CS21: INTRODUCTION TO COMPUTER SCIENCE

Prof. Mathieson

Fall 2018

Swarthmore College

Outline Oct 8:

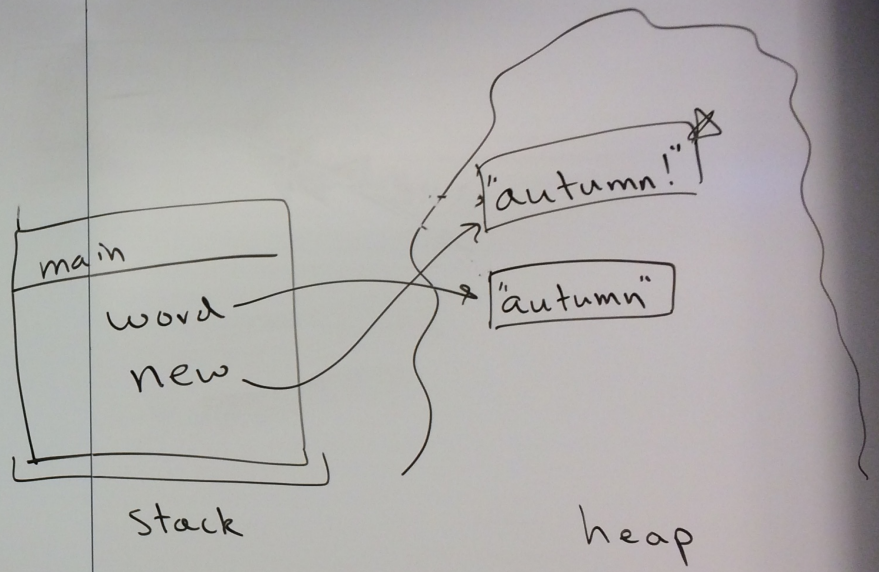
Sit somewhere new!

- One more stack example
- Introduction to object-oriented programming
- Start graphics
- Random circle program (**circles.py**)
- Cat face program (**cat_face.py**)

