CS21: INTRODUCTION TO COMPUTER SCIENCE

Prof. Mathieson

Fall 2018

Swarthmore College

Informal quiz (discuss with a partner)

1) c is an ________ of the Circle _______.

2) GraphWin(..), Point(..), and Circle(..) are all ________.

3) width/2, height/2, “white”, “blue” are all ________.

4) setFill(..), setOutline(..), and draw(..) are all ______ not ______.

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height = 600
win = GraphWin("Random Circles", width, height)
win.setBackground("white")

p = Point(width/2, height/2)
c = Circle(p, 10)
c.setFill("blue")
c.setOutline("blue")
c.draw(win)
```

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function
instance
type
class
method
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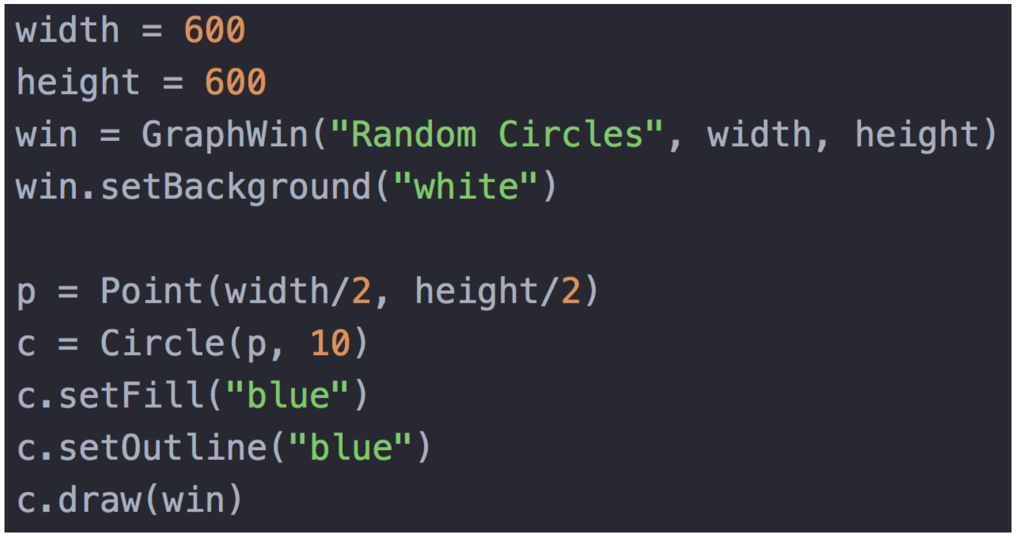

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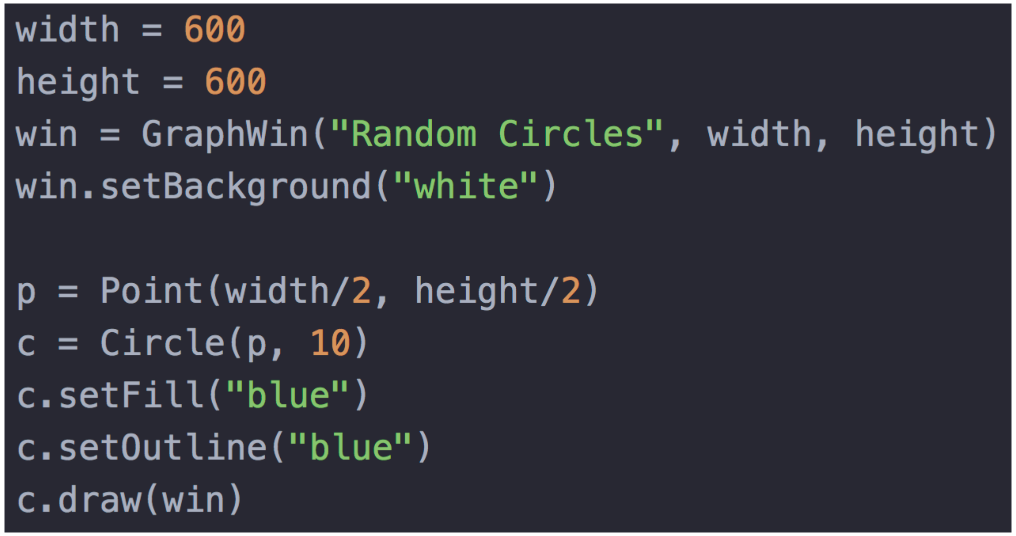

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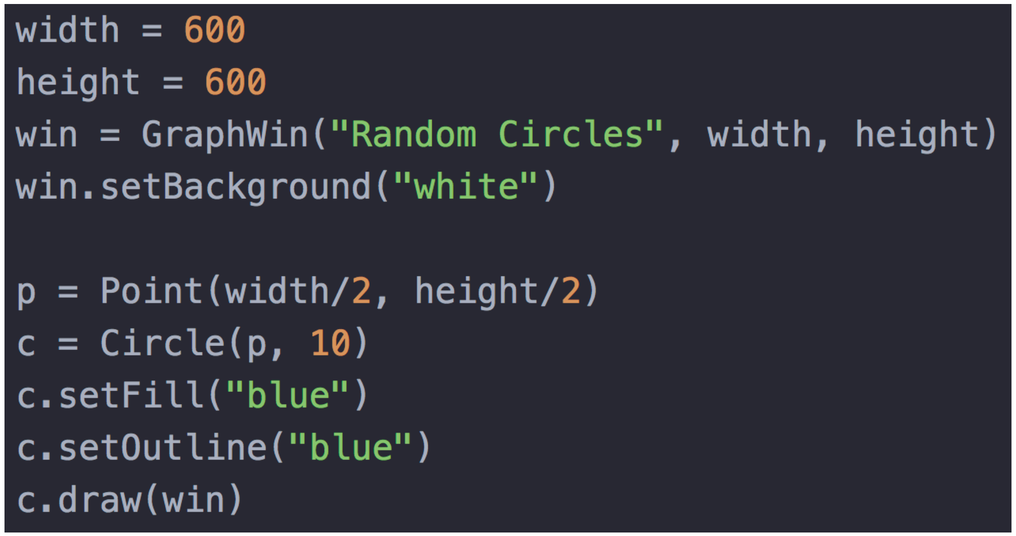

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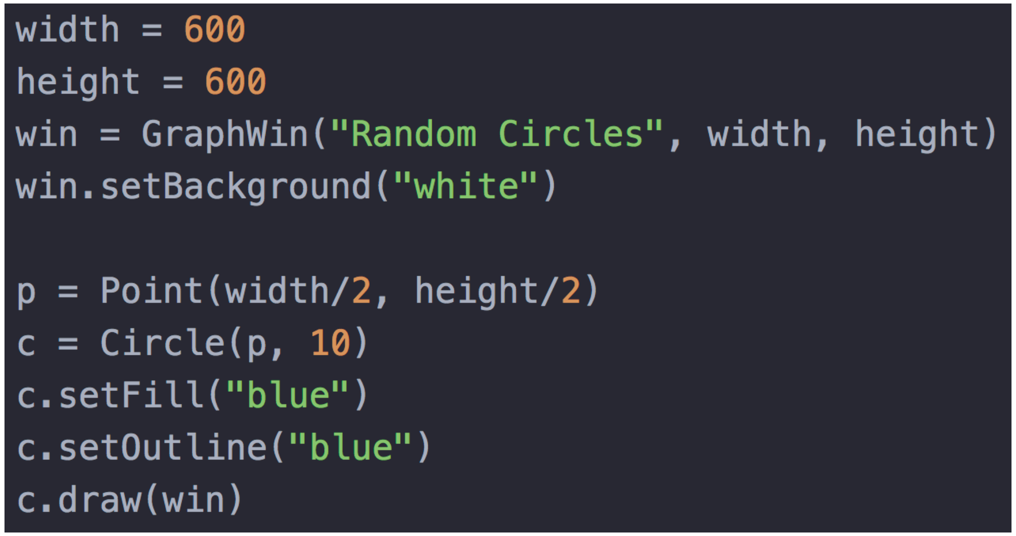
