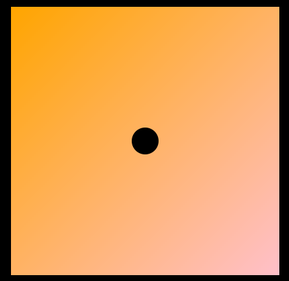
CIS 1100

PennDraw (Lecture)

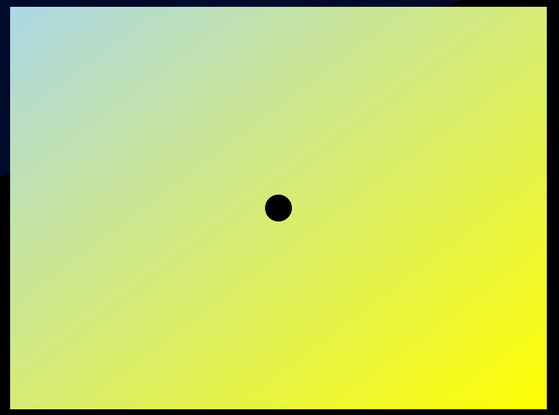
Python
Fall 2024
University of Pennsylvania

Recap: Dimensions vs. Coordinate System

- The *width* and *height* of the canvas can be described using pixels.
- Independent of the *width* and *height* of the canvas, we can describe a point on the screen using a coordinate pair between `(0, 0)` and `(1, 1)`.



200x200 canvas, point at `(0.5, 0.5)`



400x300 canvas, point at `(0.5, 0.5)`

Recap: The PennDraw Sandwich

- At the start of your PennDraw programs:

```
import penndraw as pd
```

- Nothing will appear in your output unless you add `pd.run()` to the end of your program.
  - If you don't see anything being drawn, double check that you have `pd.run()` at the very end.

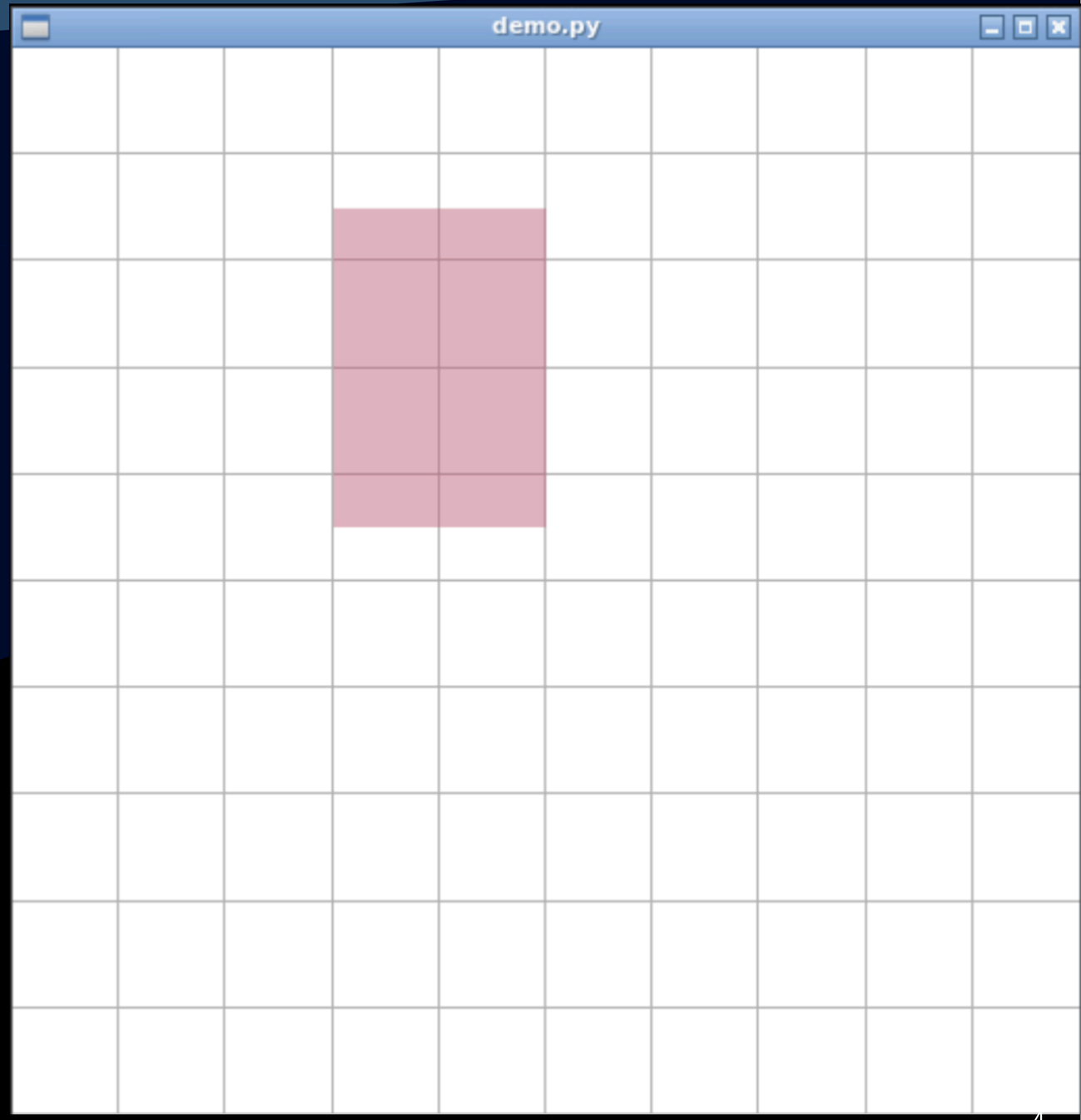
Recap: Running & Stopping PennDraw Programs