Notes

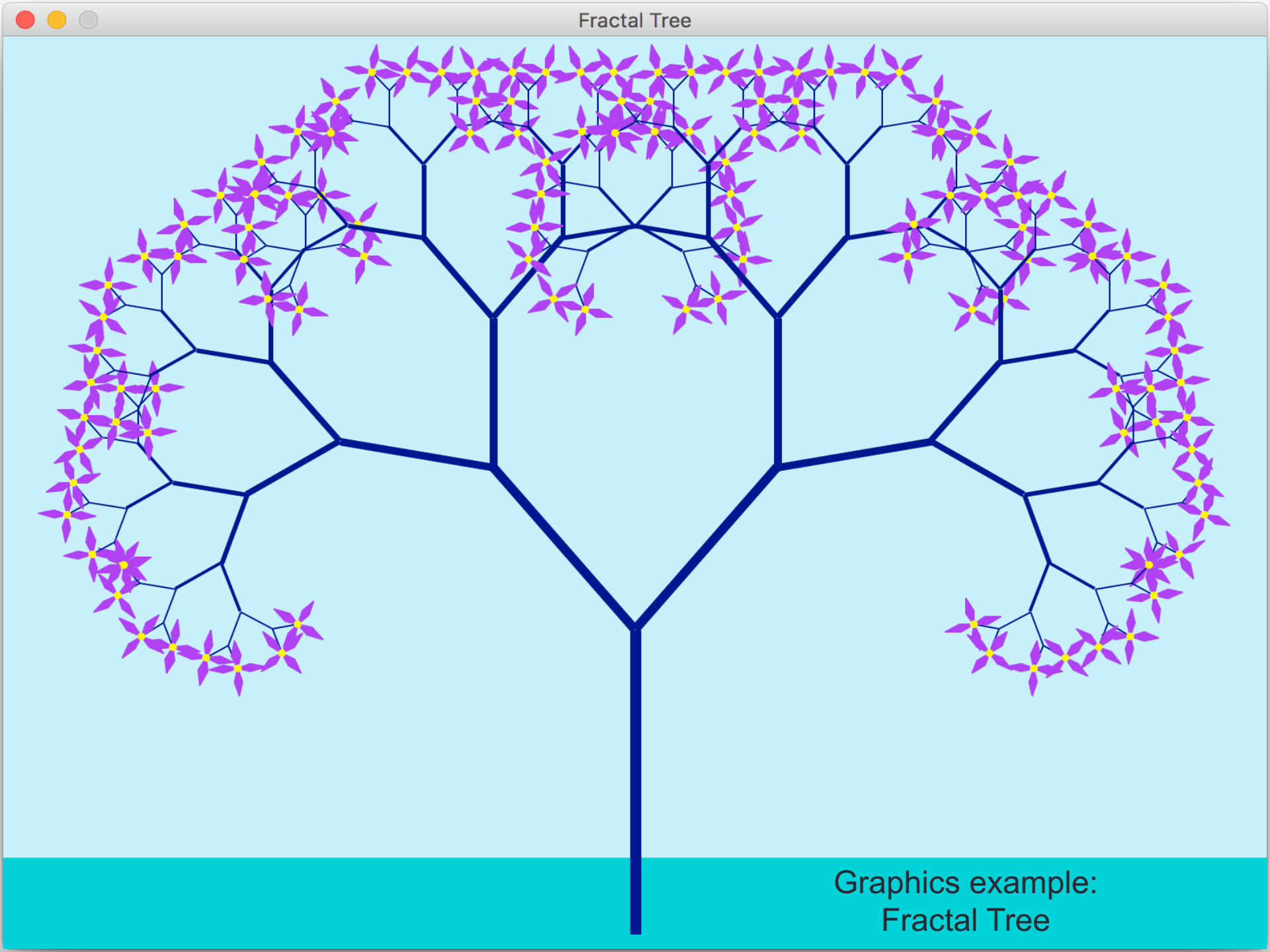
- **Lab 5** due **Friday** (written), **Saturday** (coding)
- **Office Hours 2-4pm on THURSDAY (just this week!)**