4) setFill(..), setOutline(..), and draw(..) are all *methods* not *functions*.



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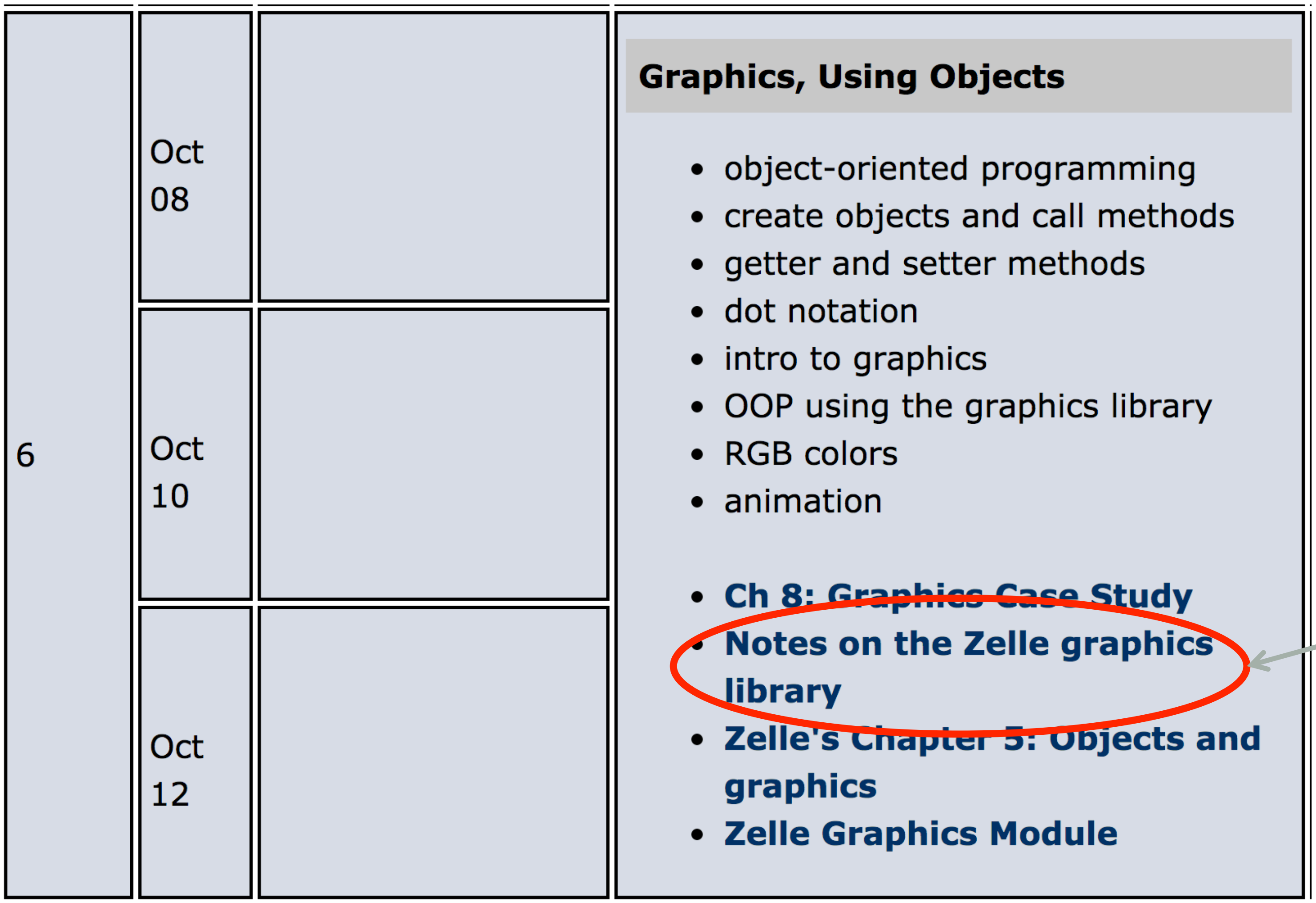
Outline Oct 10:

- Recap OOP vocabulary & followups from Mon
- Continue graphics
- User clicks
- Getters and setters
- Moving box program (**box.py**)
- Falling snow program (**snow.py**)
- Hand back Quiz 2 & go over common issues

Notes

•**Lab 5** due **Friday** (in-class) and **Saturday** night
•**Office Hours 2-4pm on Thursday (just this week!)**

