

Objectives

- Problem solving using Graphics API
 - Animation
- Broader Issue: DARPA Urban Challenge

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Review: Object-Oriented Programming

- How do we create a new object?
- How do we “talk” to objects?
- What is the syntax for calling a method on an object?
- What are two types of methods we talked about?
 - How do they work differently?

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Review: Object-Oriented Programming

- Objects combine data and methods together
 - Provides **interface** (the methods) that users interact with

Hides internal data structures, implementation



Use an **Application Programming Interface (API)** to interact with a set of classes.

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Review: Benefits of Object-Oriented Programming

- Abstraction
 - Hides details of underlying implementation
 - Easier to change implementation
- Easy reuse of code
 - We used the `graphics.py` package
- Collects related data/methods together
 - Easier to reason about data
- Reduces code in program

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Review: What Does This Code Do?

- Use OO terminology previously defined

```
from graphics import *
win = GraphWin("My Circle", 100, 100)
c = Circle(Point(50,50), 10)
c.draw(win)
win.getMouse()
```

GraphWin object
Also known as an **instance of the GraphWin class**

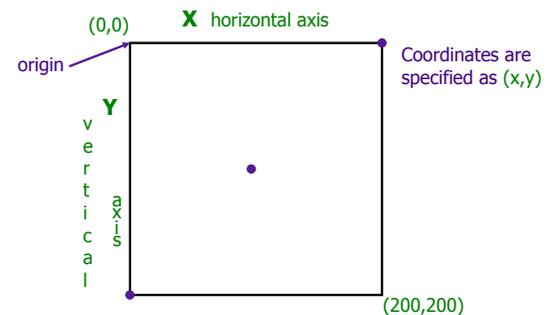
Constructor

Method called on GraphWin object

Note: Class names start with capital letters, Method names start with lowercase letters

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Review: A GraphWin Object's Canvas



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Problem: Draw a Full-Canvas Tic-Tac-Toe Board

- Using the Graphics API
- Make lines purple and line width 3
 - Keep it general, regardless of GraphWin width, height

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Modification to Tic-Tac-Toe

- **clone** a vertical line and horizontal line and shift appropriately
- Why clone?
 - Maintain the same properties (color, line-width, length)
 - Simplifies code

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Getting Input from the User

- `<GraphWinObj>.getMouse()`
 - Returns the user's mouse click as a **Point** object
- Entry objects
 - Get text from user

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Problem

- Create a program where the user tells you where to draw a line
 - What do you need from the user?
 - What do you need to create a line?

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Problem: Circle Shift

- Move a circle to the position clicked by the user
 - Repeat five times

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Animation

- Use combinations of the method **move** and the function **sleep**
 - Need to **sleep** so that humans can see the graphics moving
 - Computer would process the **moves** too fast!
- **sleep** is part of the **time** module
 - takes a float representing *seconds* and pauses for that amount of time

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`fenway.py` 12

Examples of Animation

- From Previous Classes

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Problem: Animate Moving to User Click

- In X steps, move from the circle's current location to the location clicked by user

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[circleShiftAnim.py](#)

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Broader Issue: DARPA Urban Challenge

- Challenge: automated cars in an urban setting
 - Deal with human drivers, automated drivers
 - Correctly obey traffic laws
 - Winners: 1st - \$2Mill, 2nd - \$1Mill, 3rd - \$500K
 - Apply for \$1Million in "seed money"

Collier
Will
Nick
Dalena

Jeni
Phil
James
Sirocco
CJ

Amy
Dave
Andrew
George
Hank

Shannon
Taylor
Luke
Harrison
Ben

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DARPA Urban Challenge

- Will you feel safe (safer?) with an automated driver in the lane next to you?
- What guarantees about the cars would you want from the company/government?
- Are there situations that would be particularly difficult for software to handle that a person would be better equipped to handle?
- What should the next DARPA Challenge be?
 - In a year?
 - In 5 years?
- Your questions?

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Relation To Our Class

- One IF statement from victory
 - Programming you're learning applied to major tasks
- Importance of testing
 - Need robustness, reliability of systems
 - Test the "small"
- Likely, infinite loop waiting for signals
- Imagine an API to car
 - `move(direction, amount)`
 - `getSpeed()`
 - etc
- Your comments: tell us more!
 - I encourage you to see what information is out there

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