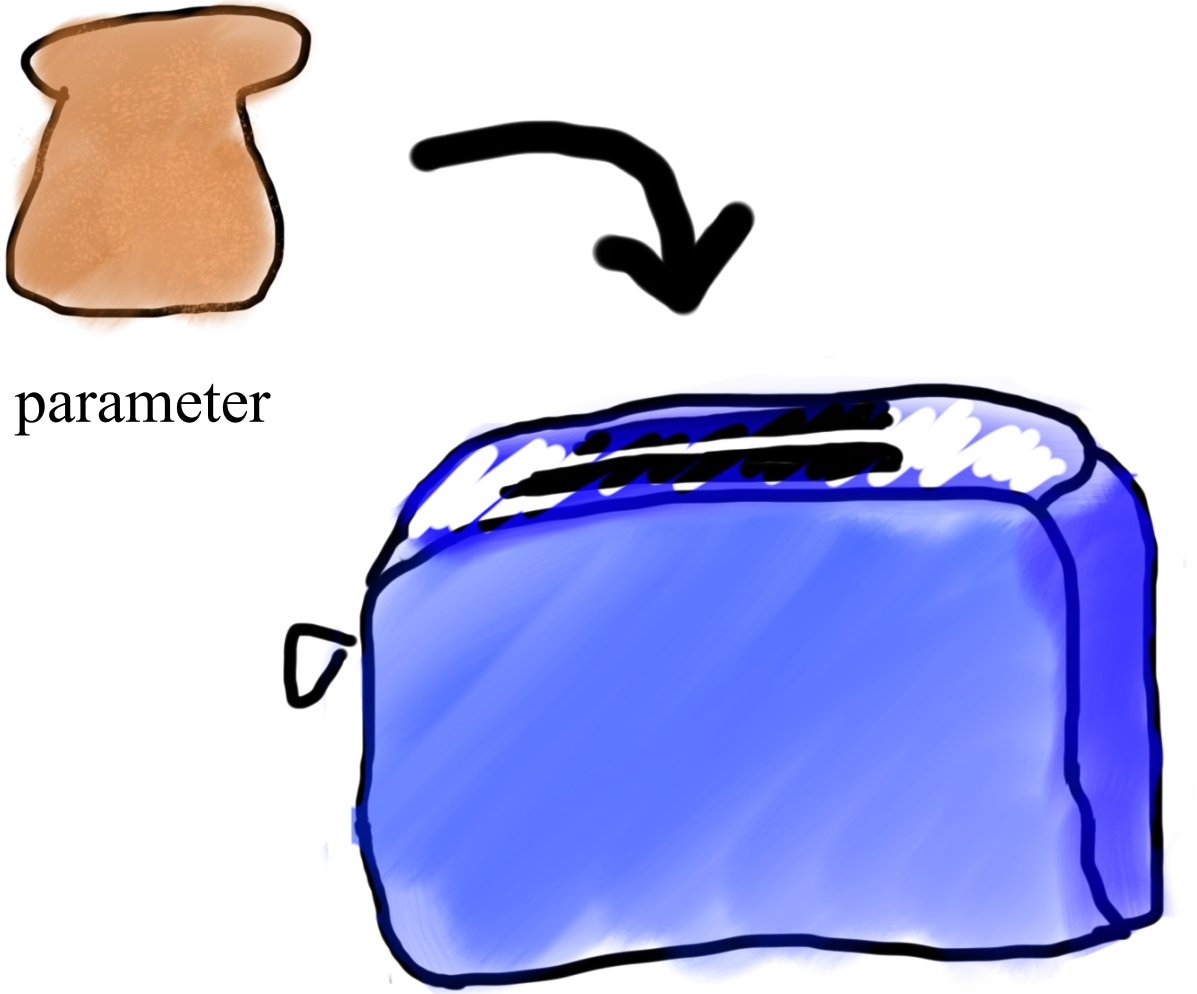
Toasters are functions



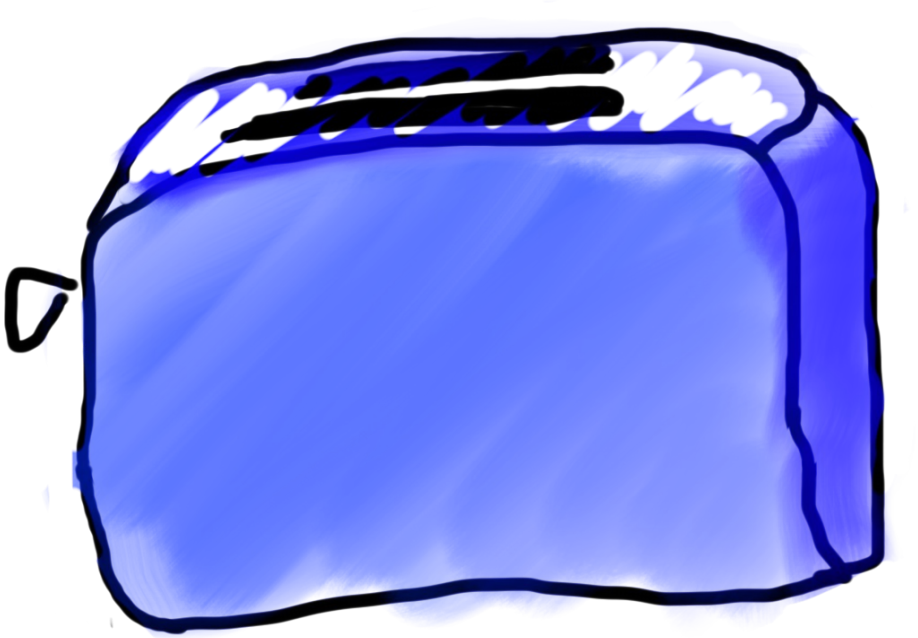
Toasters are functions

parameter

Toasters are functions

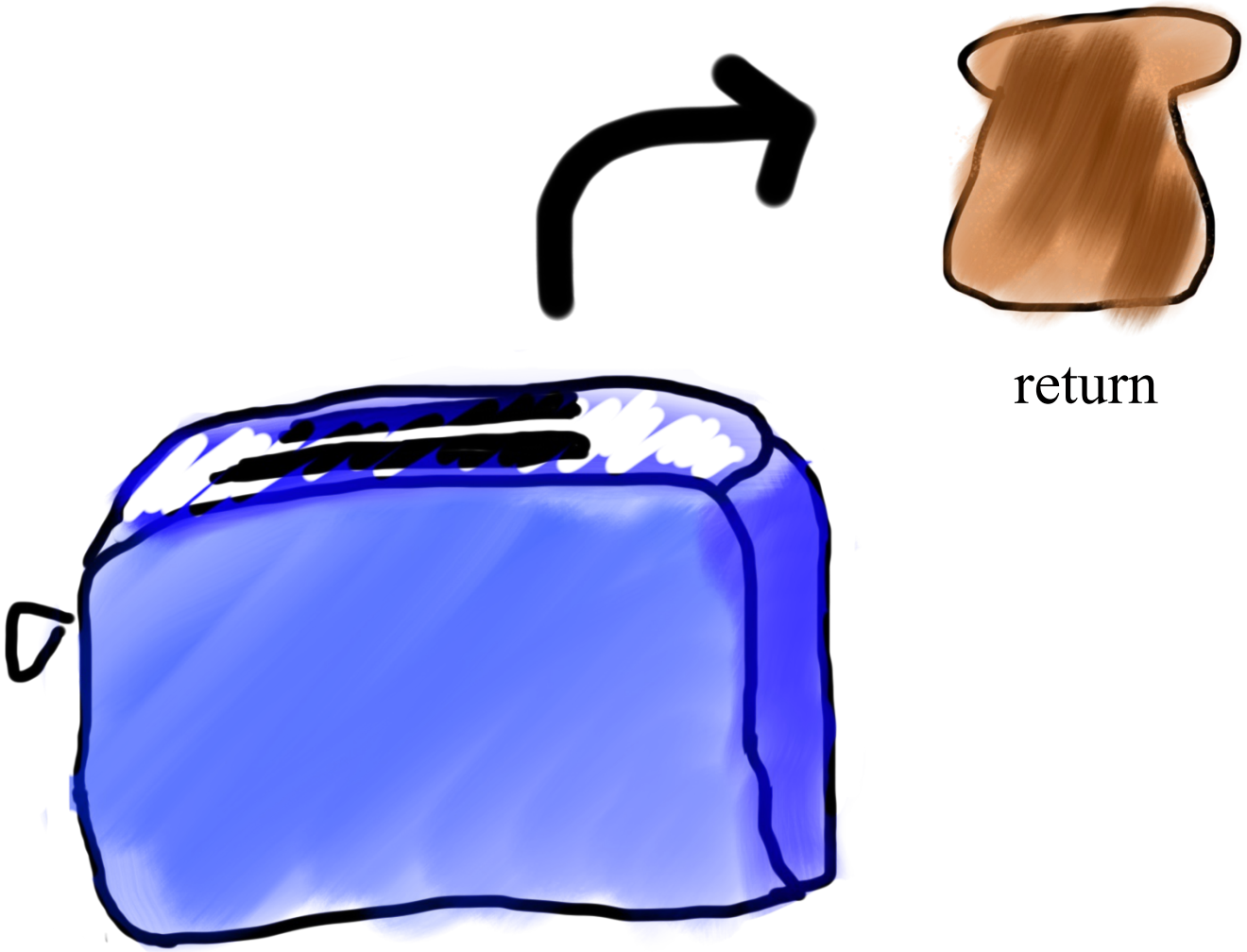


Toasters are functions



Toasters are functions

Toasters are functions



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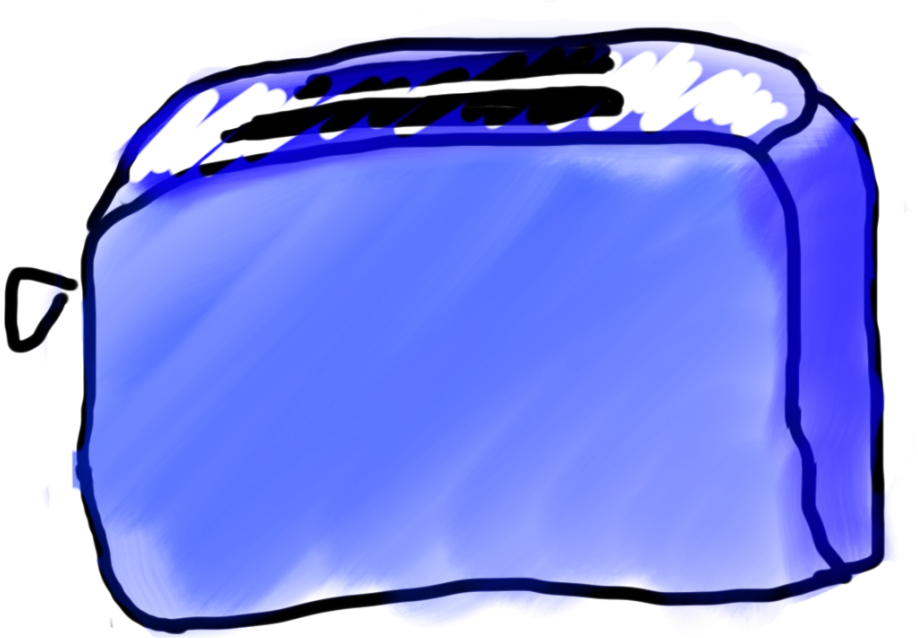
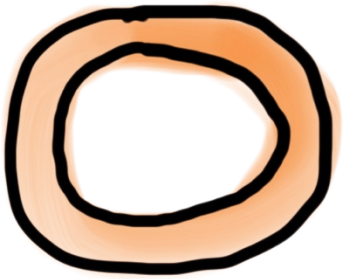