- For programs that use PennDraw, the program will continue to run so that you can see the drawing you made!
- **Before re-running**, you need to stop the program execution one of two ways:
    i. Close the drawing window
    ii. Press Control-C on your keyboard in the terminal

Recap: Inputs

`pd.filled_rectangle(...)` takes four arguments:

- `x_center`: the x coordinate of the center of the rectangle
- `y_center`: the y coordinate of the center of the rectangle
- `half_width`: the horizontal distance between side and center
- `half_height`: the vertical distance between top and center



Recap: Inputs

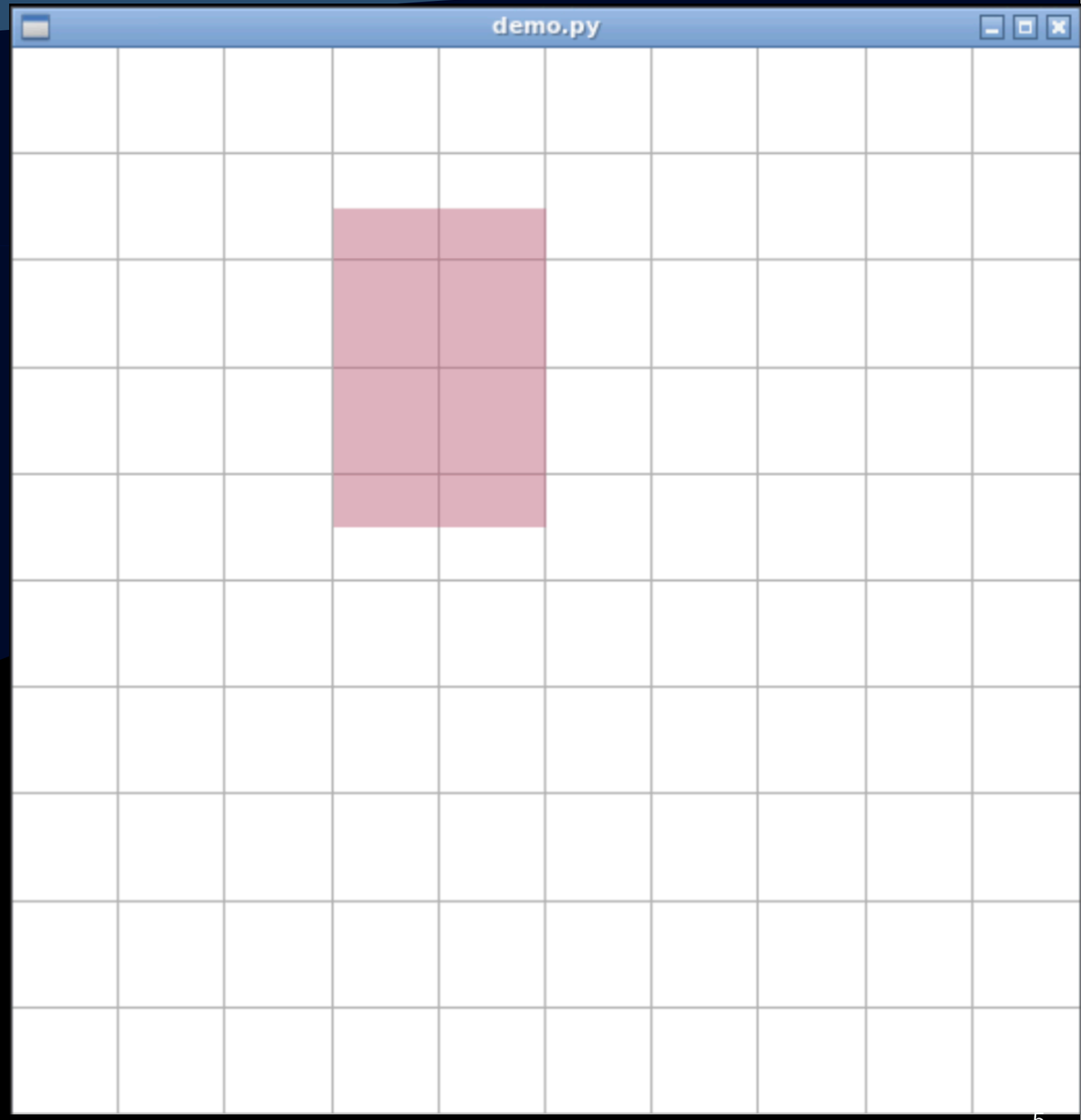
`pd.filled_rectangle(...)`

takes four arguments:

- `x_center`: `0.4`
- `y_center`: `0.7`
- `half_width`: `0.1`
- `half_height`: `0.15`

So:

```
pd.filled_rectangle(0.4, 0.7, 0.1, 0.15)
```



Activity: Pick the Dimensions (M1)

```
pd.circle(x_center,
y_center, radius)
```