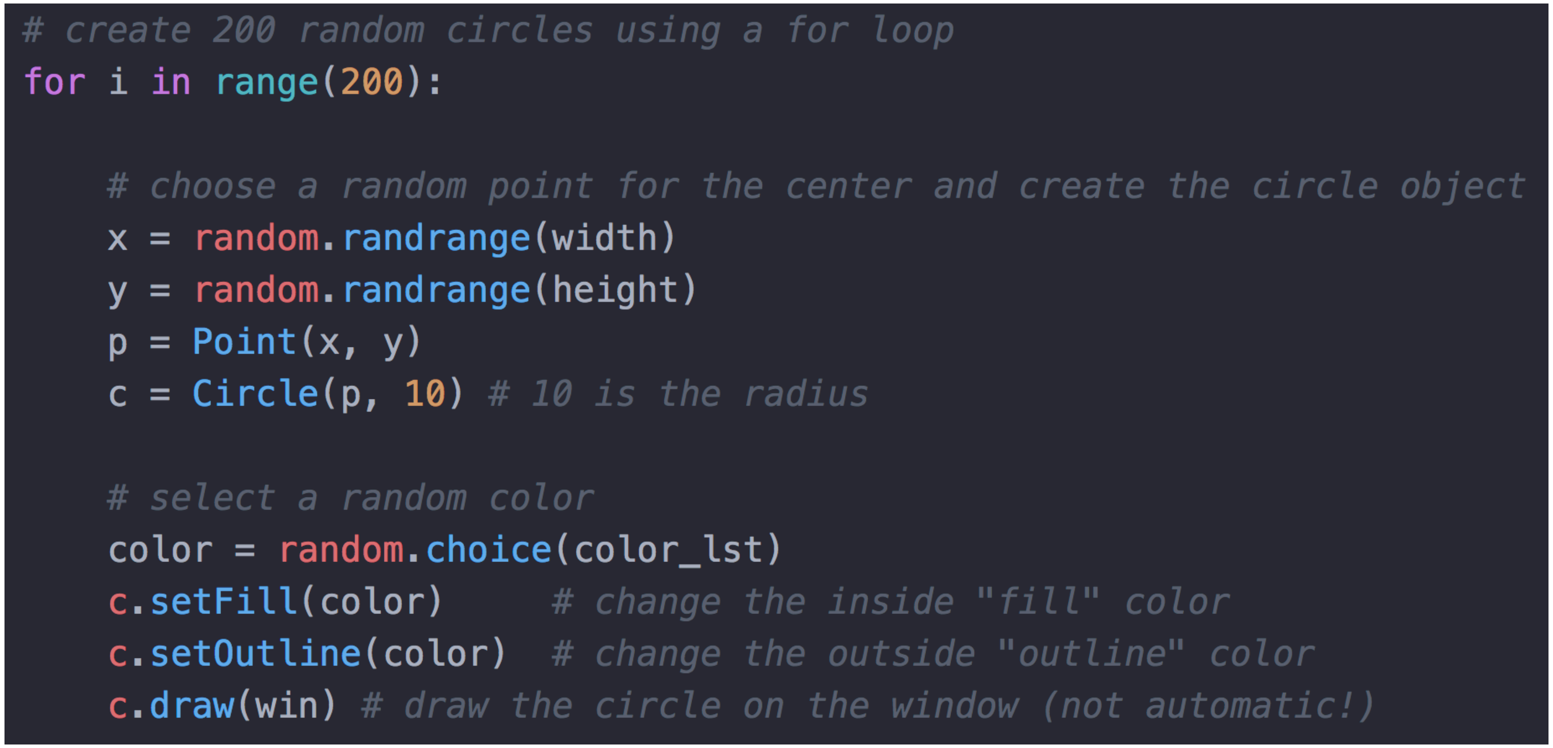
Graphics Reference and Notes



6	Oct 08		**Graphics, Using Objects** • object-oriented programming • create objects and call methods • getter and setter methods • dot notation • intro to graphics • OOP using the graphics library • RGB colors • animation • **Ch 8: Graphics Case Study** • **Notes on the Zelle graphics library** • **Zelle's Chapter 5: Objects and graphics** • **Zelle Graphics Module**
	Oct 10		
	Oct 12		

Recommended by ninjas!

Why doesn’t reassigning *c* in the loop overwrite our last circle?