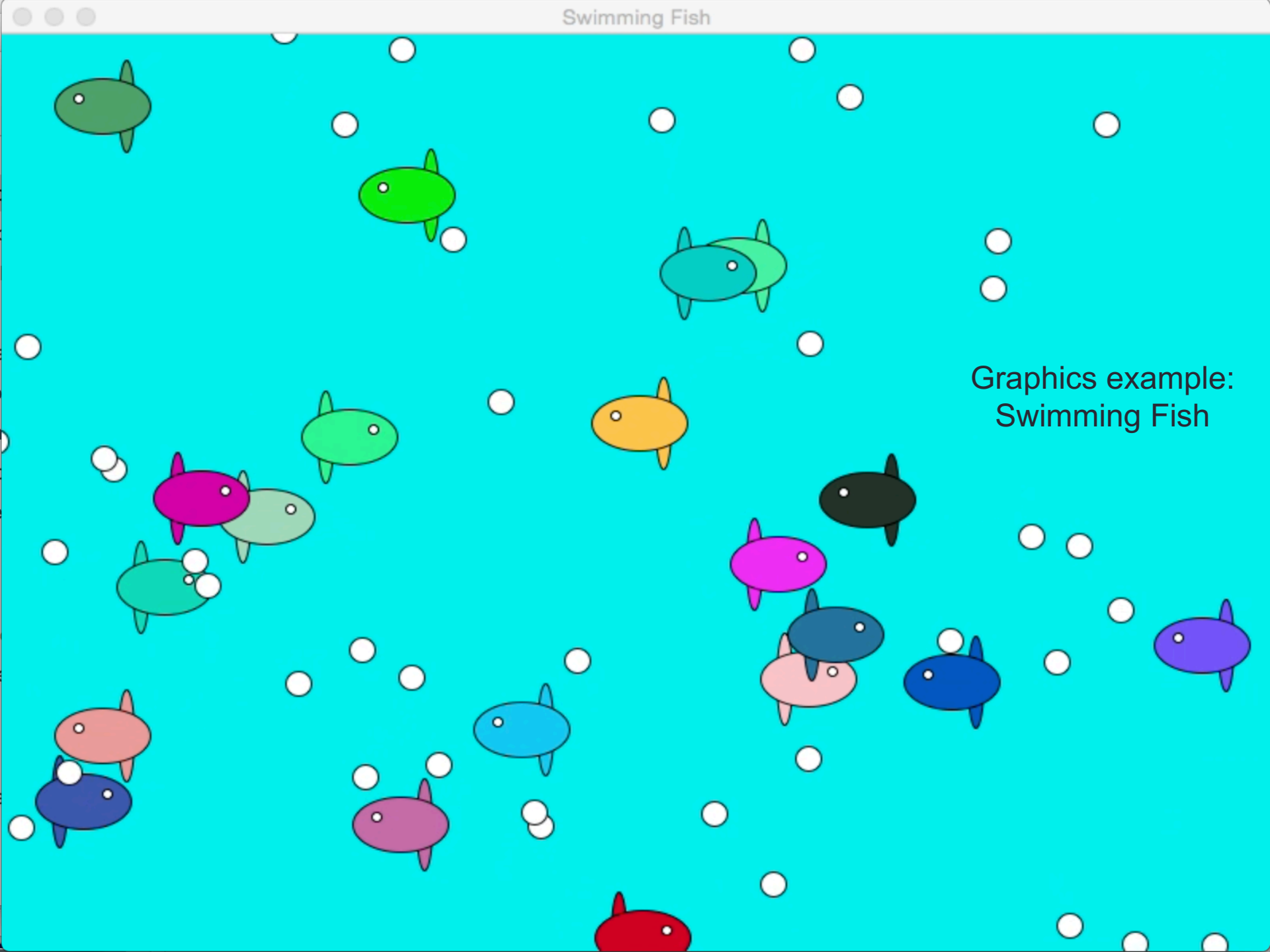
```
1   def exclaim(t):
2       t = t + "!"
3       return t
4
5   def main():
6       word = "autumn"
7       new = exclaim(word)
8       print(new)
9
10  main()
```



One more stack example

Graphics and Object Oriented Programming (OOP)


Fractal Tree
Graphics example:
Fractal Tree


Swimming Fish
Graphics example:
Swimming Fish

Goals for this week

- Understand the idea of *OOP*
- Be able to create *objects* and call *methods*
- Become comfortable with the vocabulary of OOP
- Be able to use the graphics library documentation to learn new types and methods

Idea of Object Oriented Programming

Objects have:

* Data
* Methods
* Type

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>>> type(p)
<class 'graphics.Point'>
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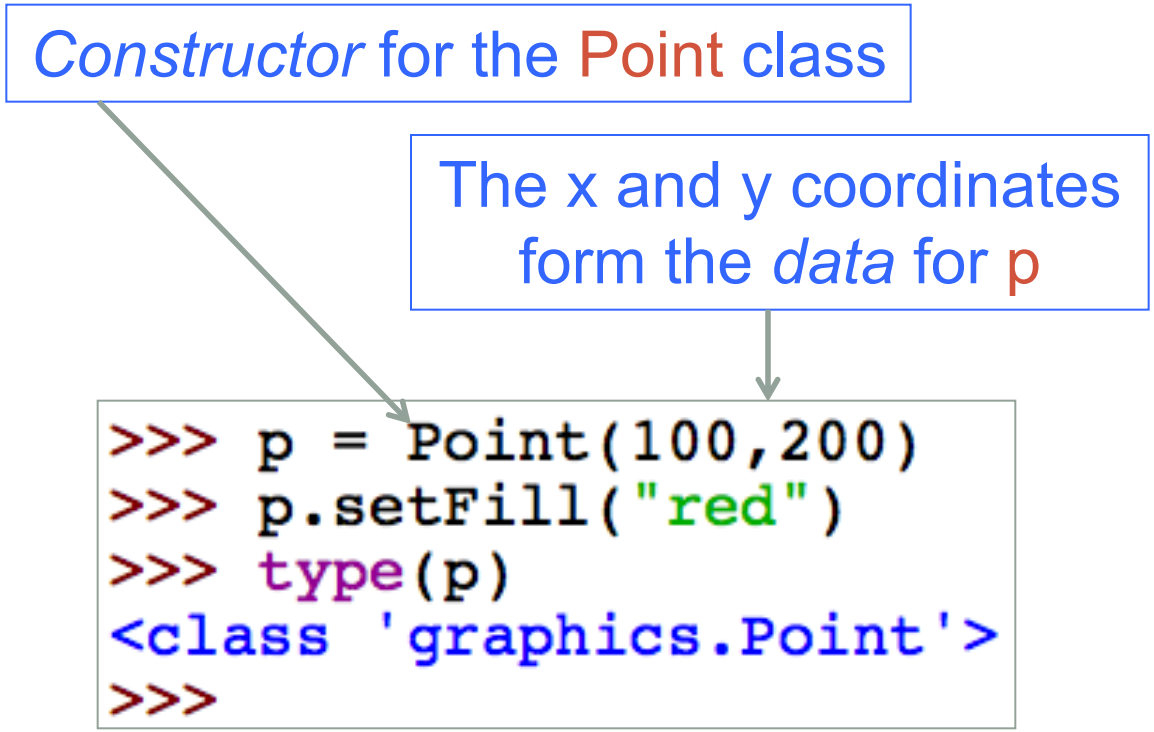