A: `(0.3, 0.8, 0.5)`

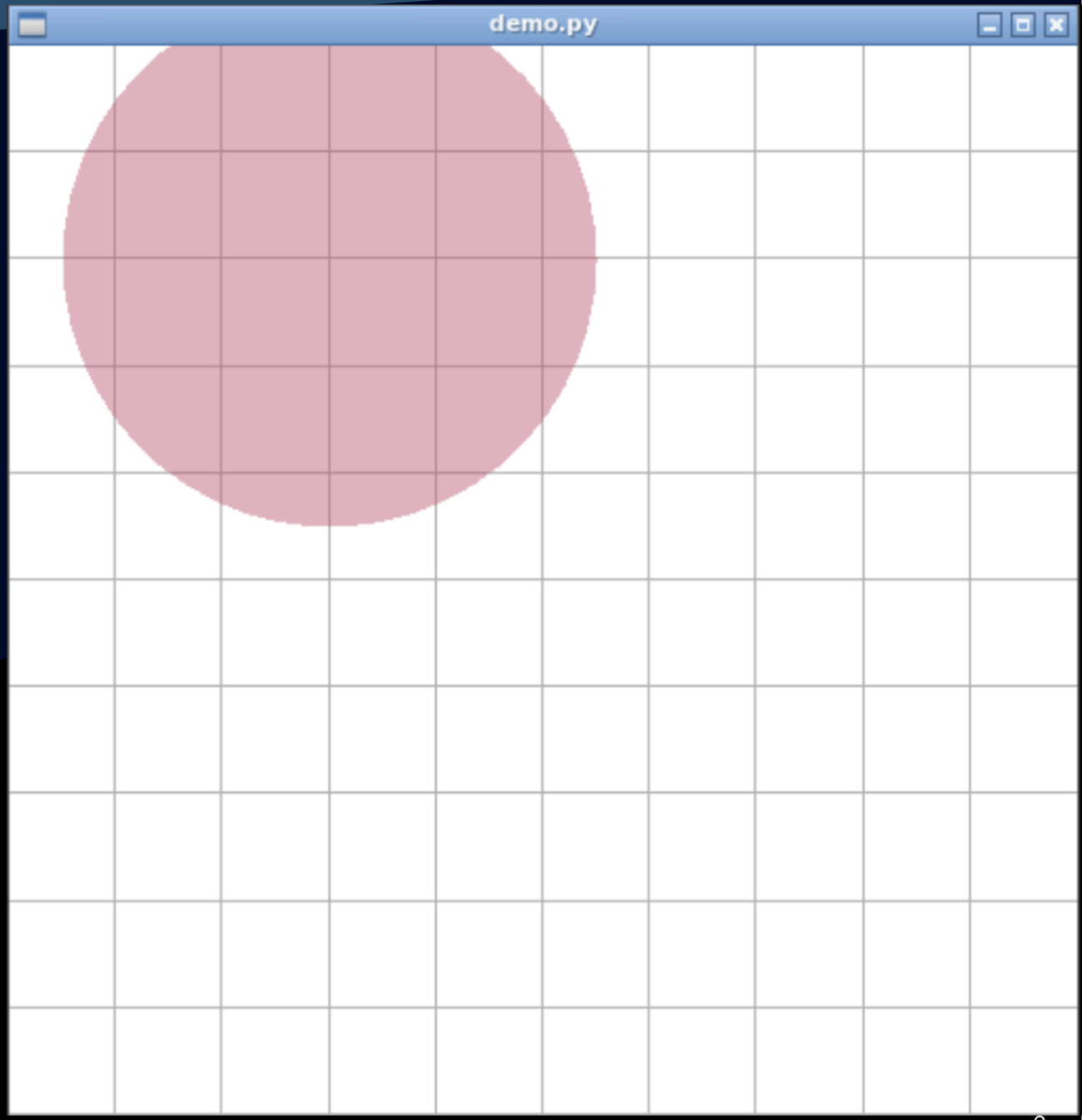
B: `(0.8, 0.3, 0.25)`

C: `(0.3, 0.8, 0.25)`

D: `(0.8, 0.3, 0.125)`

E: `(0.4, 0.2, 0.2)`

(By the way, the canvas is 512x512)



Activity: Draw the Shape (S7)

Imagine that the box for **S7** is your canvas. What would the output drawing look like?

```
import penndraw as pd

pd.set_canvas_size(400, 200)
pd.rectangle(0.5, 0.75, 0.4, 0.1)

pd.run()
```

Activity: Draw the Shape (S7)

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import penndraw as pd

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pd.rectangle(0.5, 0.75, 0.4, 0.1)