```
# create 200 random circles using a for loop
for i in range(200):

    # choose a random point for the center and create the circle object
    x = random.randrange(width)
    y = random.randrange(height)
    p = Point(x, y)
    c = Circle(p, 10) # 10 is the radius

    # select a random color
    color = random.choice(color_lst)
    c.setFill(color)     # change the inside "fill" color
    c.setOutline(color)  # change the outside "outline" color
    c.draw(win) # draw the circle on the window (not automatic!)
```

See stack explanation from class

Different ways of animating

- Make movement very small

```
>>> from graphics import *
>>> win = GraphWin("hello",400,400)
>>> c = Circle(Point(200,200),100)
>>> c.draw(win)
Circle(Point(200.0, 200.0), 100.0)
>>>
>>> for i in range(100000):
...     c.move(0.01,0)
```

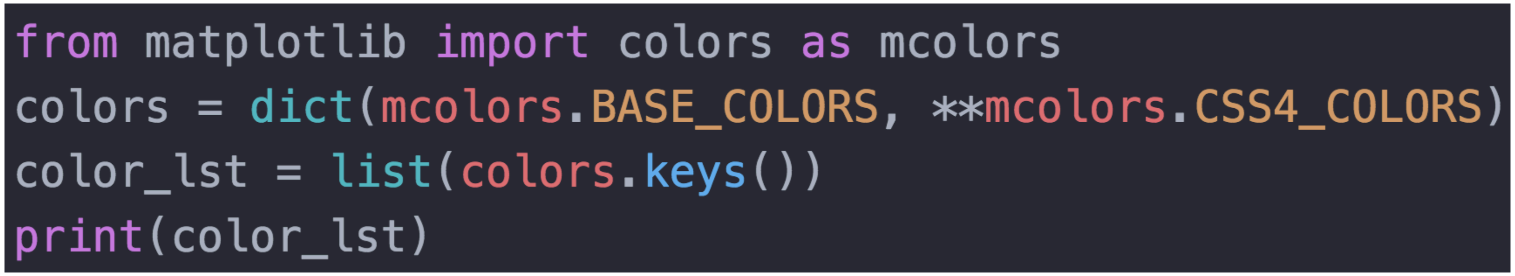
- Use time.sleep(<sec>)

```
>>> from graphics import *
>>> win = GraphWin("hello",400,400)
>>> c = Circle(Point(200,200),100)
>>> c.draw(win)
Circle(Point(200.0, 200.0), 100.0)
>>> import time
>>>
>>> for i in range(100):
...     c.move(1,0)
...     time.sleep(1)
```

- Call update()

```
>>> from graphics import *
>>> win = GraphWin("hello", 400, 400, autoflush=False)
>>> c = Circle(Point(200,200),100)
>>> c.draw(win)
Circle(Point(200.0, 200.0), 100.0)
>>> for i in range(100):
...     c.move(1,0)
...     update()
```

How to get all the colors?