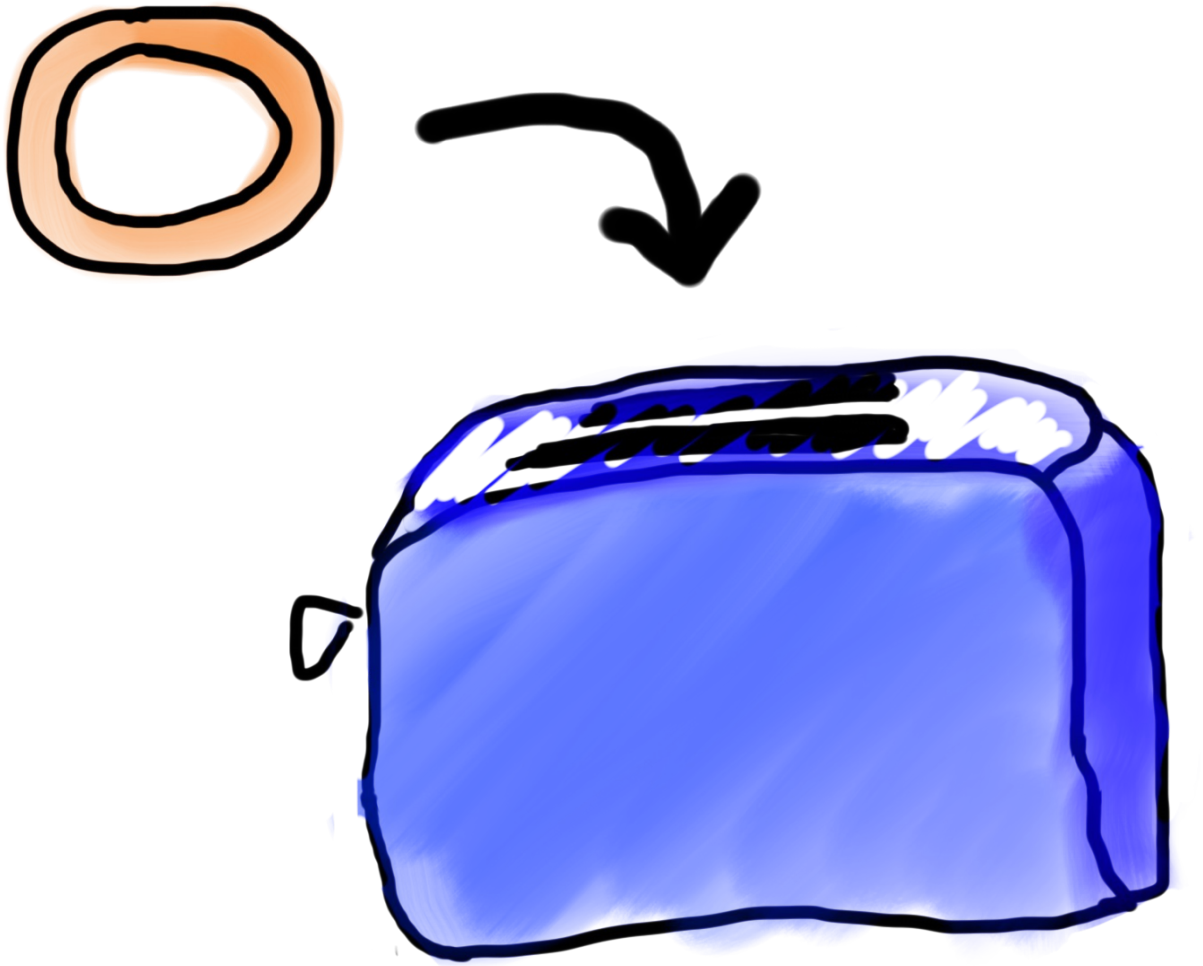


Toasters are functions

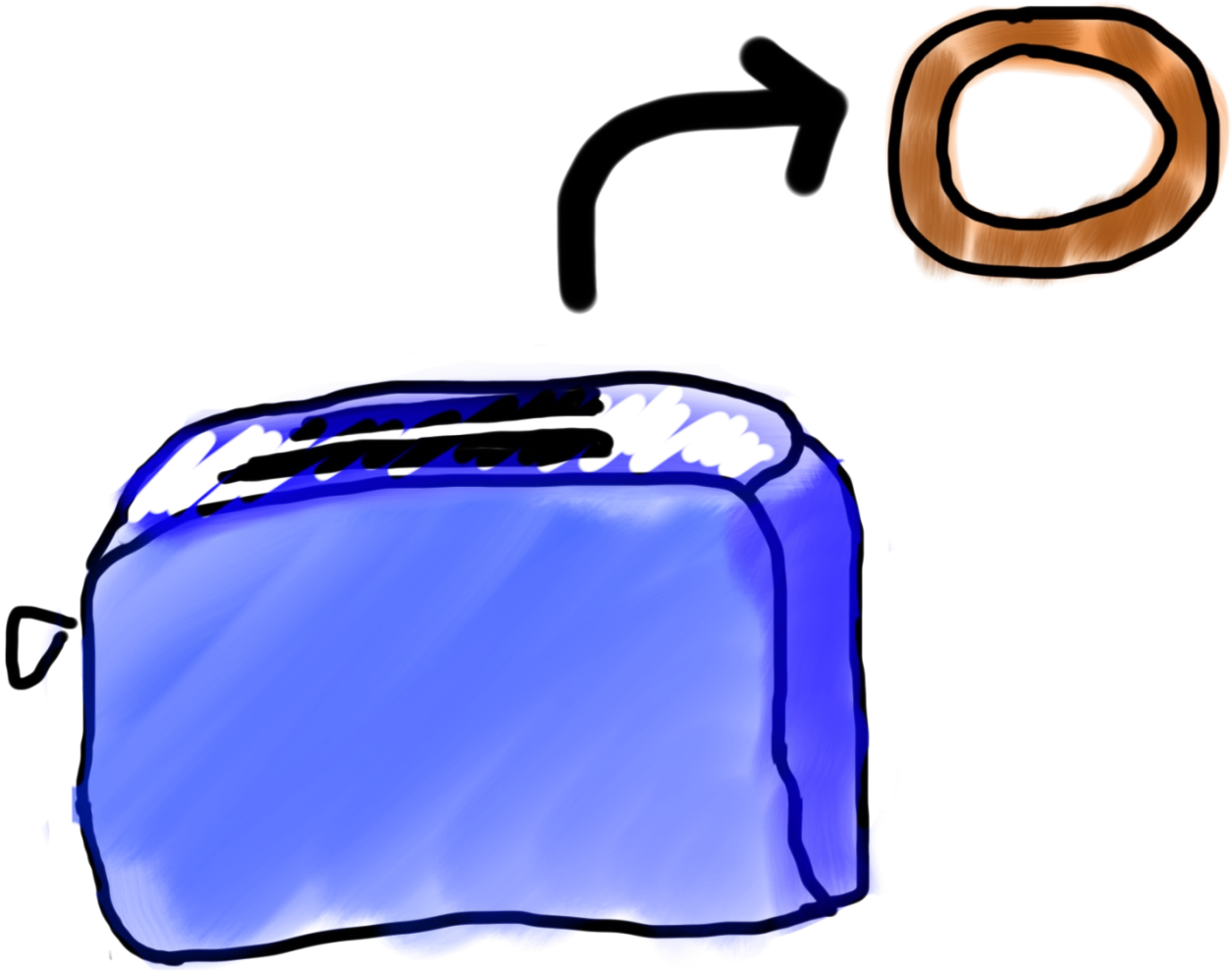


* You don’t need a second toaster if you want to toast bagels. Use the same one.

Toasters are functions



Toasters are functions



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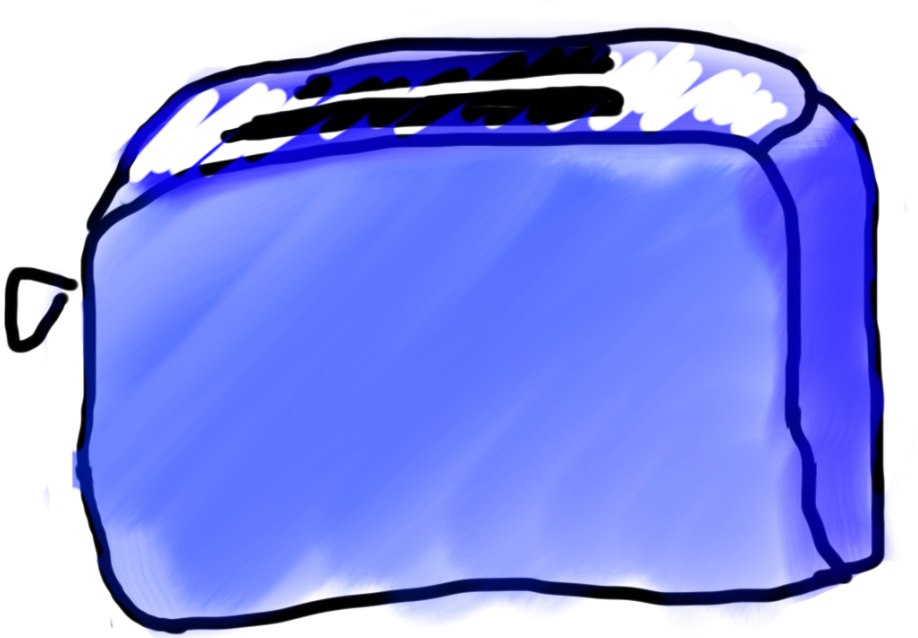
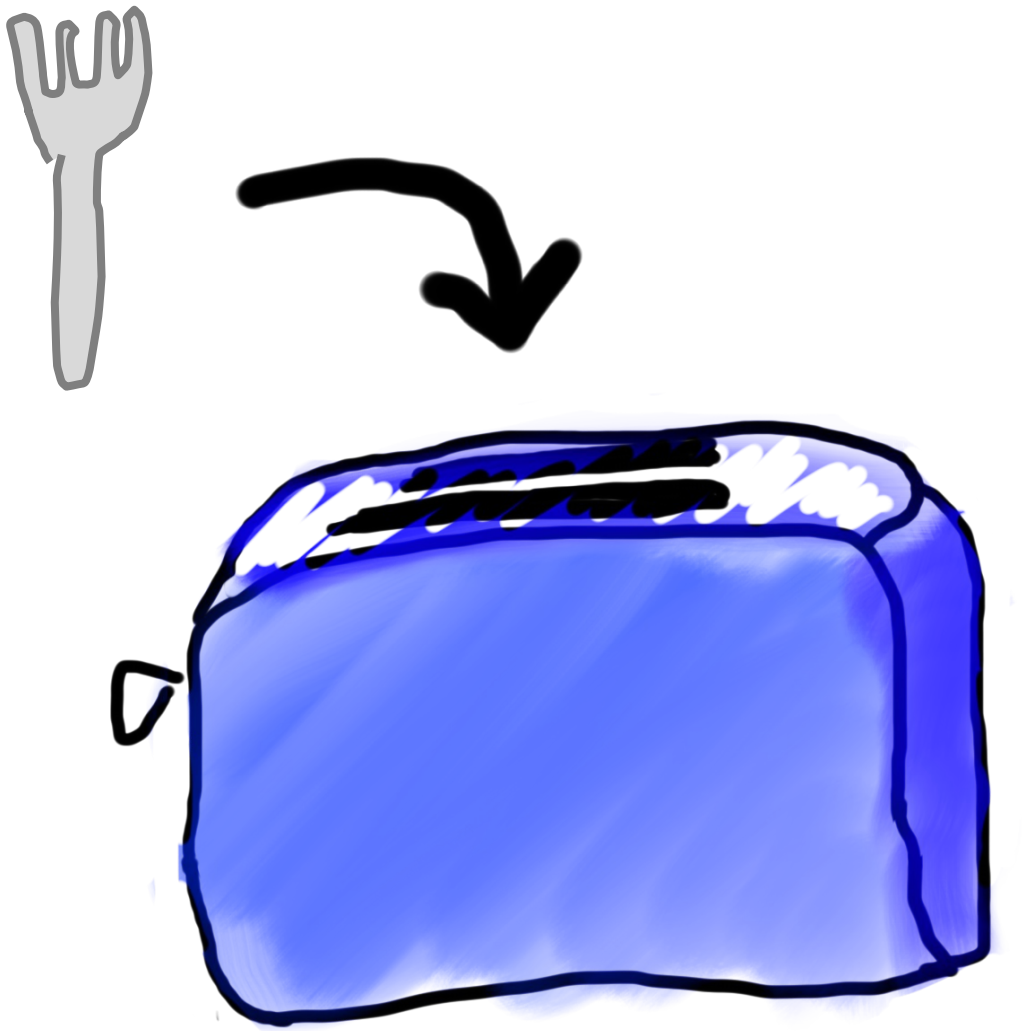
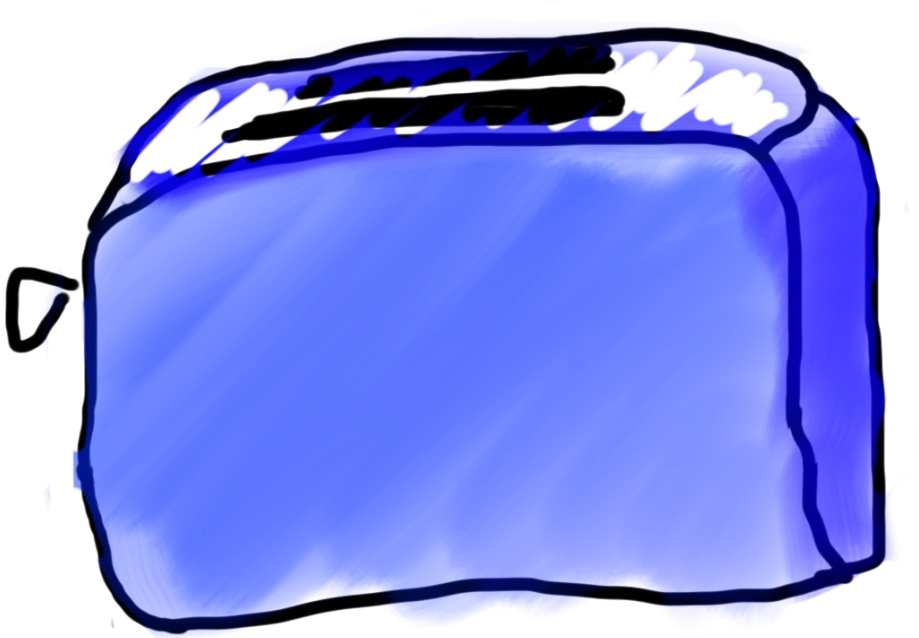