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The x and y coordinates form the *data* for p

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setFill(..) is a *method*, not a *function*

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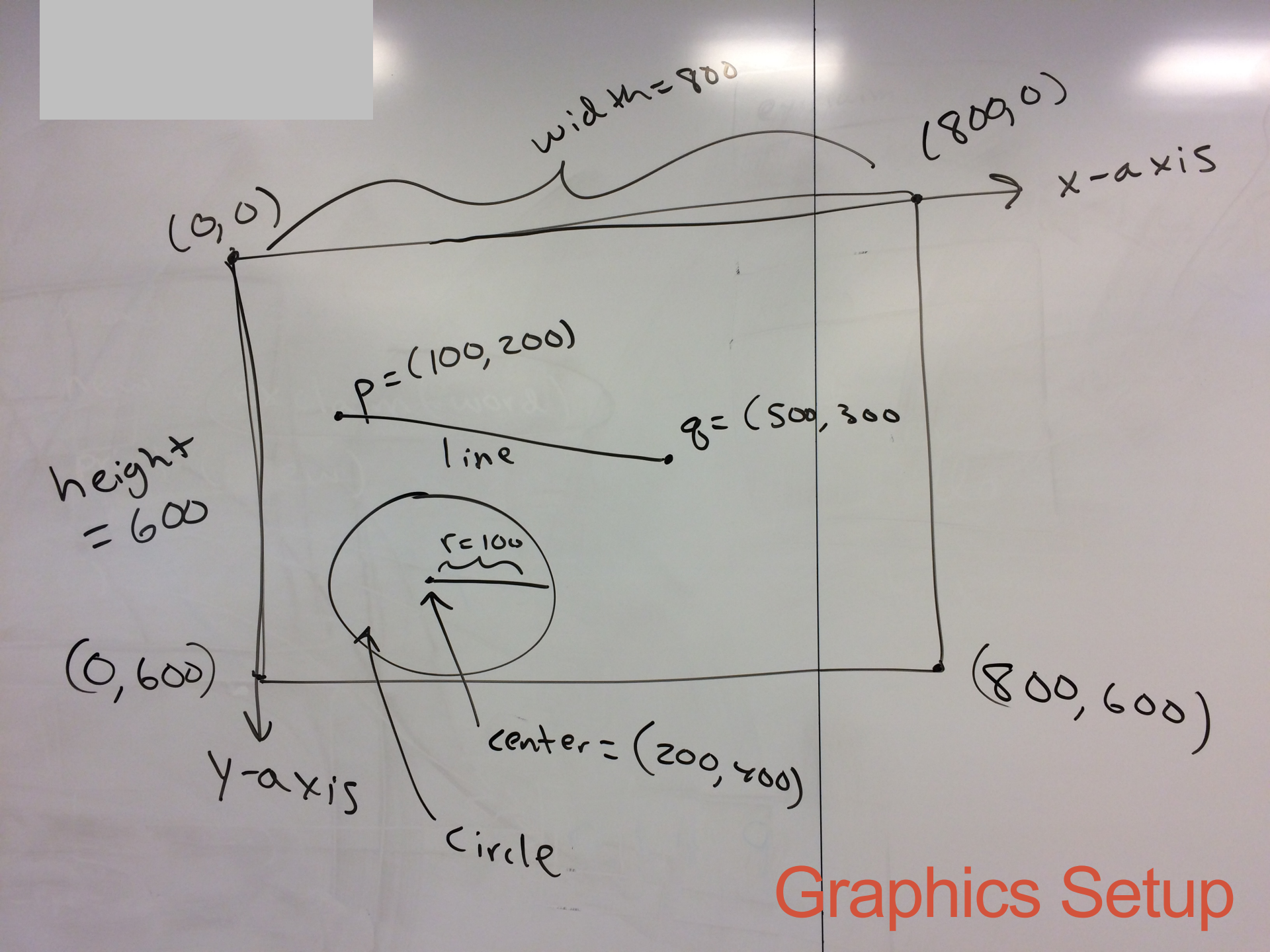
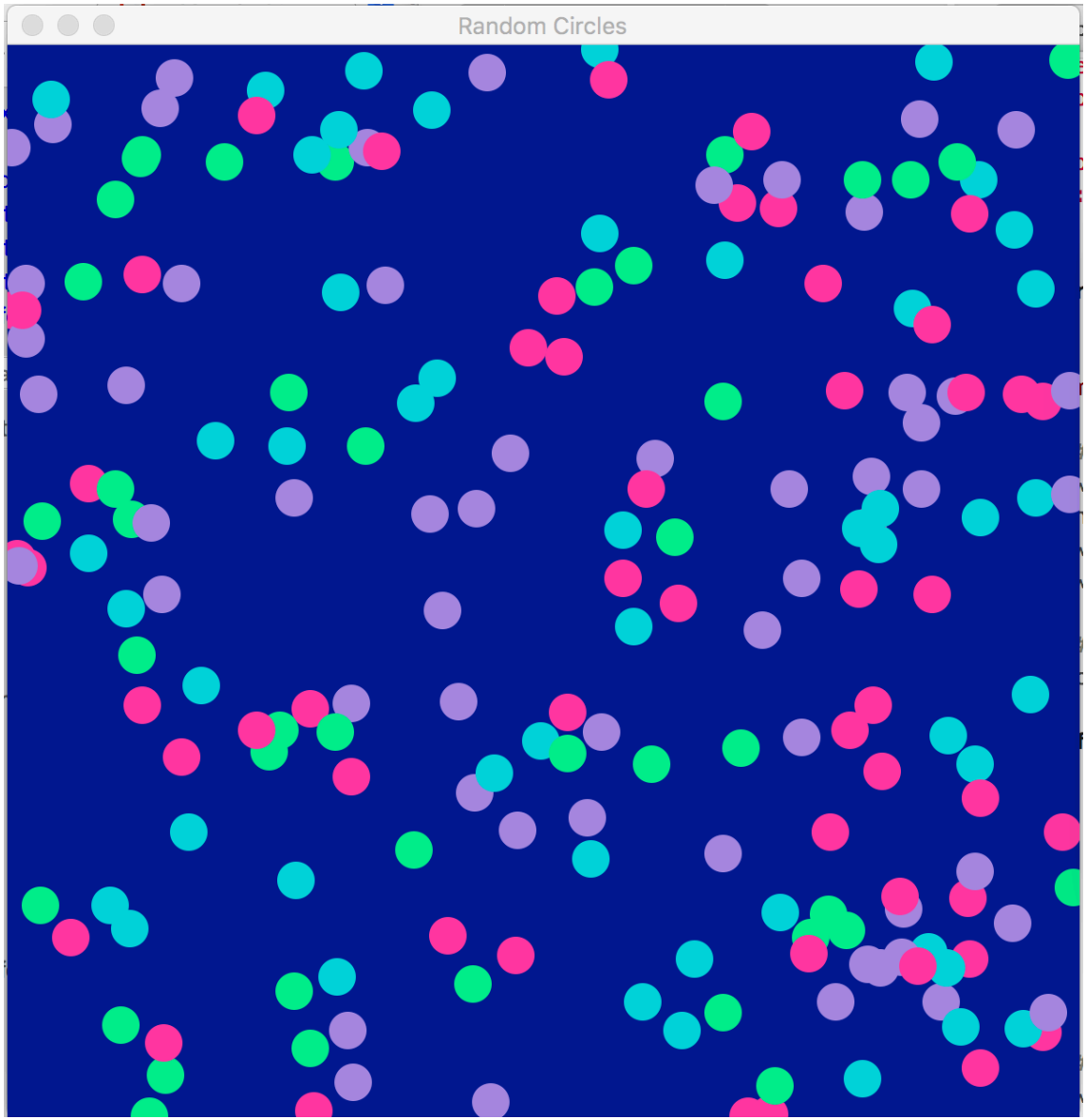
setFill(..) is a *method*, not a *function*