```python
from matplotlib import colors as mcolors
colors = dict(mcolors.BASE_COLORS, **mcolors.CSS4_COLORS)
color_lst = list(colors.keys())
print(color_lst)
```

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

```
['b', 'g', 'r', 'c', 'm', 'y', 'k', 'w', 'aliceblue', 'antiquewhite', 'aqua', 'aquamarine', 'azure', 'beige', 'bisque', 'black', 'blanchedalmond', 'blue', 'blueviolet
', 'brown', 'burlywood', 'cadetblue', 'chartreuse', 'chocolate', 'coral', 'cornflowerblue', 'cornsilk', 'crimson', 'cyan', 'darkblue', 'darkcyan', 'darkgoldenrod', 'd
arkgray', 'darkgreen', 'darkgrey', 'darkkhaki', 'darkmagenta', 'darkolivegreen', 'darkorange', 'darkorchid', 'darkred', 'darksalmon', 'darkseagreen', 'darkslateblue',
 'darkslategray', 'darkslategrey', 'darkturquoise', 'darkviolet', 'deeppink', 'deepskyblue', 'dimgray', 'dimgrey', 'dodgerblue', 'firebrick', 'floralwhite', 'forestgr
een', 'fuchsia', 'gainsboro', 'ghostwhite', 'gold', 'goldenrod', 'gray', 'green', 'greenyellow', 'grey', 'honeydew', 'hotpink', 'indianred', 'indigo', 'ivory', 'khaki
', 'lavender', 'lavenderblush', 'lawngreen', 'lemonchiffon', 'lightblue', 'lightcoral', 'lightcyan', 'lightgoldenrodyellow', 'lightgray', 'lightgreen', 'lightgrey', '
lightpink', 'lightsalmon', 'lightseagreen', 'lightskyblue', 'lightslategray', 'lightslategrey', 'lightsteelblue', 'lightyellow', 'lime', 'limegreen', 'linen', 'magent
a', 'maroon', 'mediumaquamarine', 'mediumblue', 'mediumorchid', 'mediumpurple', 'mediumseagreen', 'mediumslateblue', 'mediumspringgreen', 'mediumturquoise', 'mediumvi
oletred', 'midnightblue', 'mintcream', 'mistyrose', 'moccasin', 'navajowhite', 'navy', 'oldlace', 'olive', 'olivedrab', 'orange', 'orangered', 'orchid', 'palegoldenro
d', 'palegreen', 'paleturquoise', 'palevioletred', 'papayawhip', 'peachpuff', 'peru', 'pink', 'plum', 'powderblue', 'purple', 'rebeccapurple', 'red', 'rosybrown', 'ro
yalblue', 'saddlebrown', 'salmon', 'sandybrown', 'seagreen', 'seashell', 'sienna', 'silver', 'skyblue', 'slateblue', 'slategray', 'slategrey', 'snow', 'springgreen',
'steelblue', 'tan', 'teal', 'thistle', 'tomato', 'turquoise', 'violet', 'wheat', 'white', 'whitesmoke', 'yellow', 'yellowgreen']
```

Continue Graphics

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

User clicks and getters

- **win.getMouse()** waits for the user to click
- It returns the user's click as a **Point**
- We can use that **Point** later on or extract the x and y coordinates using a *getter*