Toasters are functions

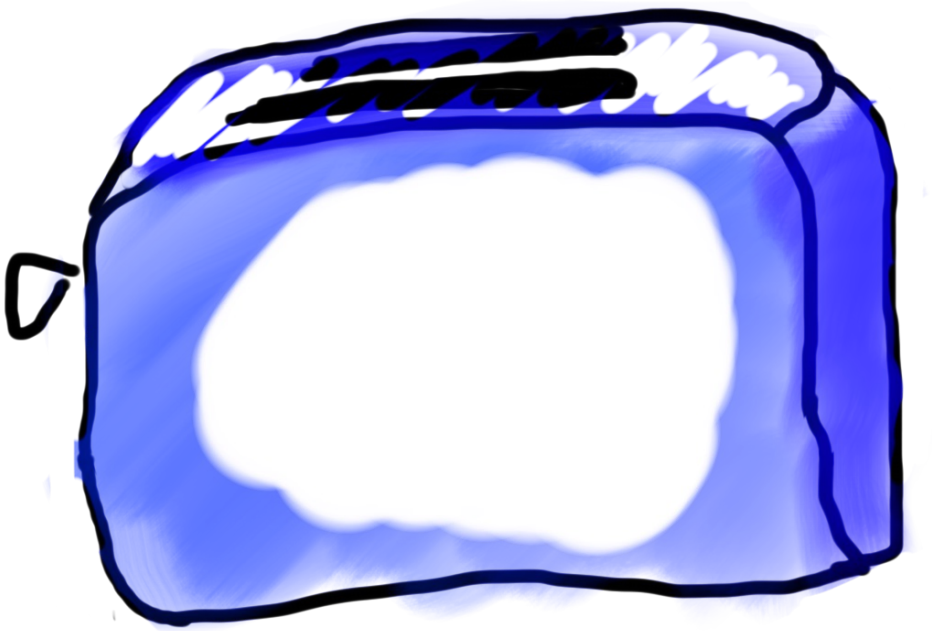


Toasters are functions

functions are Like Toasters

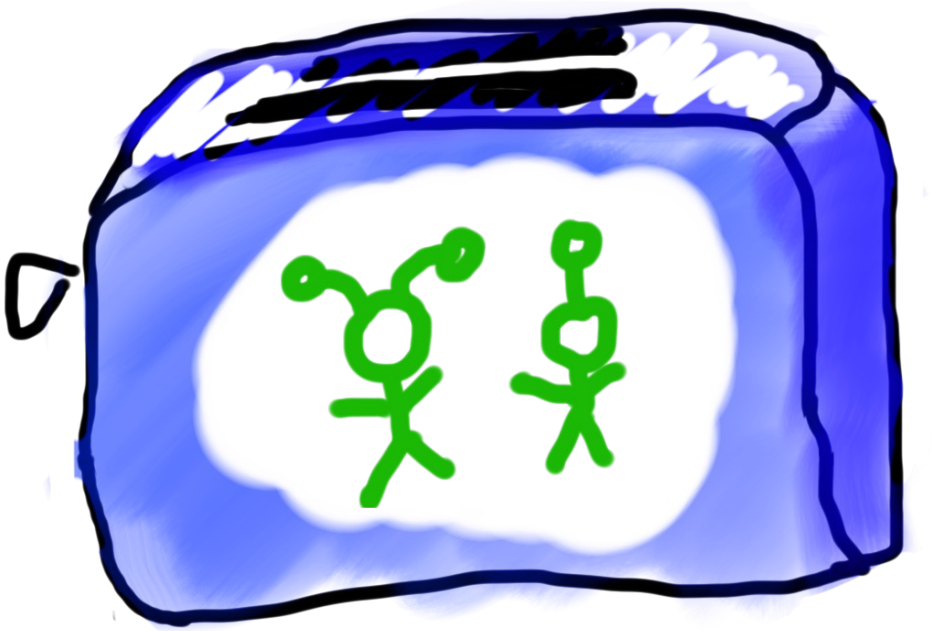


functions are Like Toasters

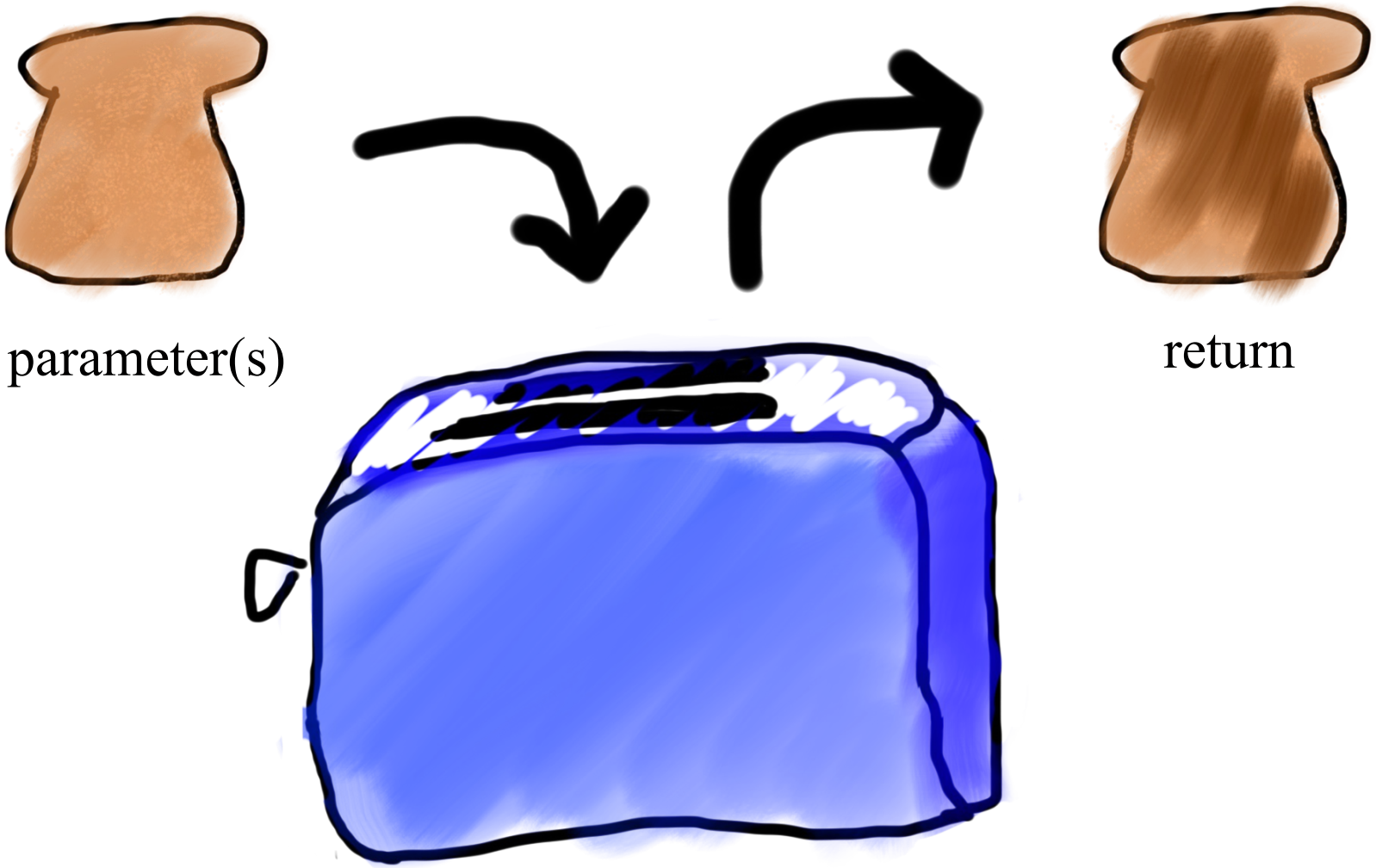


functions are Like Toasters

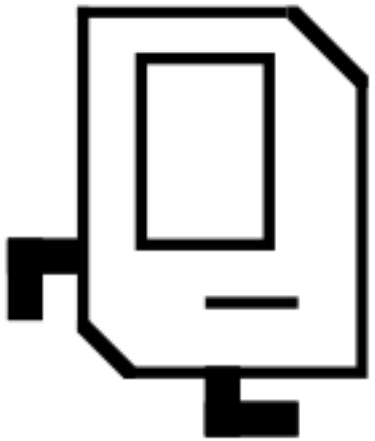
functions are Like Toasters

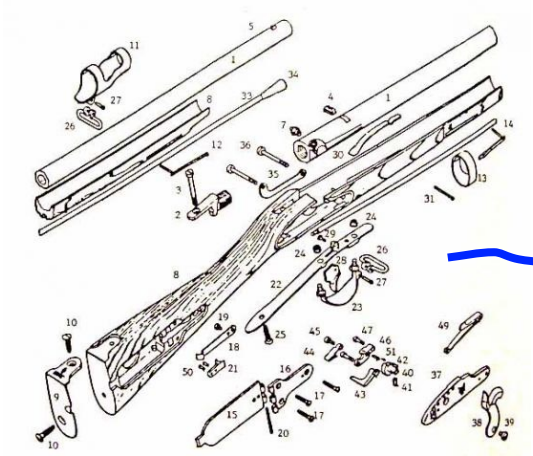


functions are Like Toasters



Chance Connections





Classic Challenge for CS106A

Perhaps the most underrated concept by students

Anatomy of a function

```
def main():
    mid = average(5.0, 10.2)
    print(mid)


def average(a, b):
    sum = a + b
    return sum / 2
```

Anatomy of a function

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

function "call"

function "definition"

```
def average(a, b):
    sum = a + b
    return sum / 2
```