The type of p is Point, p is an *instance* of the Point *class*



Graphics Setup

Random circles (circles.py)



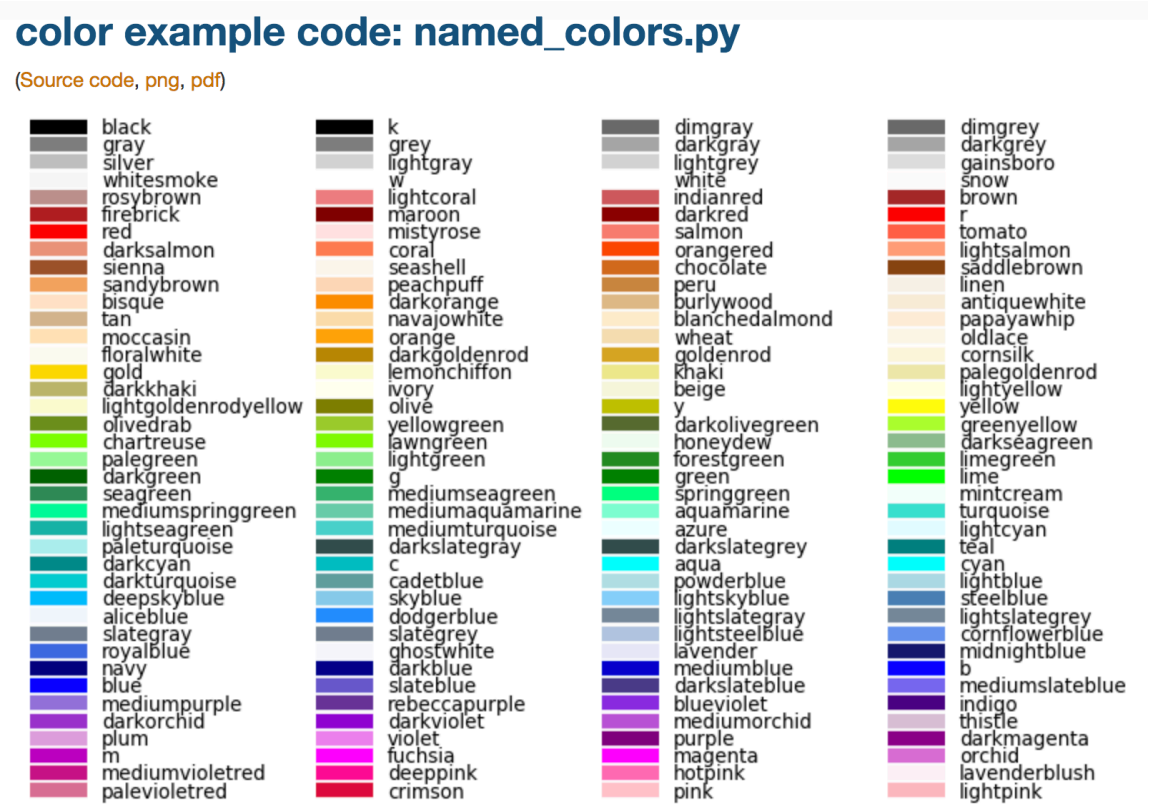
Websites to bookmark

- Graphics library documentation:

http://mcsp.wartburg.edu/zelle/python/graphics/graphics.pdf

- Colors we can use:

https://matplotlib.org/2.0.2/examples/color/named_colors.html



GraphWin class

- **GraphWin(title, width, height)** – constructs a new graphics window (default width and height are both 200)
- **setBackground(color)** – set the background color
- **close()** – closes the window
- **getMouse()** – waits for the user to click, returns the click position as a **Point**
- **checkMouse()** – does not wait for the user to click, returns the click position as a **Point,** or None if no position clicked

Methods for all Graphics Objects

- **setFill(color)** – sets the interior color of an object
- **setOutline(color)** – sets the outline color of an object
- **setWidth(pixels)** – sets the outline width (doesn't work for **Point**)
- **draw(window)** – draws the object on the given window
- **undraw()** – removes the object from a graphics window
- **move(dx,dy)** – moves the object dx in the x direction and dy in the y direction
- **clone()** – returns a duplicate (new copy) of the object

Point class

- **Point(x,y)** – constructs a new point at the given position
- **getX()** – returns the current x coordinate
- **getY()** – returns the current y coordinate

Line class

- **Line(point1, point2)** – constructs a line from point1 to point2
- **setArrow(string)** – sets the arrowhead of a line ("first", "last", "both", "none")
- **getCenter()** – returns the midpoint of the line
- **getP1()**, **getP2()** – returns a clone of the corresponding endpoint

Circle class

- **Circle(center, radius)** – constructs a circle at the given position and with the given radius
- **getCenter()** – returns a clone of the center point
- **getRadius()** – returns the radius
- **getP1()**, **getP2()** – returns a clone of the corresponding corner of the circle's bounding box (upper left, lower right)

Rectangle class

- **Rectangle(point1, point2)** – constructs a rectangle with opposite corners at the given points (upper left, lower right)
- **getCenter()** – returns the center point
- **getP1()**, **getP2()** – returns a clone of the corner point

Polygon class

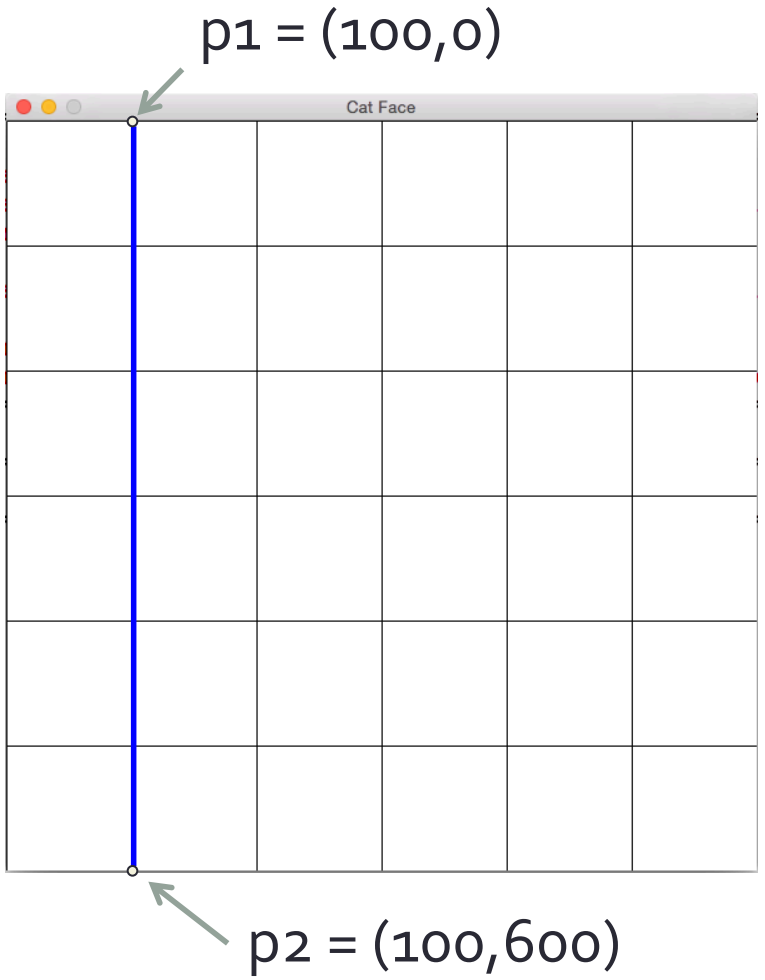
- **Polygon(point1, point2, point3, ...)** – constructs a polygon with the given points as vertices (also accepts a list of points)
- **getPoints()** – returns a list of the points in the polygon