pd.run()
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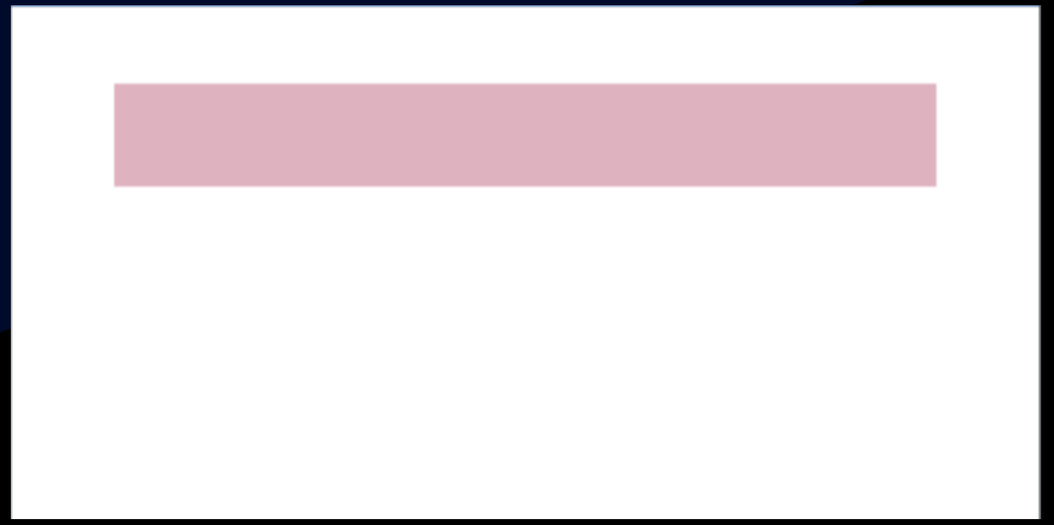