Anatomy of a function

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

name

```
def average(a, b):
    sum = a + b
    return sum / 2
```

Anatomy of a function

Input given

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

Input expected

```
def average(a, b):
    sum = a + b
    return sum / 2
```


Anatomy of a function

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

Arguments

```
def average(a, b):
    sum = a + b
    return sum / 2
```

Parameters

Anatomy of a function

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

```
def average(a, b):
    sum = a + b
    return sum / 2
```

body

Anatomy of a function

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

This call "evaluates" to the value returned

```
def average(a, b):
    sum = a + b
    return sum / 2
```

Ends the function and gives back a value

Anatomy of a function

Also a function call

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

```
def average(a, b):
    sum = a + b
    return sum / 2
```

Anatomy of a function

No parameters (expects no input)

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

```
def average(a, b):
    sum = a + b
    return sum / 2
```


Anatomy of a function

```
def main():
    mid = average(5.0, 10.2)
    print(mid)
```

When a function ends it "returns"

```
def average(a, b):
    sum = a + b
    return sum / 2
```

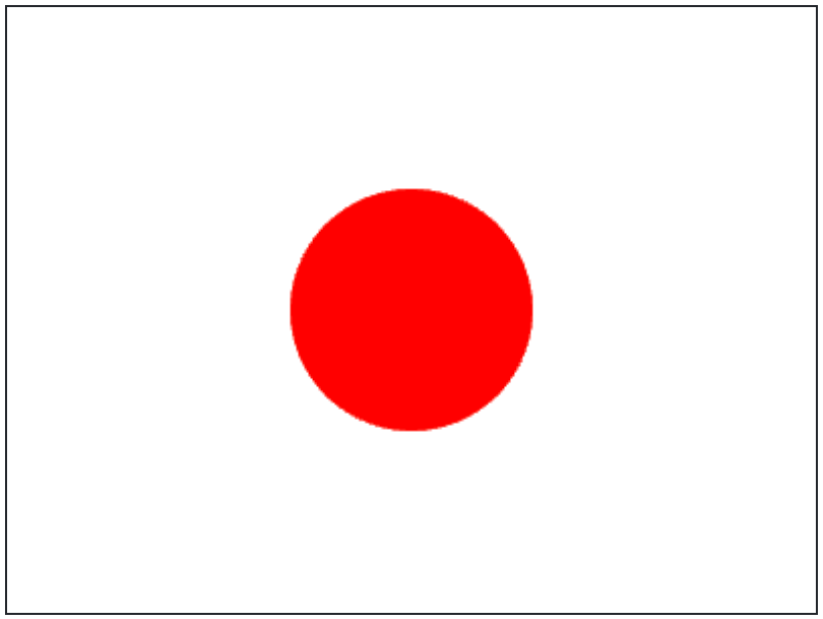
Call Functions Many Times

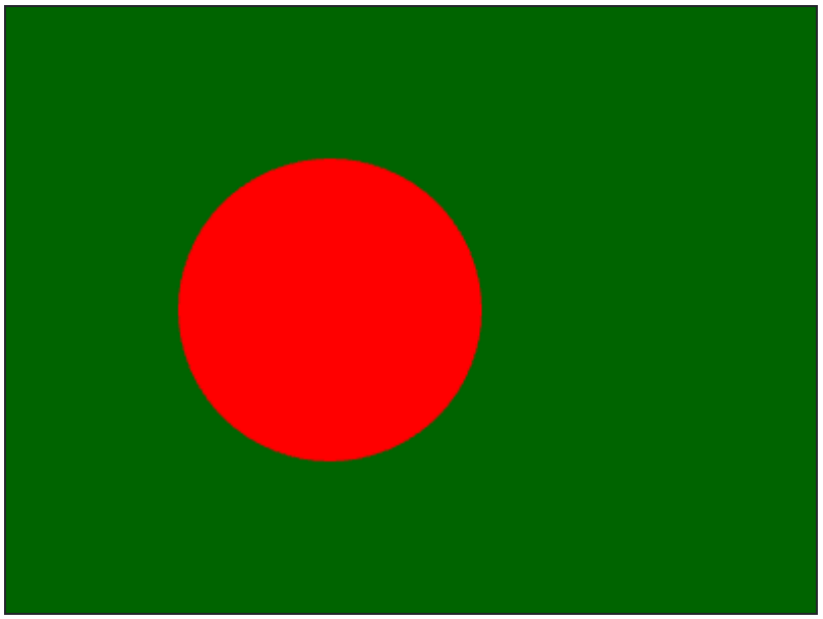
```
def main():
    avg_1 = average(0, 10)
    avg_2 = average(8, 10)

    final = average(avg_1, avg_2)
    print("avg_1", avg_1)
    print("avg_2", avg_2)
    print("final", final)

def average(a, b):
    """
    returns the number which is half way between a and b
    """
    sum = a + b
    return sum / 2

if __name__ == '__main__':
    main()
```


Parameters

Parameters let you provide a function some information when you are calling it.

What Function Do you Want?





Same:

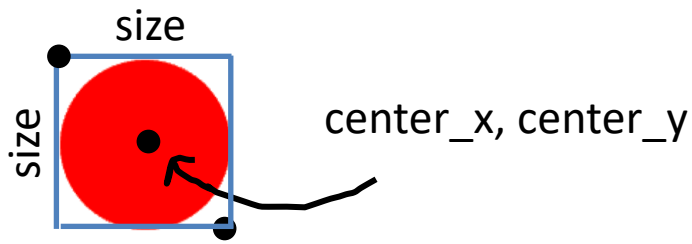
- Both are circles
- Same color

Different:

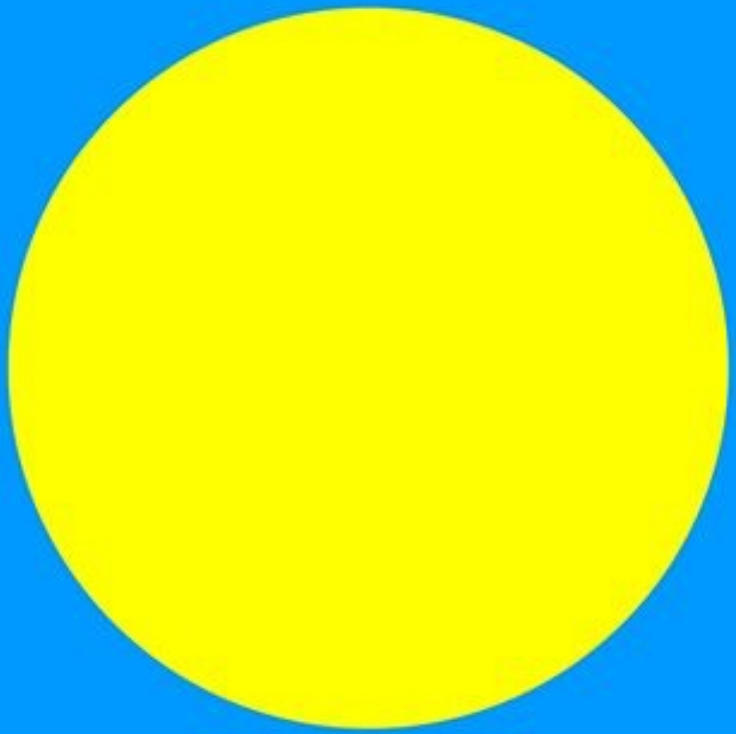
- Position
- Size

What Function Do you Want?

```
def draw_red_circle(canvas, center_x, center_y, size):
    """
    Draws a circle on the given canvas. The circle will have its center
    at center_x, center_y. It will be size pixels tall and size pixels wide.
    """
    left_x = center_x - size/2
    top_y = center_y - size/2
    right_x = left_x + size
    bottom_y = top_y + size
    canvas.create_oval(left_x, top_y, right_x, bottom_y, 'red')
```



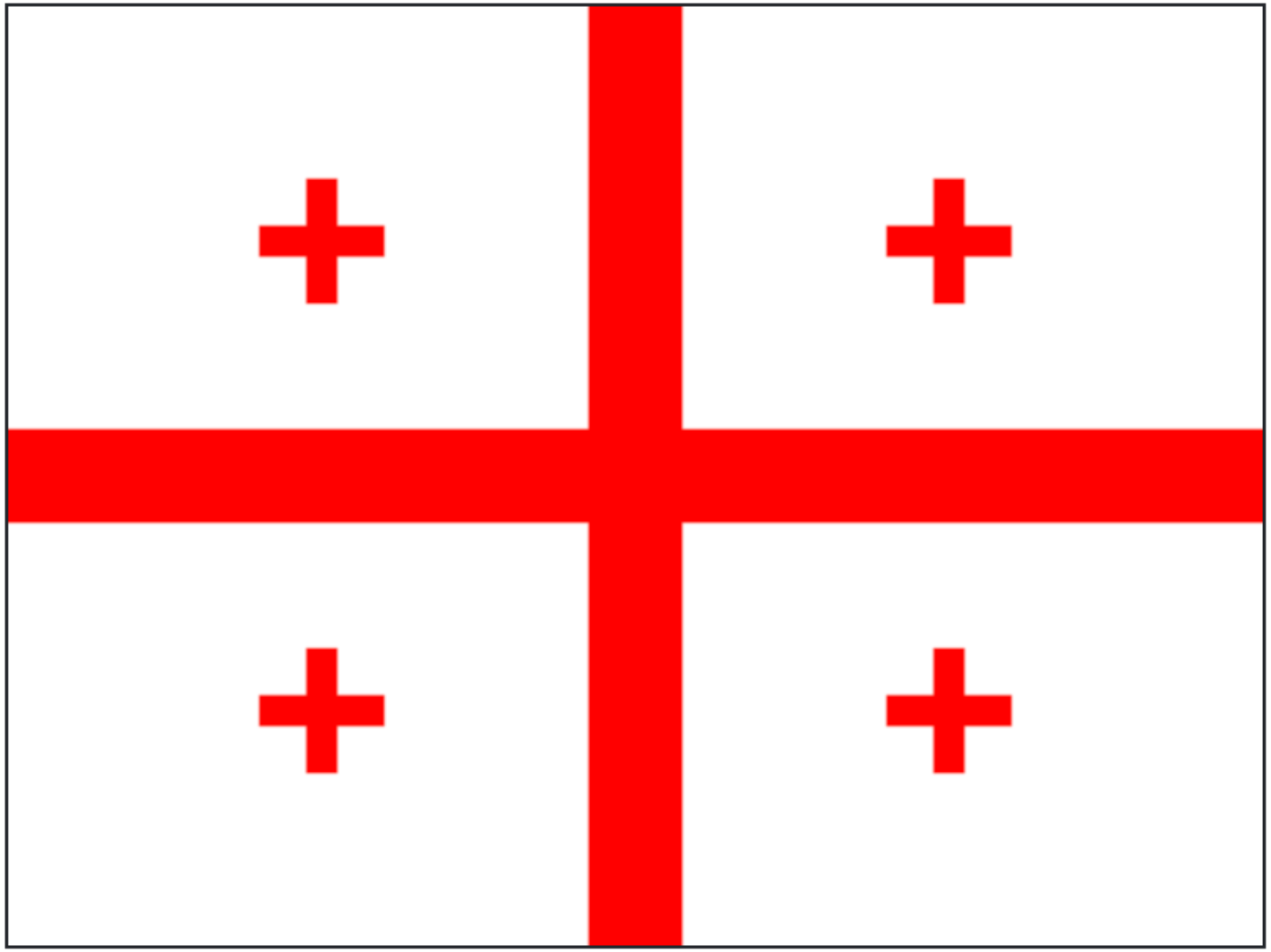
What Function Do you Want?