```python
click = win.getMouse()
print(click)
x = click.getX() # getter for x coordinate
y = click.getY() # getter for y coordinate
print(x_click, y_click)

c = Circle(click, 10)
center = c.getCenter() # getter (what is the type of center?)
```

Programs for today

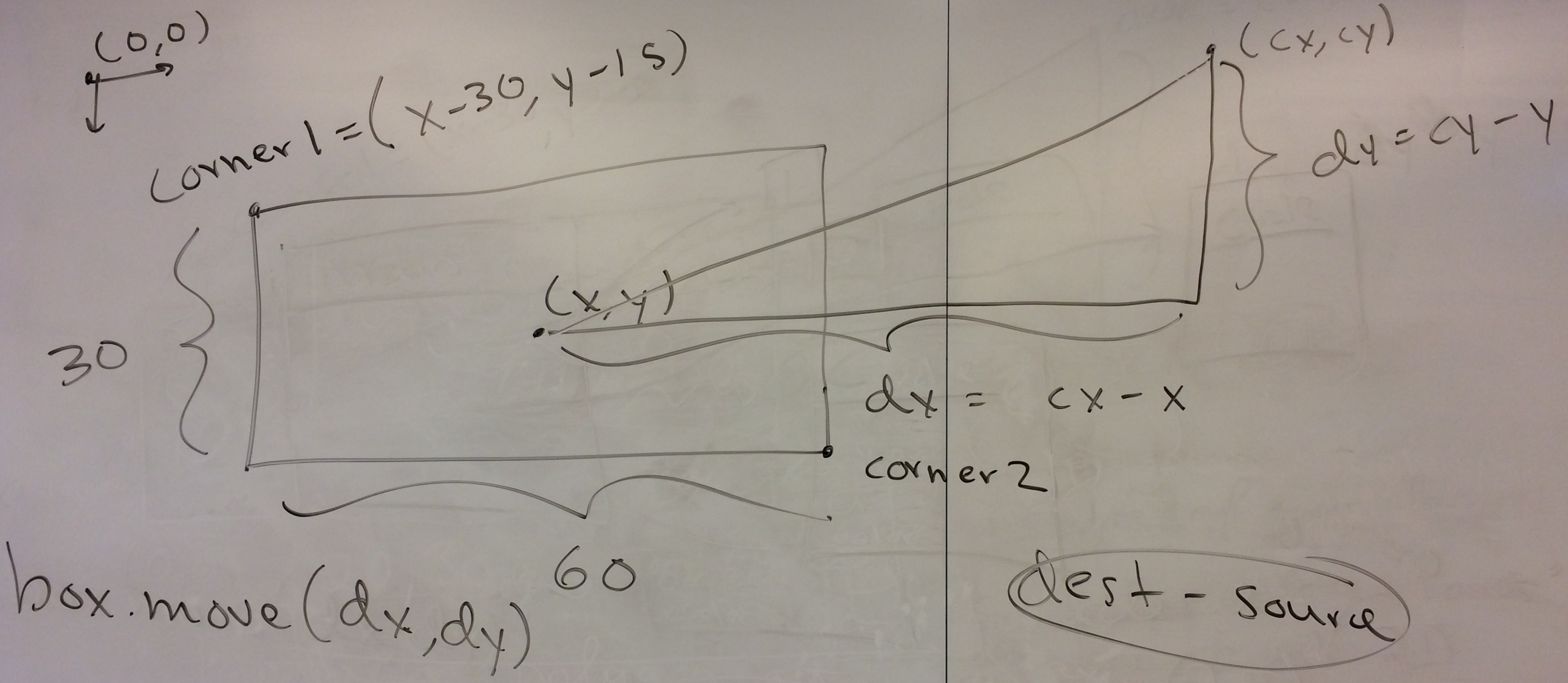


Diagram for box.py

Work with a partner on one computer!

- *Pair programming* is frequently used in upper level CS classes and afterward in industry/academia
- One person is the *driver* at the keyboard (typing)
- The other person is the *navigator* who is providing advise, feedback, etc.
- Switch frequently between roles

- **cs21/inclass/w06/box.py** (first)
- **cs21/inclass/w06/snow.py** (second)