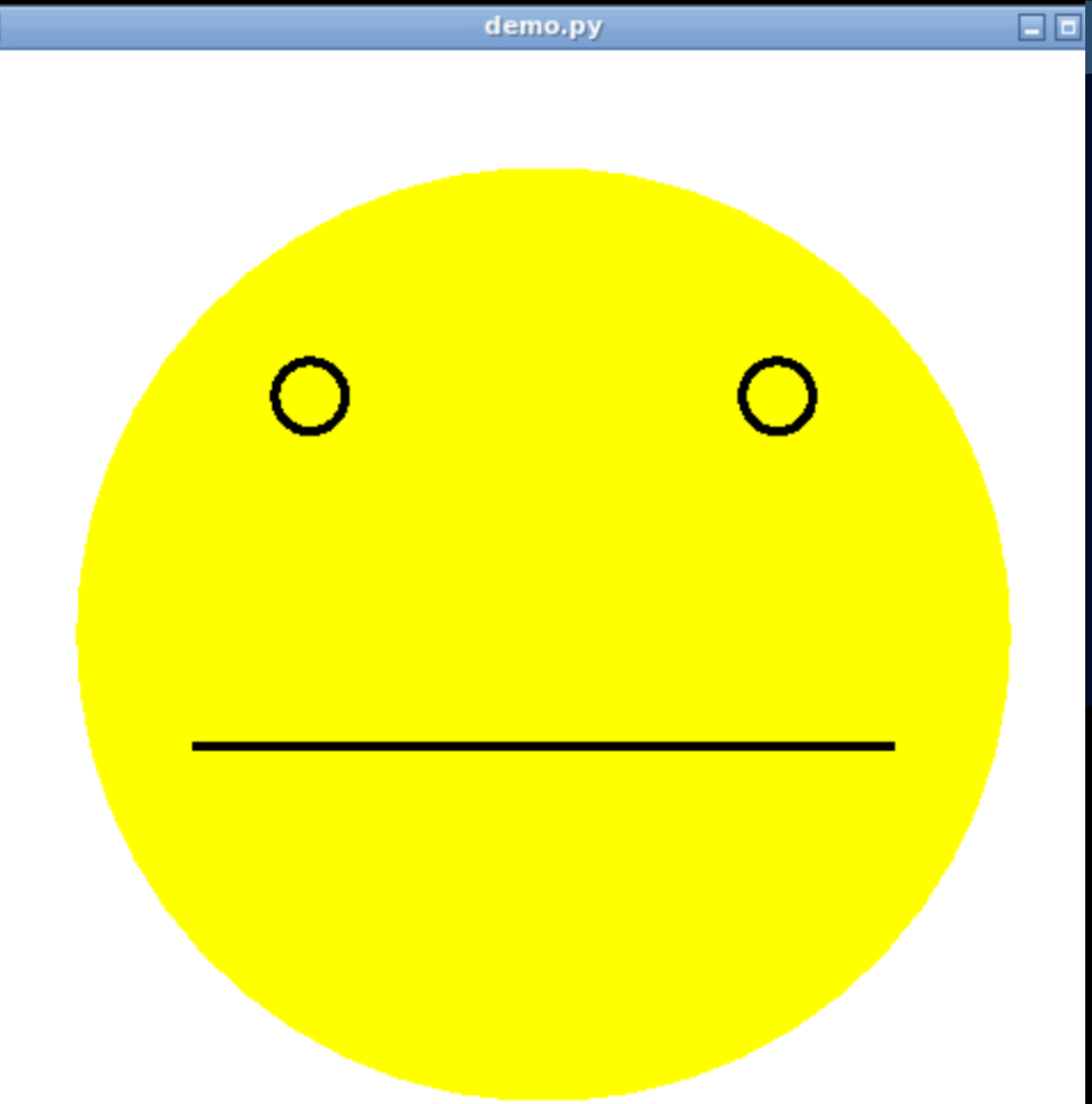

Activity: Reproduce the Drawing

(S8): What is the least number of times that you have to set the pen color to make this drawing?

(L11): Write down the names of each of the PennDraw functions you'd need to make this drawing.

(C12): Write the short program that can reproduce this drawing.

Some Facts about Mars

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3. Also, the gravity on Mars is about 38% of Earth's gravity.

Activity: my_house_on_mars.py

```
import penndraw as pd                                                    # 1
pd.set_canvas_size(500, 500)                                             # 2
# draw a blue background                                                 # 3
pd.clear(pd.BLUE)                                                        # 4
# draw a green field                                                     # 5
pd.set_pen_color(0, 170, 0)                                              # 6
pd.filled_rectangle(0.5, 0.25, 0.5, 0.25)                                # 7
# change the pen color to a shade of yellow                              # 8
pd.set_pen_color(200, 170, 0)                                            # 9
# draw a filled triangle (roof)                                          # 10
pd.filled_polygon(0.255, 0.70, 0.745, 0.70, 0.49, 0.90)                  # 11
# draw the house                                                         # 12
pd.filled_rectangle(0.5, 0.52, 0.24, 0.18)                               # 13
```

(L13): Change a line so that the ground becomes a brownish-red color.