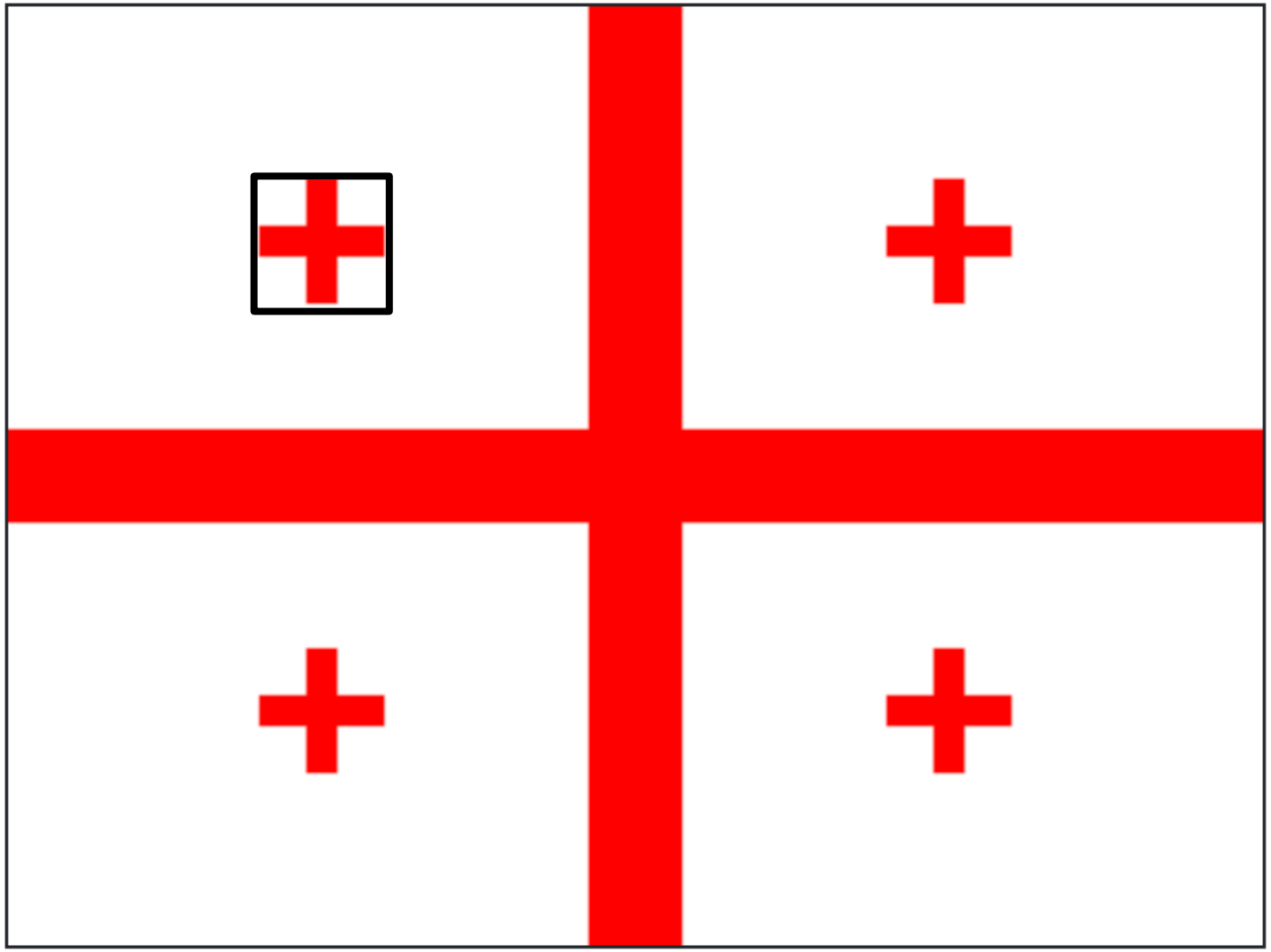
draw_circle
Is the turn_right of graphics

Advanced Version

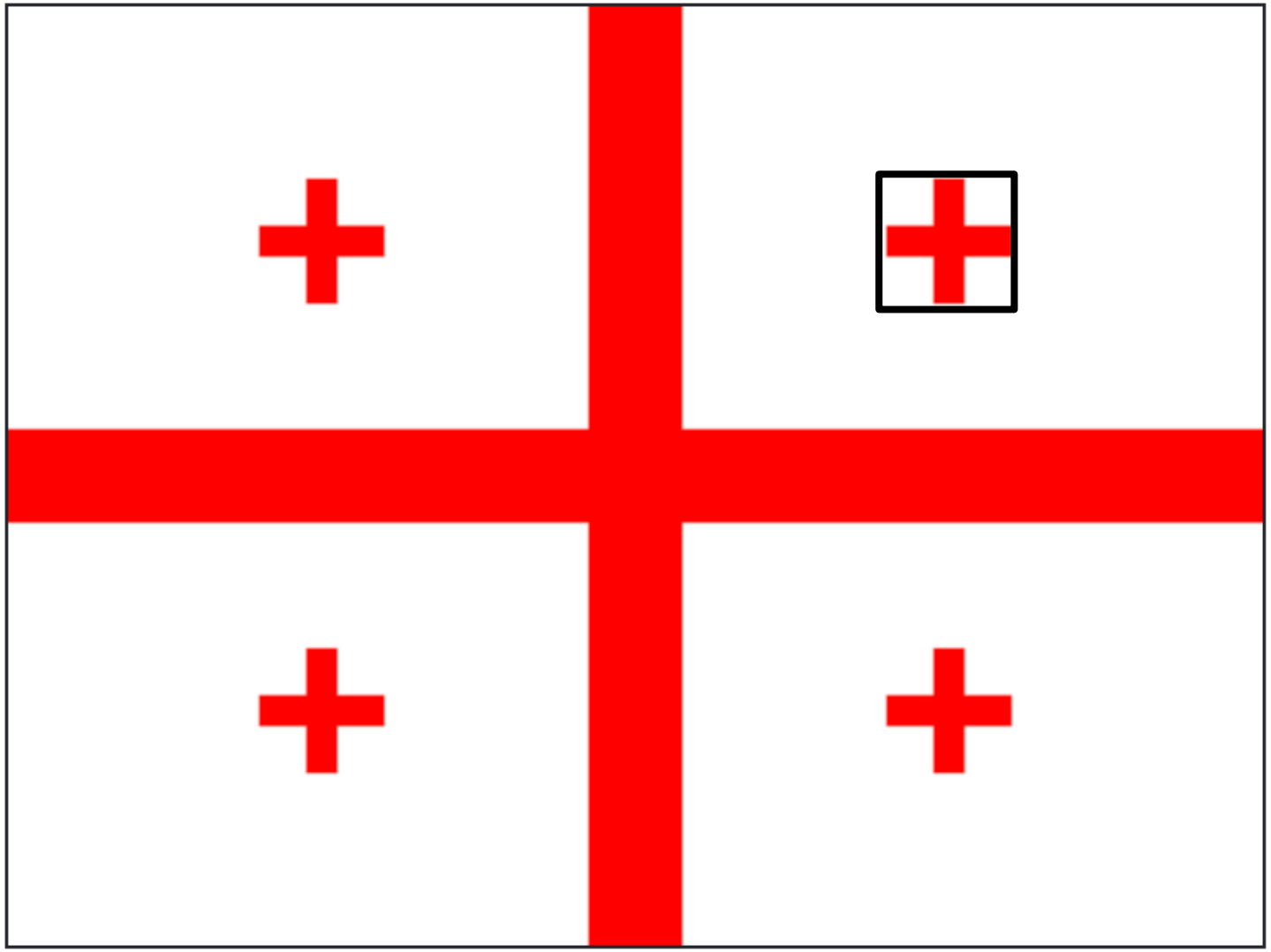
What Function Do you Want?



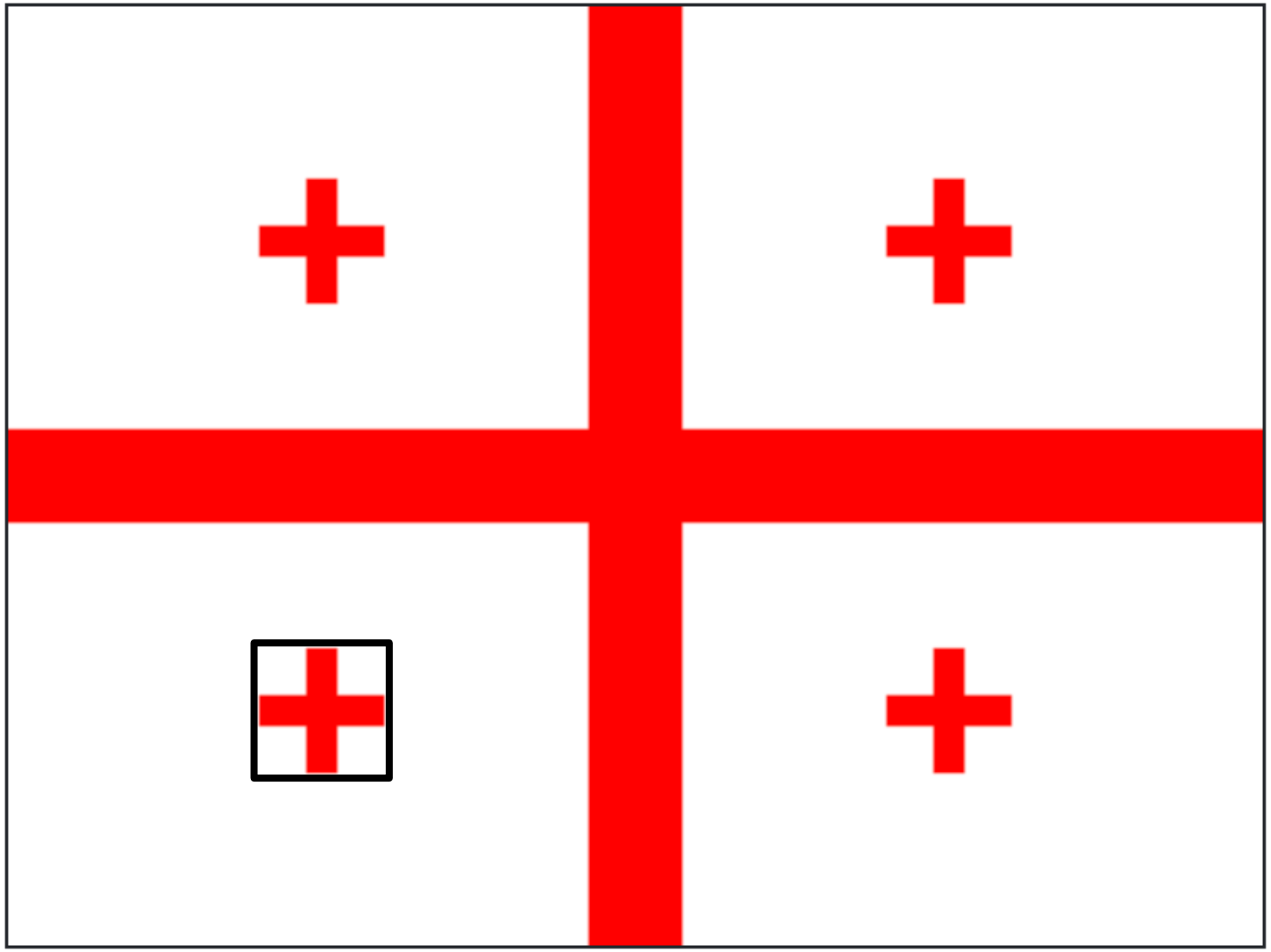
What Function Do you Want?



What Function Do you Want?



What Function Do you Want?