Cat Face Exercise

Step 1: (optional) create a grid

- Window 600 x 600
- Grid lines every 100
- Line example:

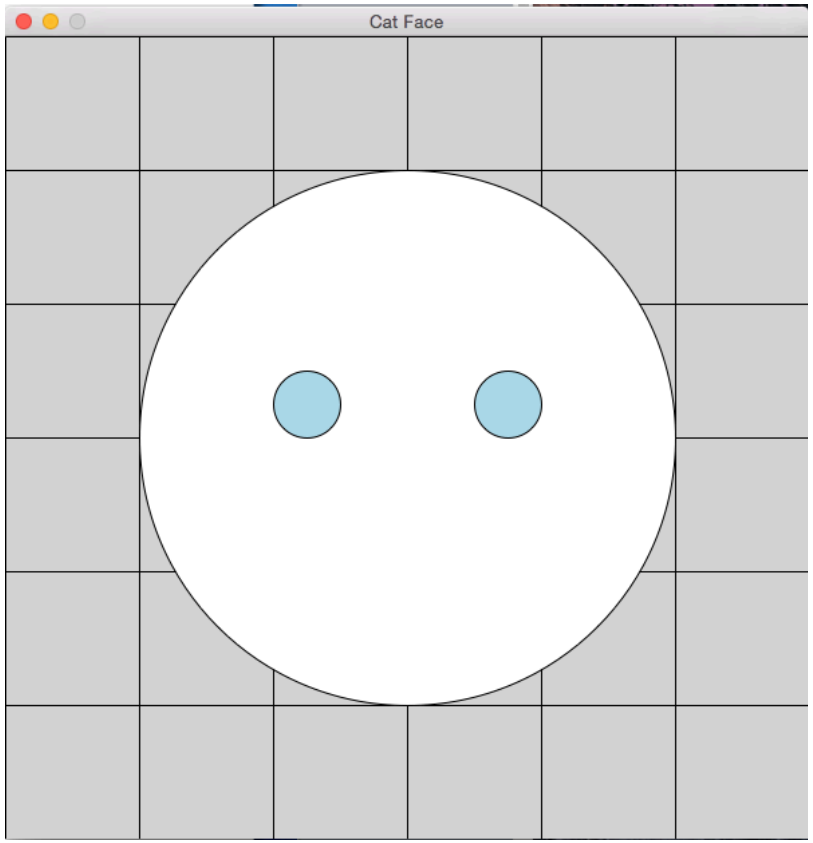
```
# first vertical line
p1 = Point(100,0)
p2 = Point(100,height)
l = Line(p1,p2)
l.draw(win)
```



Step 2: create a face and eyes

- Create a left eye using a circle
- Clone (copy) the left eye to make the right eye
- Move the right eye over

```
right_eye = left_eye.clone()
right_eye.move(dx,dy)
right_eye.draw(win)
```



Step 3: create nose, ears, mouth

- Create mouth as a rectangle
- Create nose as a polygon
- Create ears as polygons
- Remove background grid
- Change colors!