(C14): Change a small number of lines so that the house is tall and narrow. (Make sure the roof looks OK!)

Reminders & Announcements

- There is another check-in due before Friday's lecture (1/24 @ 1:45pm)
- Regular TA Office Hours start next week (check Ed, course website for schedule)
- Recitations start next week, 1/27 & 1/28
  - These are in **Amy Gutmann Hall**, Penn's newest building at 34th & Chestnut
  - Shiny new mass timber building. Very cool.

If Time...

What if our program didn't always draw the same picture each time?

```
import random
print("Picking a random number between 0 and 0.99999...")
my_float = random.random()
print("Picking a random integer between 1 and 100.")
my_int = random.randint(1, 100)
print("my_float:", my_float, "my_int:", my_int)
```

🖨️👇 (for example)

```
Picking a random number between 0 and 0.99999...
Picking a random integer between 1 and 100.
my_float: 0.30258196864839937 my_int: 13
```

Picking a Random Color

How can we fill in the blank with lines of code so that we pick a random color for our square each time?

```
import random
import penndraw as pd

#  PUT SOME CODE HERE!

pd.set_pen_color(red, green, blue)
pd.filled_circle(0.5, 0.5, 0.2)
pd.run()
```

Picking a Random Color

How can we fill in the blank with lines of code so that we pick a random color for our square each time?

```
import random
import penndraw as pd

red = random.randint(0, 255)
green = random.randint(0, 255)
blue = random.randint(0, 255)

pd.set_pen_color(red, green, blue)
pd.filled_circle(0.5, 0.5, 0.2)
pd.run()
```