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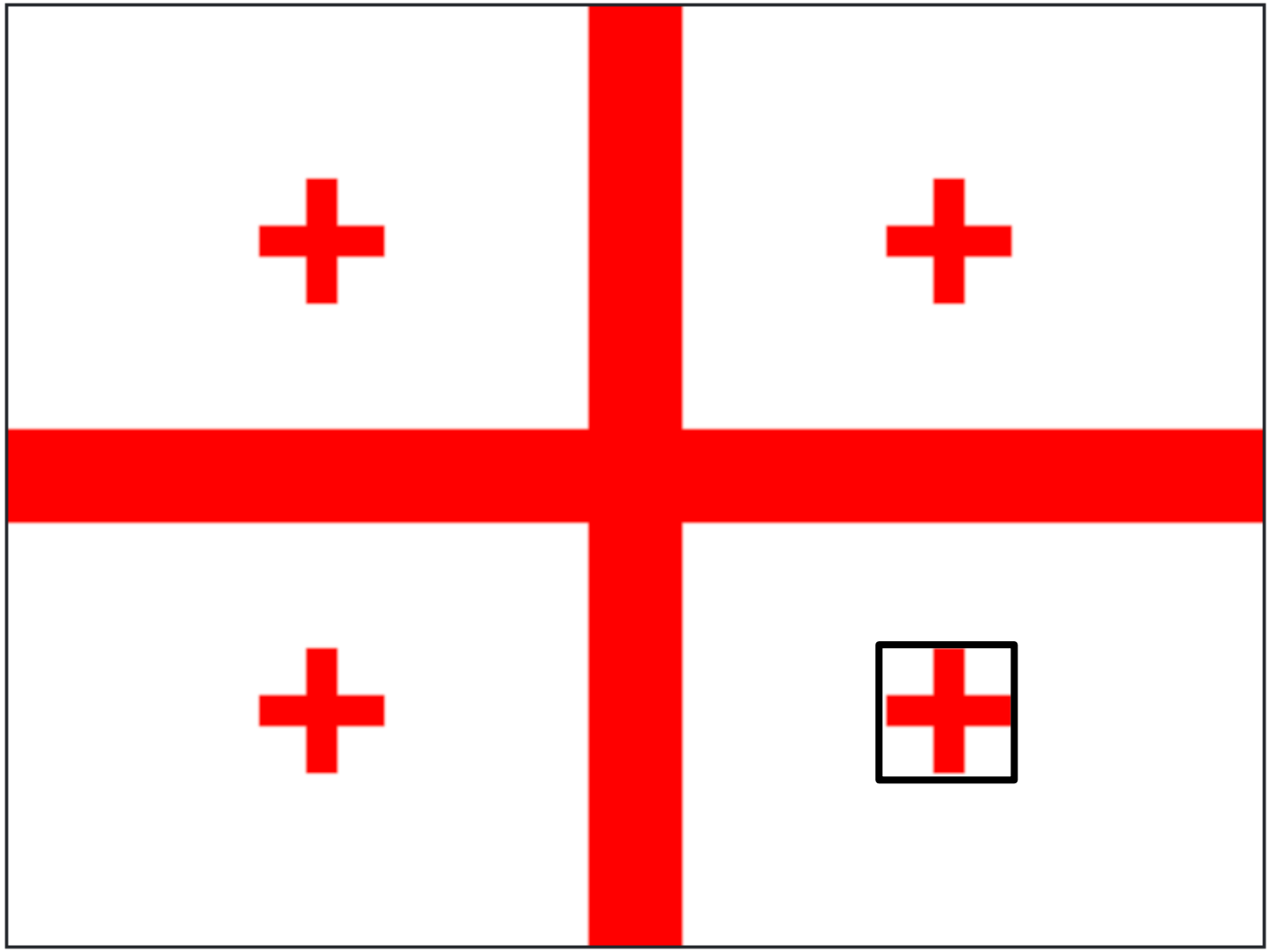
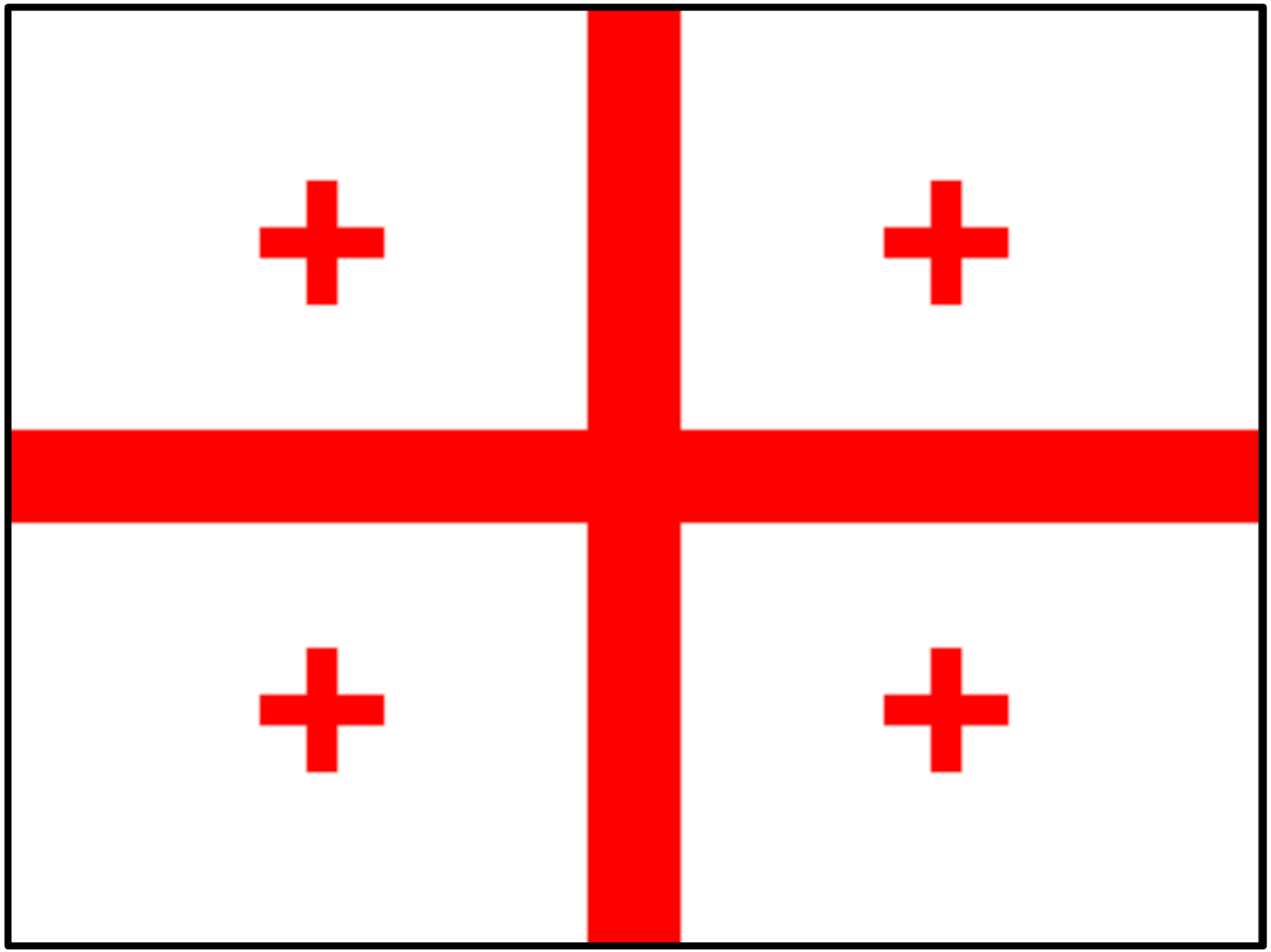
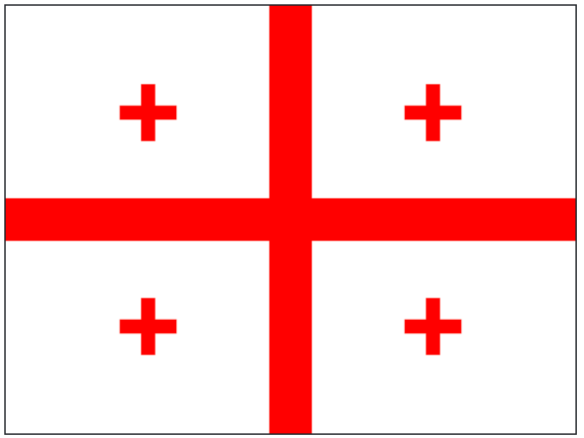


What Function Do you Want?



What Function Do you Want?

```
def draw_plus(canvas, x_1, y_1, x_2, y_2, width):
```



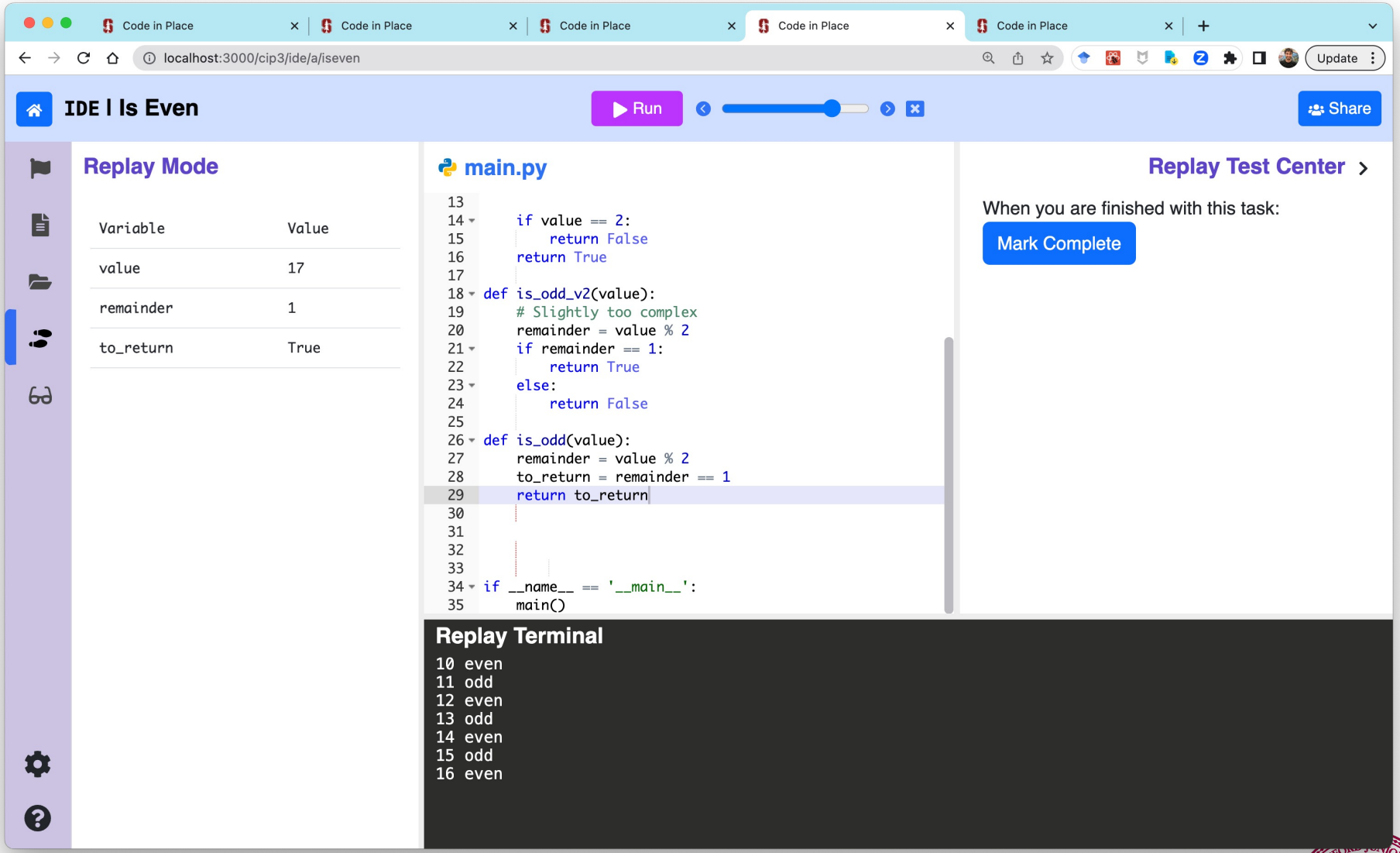
```
def draw_georgia_flag(canvas):
    # some calculations for where the pluses go!
    x_left = CANVAS_WIDTH * 1/4
    x_right = CANVAS_WIDTH * 3/4
    y_top = CANVAS_HEIGHT * 1/4
    y_bottom = CANVAS_HEIGHT * 3/4

    # four calls to draw_plus
    draw_plus(canvas, x_left - 20, y_top - 20, x_left+20, y_top+20, 10)
    draw_plus(canvas, x_right - 20, y_top - 20, x_right+20, y_top+20, 10)
    draw_plus(canvas, x_left - 20, y_bottom - 20, x_left+20, y_bottom+20, 10)
    draw_plus(canvas, x_right - 20, y_bottom - 20, x_right+20, y_bottom+20, 10)

    # big background plus
    draw_plus(canvas, 0, 0, CANVAS_WIDTH, CANVAS_HEIGHT, 30)
```

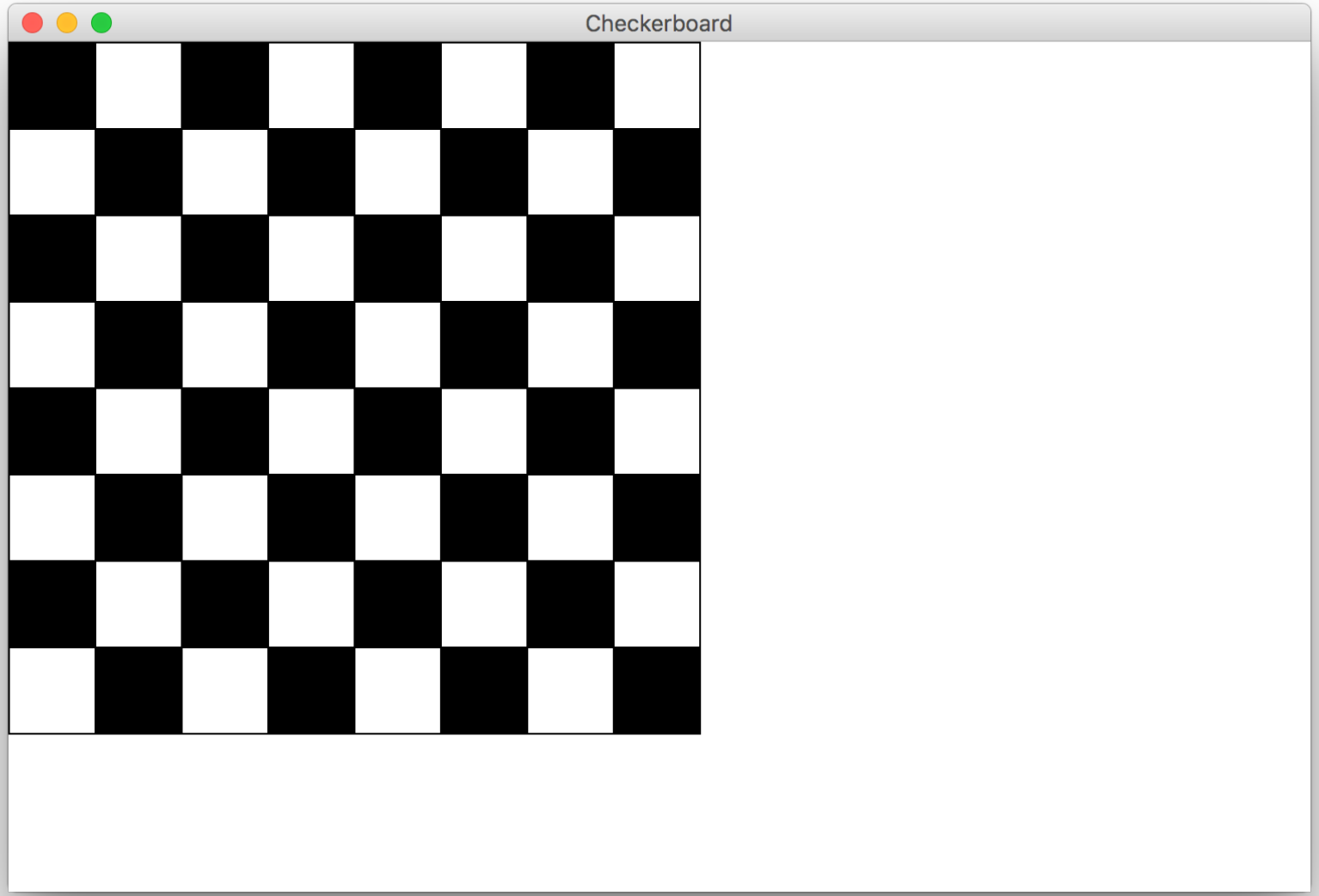
is_odd

Is Odd

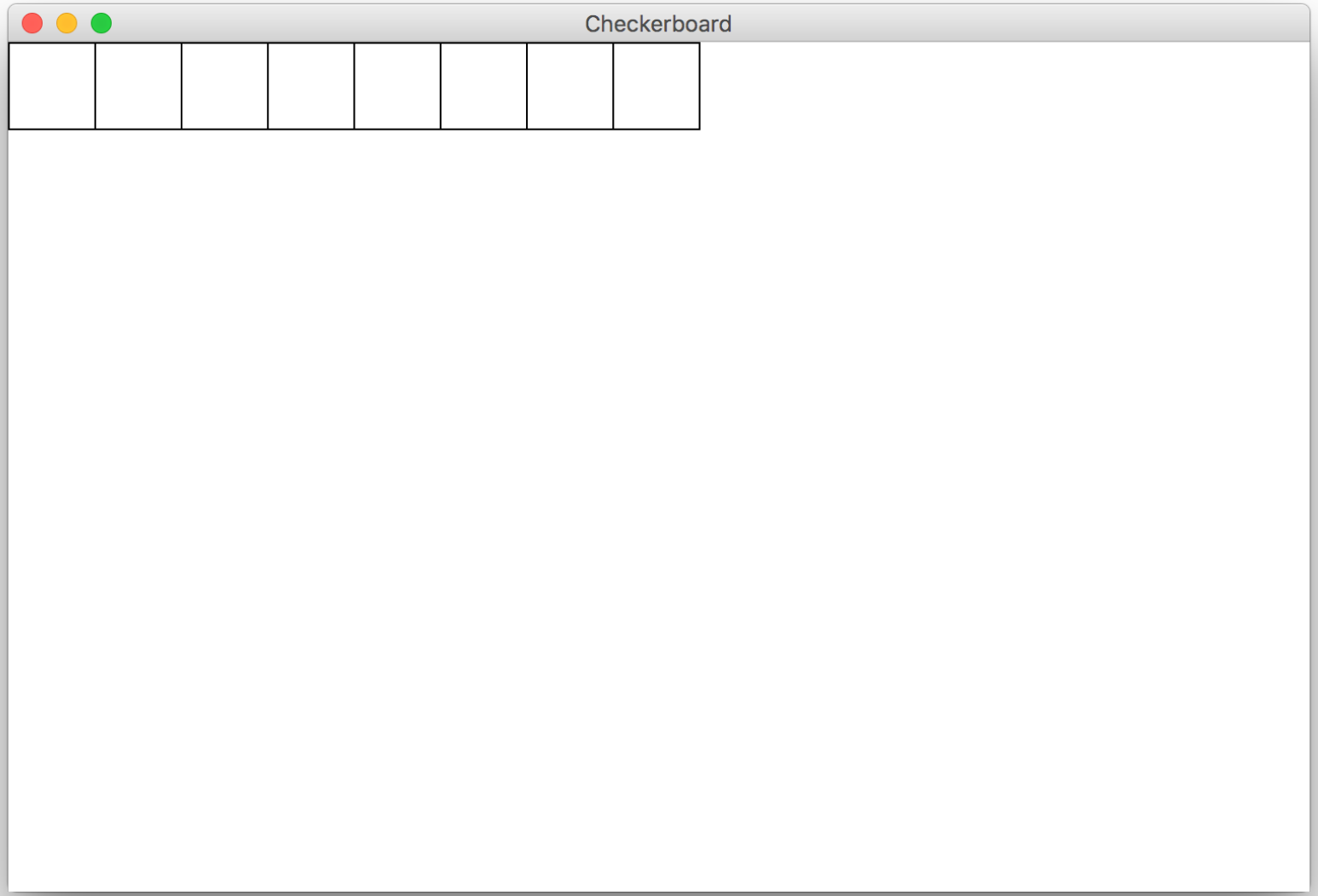

Code in Place
localhost:3000/cip3/ide/a/iseven
Update
IDE | Is Even
Run
Share
Replay Mode
Variable
Value
value
17
remainder
1
to_return
True
main.py
13
14 if value == 2:
15 return False
16 return True
17
18 def is_odd_v2(value):
19 # Slightly too complex
20 remainder = value % 2
21 if remainder == 1:
22 return True
23 else:
24 return False
25
26 def is_odd(value):
27 remainder = value % 2
28 to_return = remainder == 1
29 return to_return
30
31
32
33
34 if __name__ == '__main__':
35 main()
Replay Test Center
When you are finished with this task:
Mark Complete
Replay Terminal
10 even
11 odd
12 even
13 odd
14 even
15 odd
16 even

Chessboard

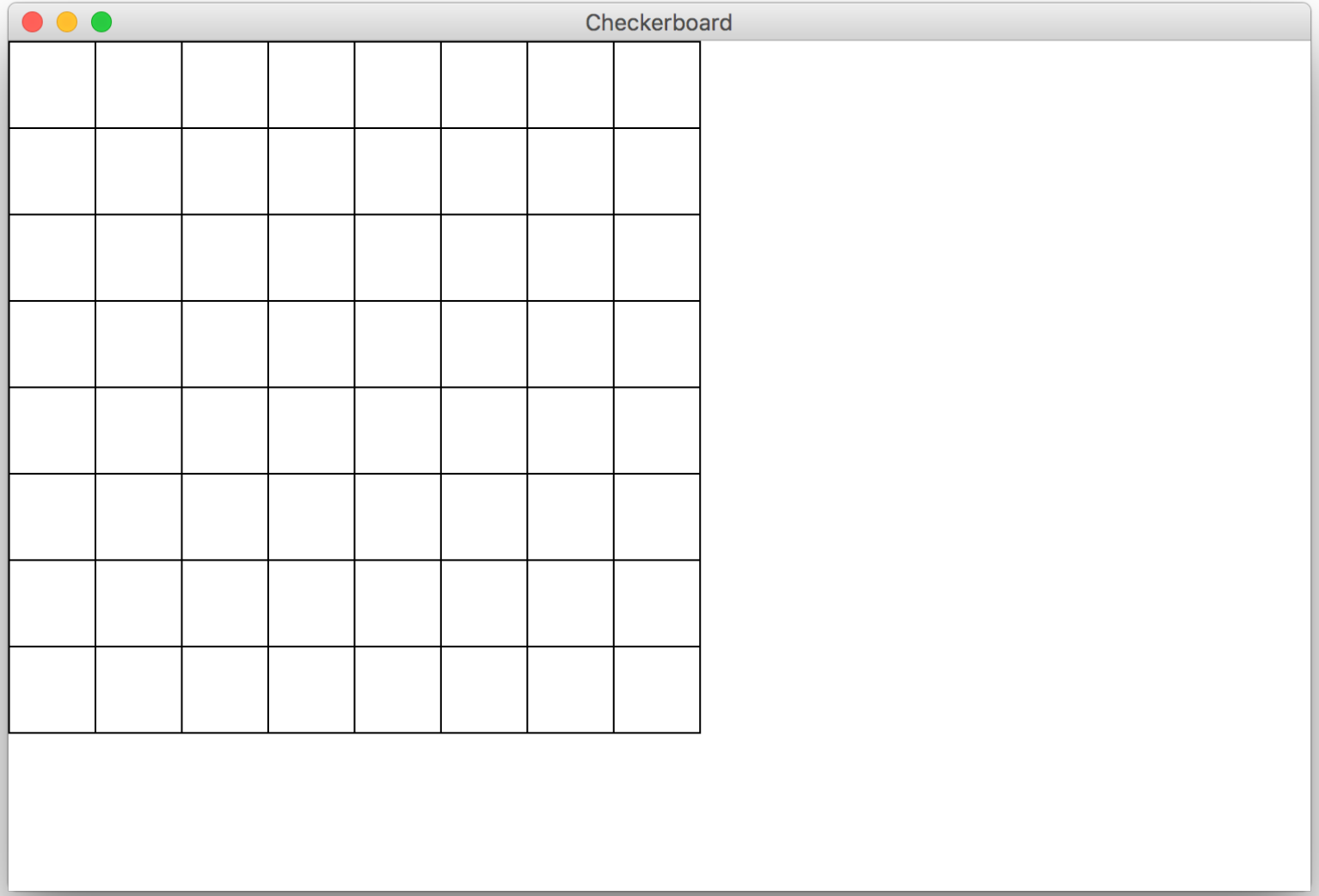
Goal



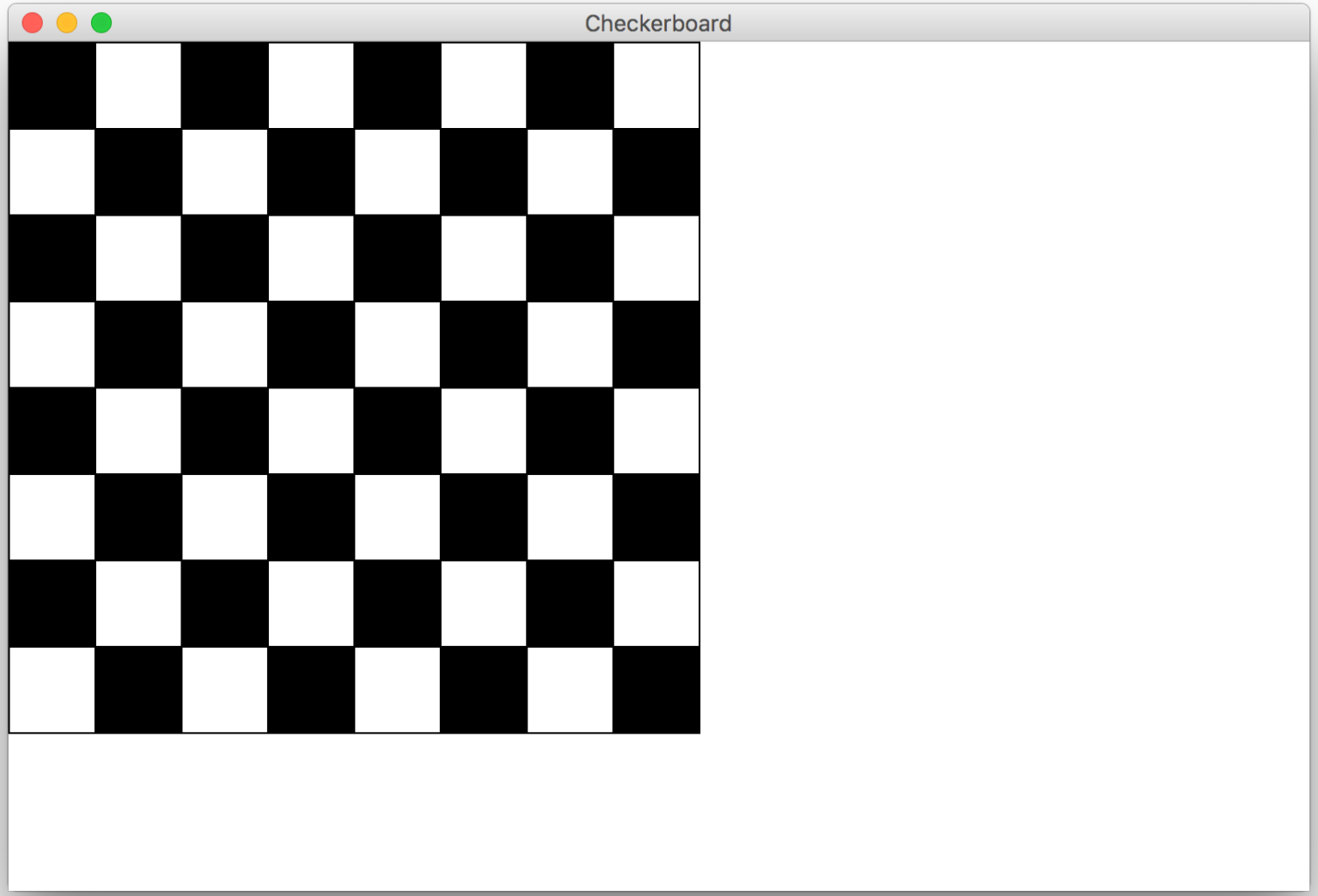
Milestone 1



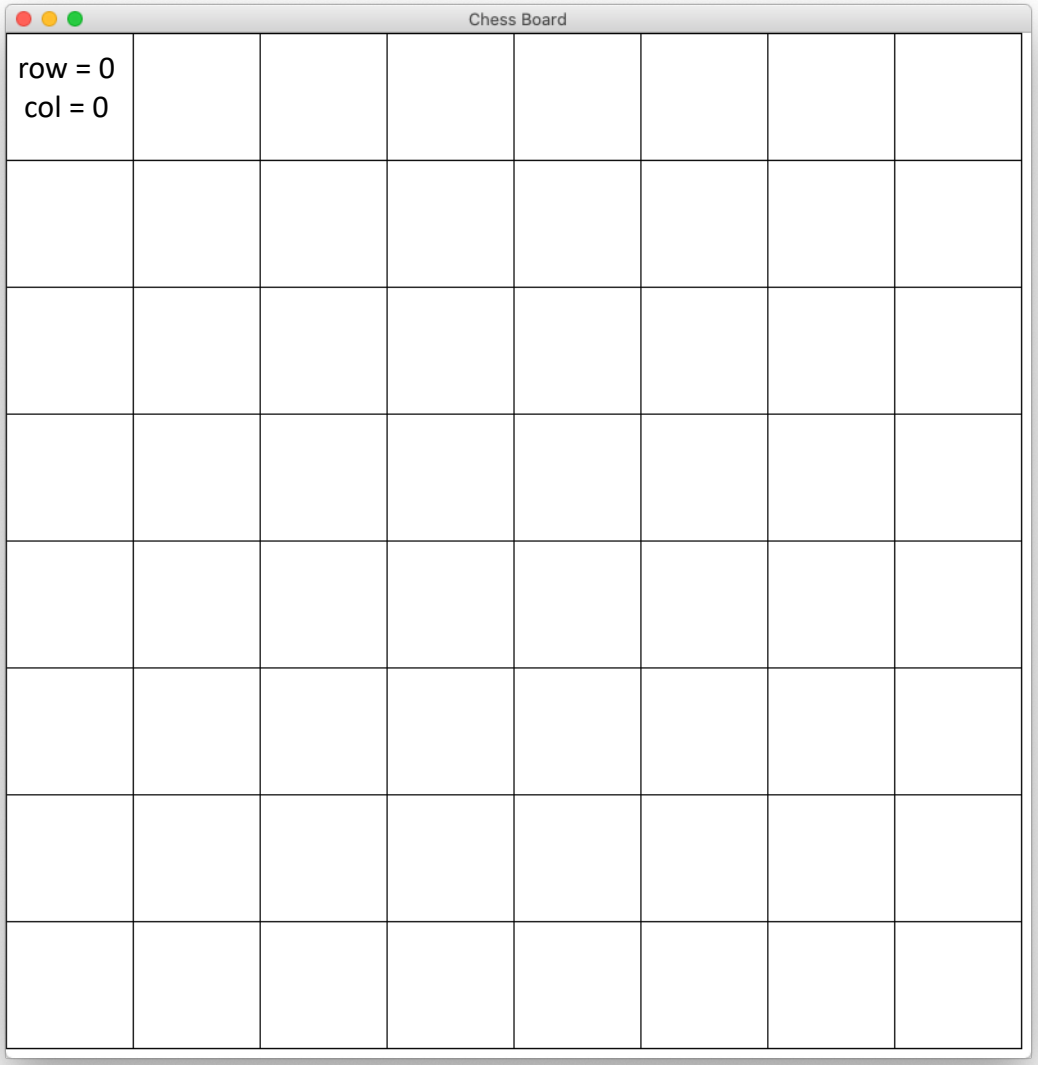
Milestone 2



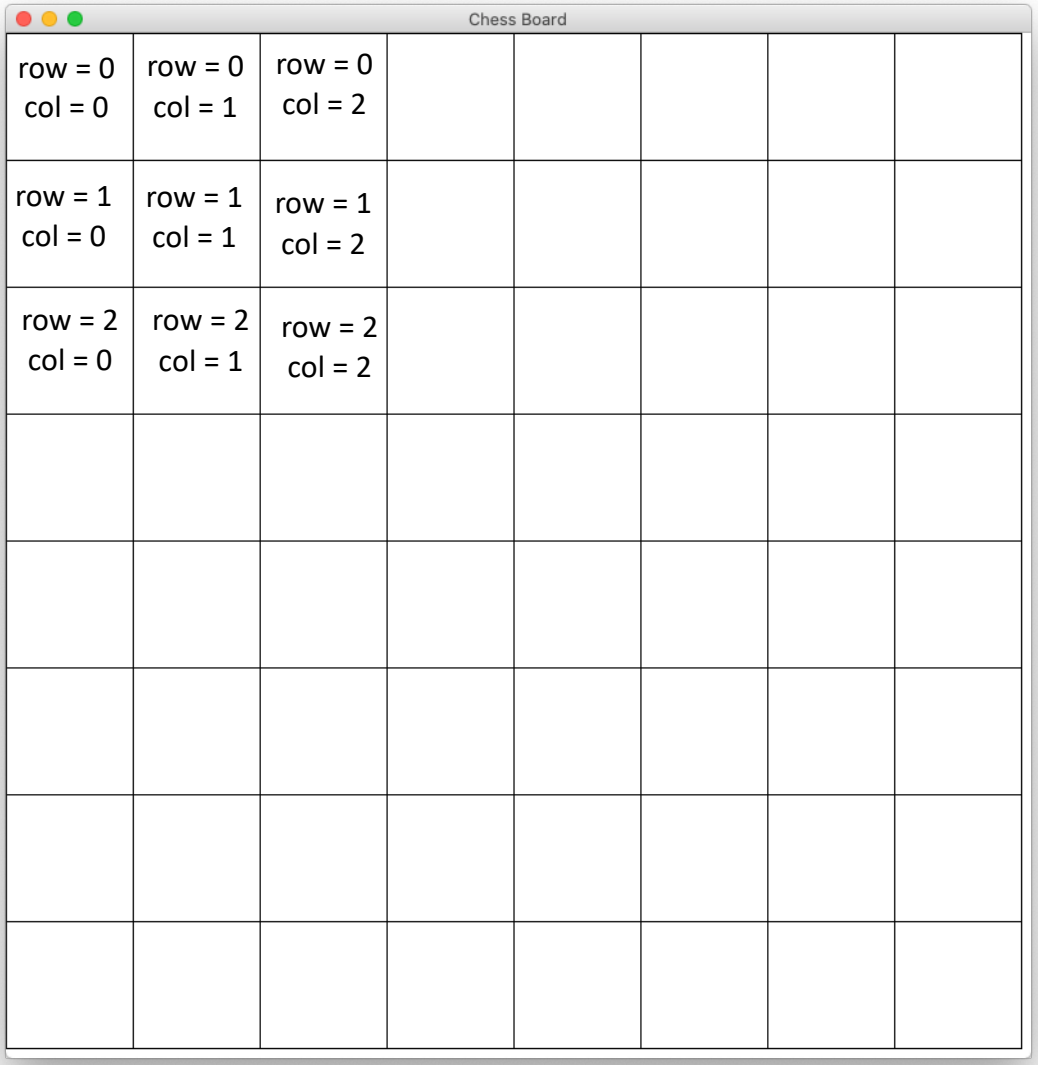
Milestone 3



Milestone 3



Milestone 3


Chess Board
row = 0 col = 0
row = 0 col = 1
row = 0 col = 2
row = 1 col = 0
row = 1 col = 1
row = 1 col = 2
row = 2 col = 0
row = 2 col = 1
row = 2 col = 2

Row + Col