CSE 142

Objects and Classes

Outline for Today

- Short review of objects
- Discussion of objects and classes
- Object and class exercise

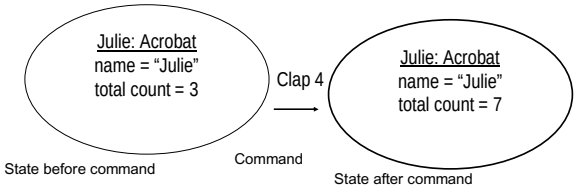
- Major concepts
  - Objects as instances of classes
  - Classes as templates
  - Objects as properties

Object Review

- Objects have properties and responsibilities
- One can send messages to objects
  - Queries [Find out values associated with properties]
  - Commands [Instruct an object to do something]
    May cause a change in state

- Acrobat Example
  - Count is a query
  - Clap and Twirl are commands
    Increase total count for objects

State



What is the state after the command Twirl 2?
What is the state after the query tellCount?

Classes

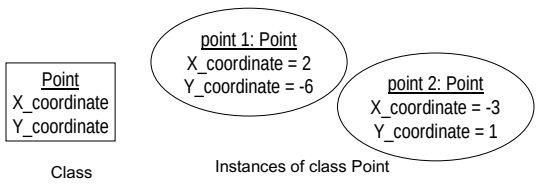
- Classes serve as templates or patterns or 'factories' for creating objects
- Objects in a class share same properties and responsibilities
  - Note: "same properties" does not imply "same values"
- Classes define the methods understood by all instances of the class
- Every object is an instance of some class
  - A fancy word: 'Instantiation' means popping out a new object from the 'factory'

The Fundamental Unit

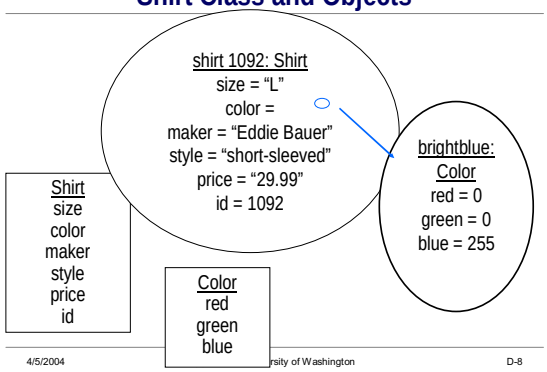
- *The class is the basic unit of programming in object-oriented programming*
- Typically a system has a small number of classes but may have a large number of instances (objects)
- Example: A university system would need to model students, courses, and buildings
  - *One* 'student' class
  - *Thousands* of student instances (objects)
  - *One* 'course' class
  - *Hundreds* of course instances
  - *One* 'building' class
  - *Dozens* of building instances

Drawing Classes and Objects

- Computer scientists are always drawing pictures!
- Drawing (our convention):
  - rectangle for class, blob for objects
  - for objects, a colon before the class name



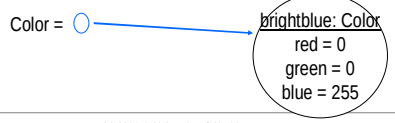
Shirt Class and Objects



Relationships Between Objects

- Objects may interact to solve a problem
- Two or more objects may have a well-defined relationship
- Example relation: One object as a property of another object
  - Reference value: refers to or denotes an object

The color property in the Shirt object refers to a Color object



Type Review

- What is a type?

Shirt Property	Value	Type
Size	"L"	
Color	Reference value	
Maker	"Eddie Bauer"	
Style	"short-sleeved"	
Price	29.99	
ID	1092	

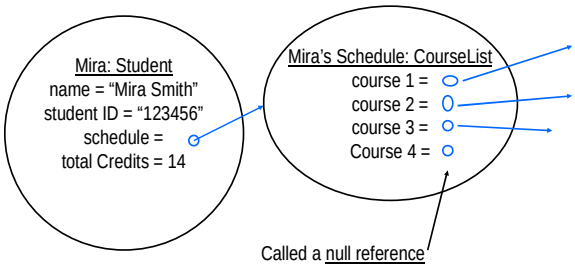
Student Registration System

- What classes would you use?
  - Remember: a class is a set of objects with the same properties and responsibilities

Student Class

- Properties
  - Student ID
  - Name
  - Address
  - Schedule
  - GPA
  - Phone Number
  - Transcript
  - Total credits
  - Full-time?
- Responsibilities
  - Add course
  - Drop course
  - Update address
  - Get GPA
  - Get transcript
  - Get schedule
  - Get student ID
  - Get total credits
  - Get full-time status

Student Object Example



Student Registration System Exercise

Student:
name
student ID
schedule
total Credits

CourseList
course 1
course 2
course 3
course 4

1. **Determine properties for classes for Course and Room**
2. **Use these classes to create instances (objects) modeling the students and schedules on the sheet**
3. **Draw object diagrams to represent the objects you create and use arrows to show references to objects**

Example Object: Mira

Mira Smith, Student ID: 123456

Schedule:

CSE 142	Course ID: 2520	4 credits	Guggenheim 224 room capacity: 275
MATH 120	Course ID: 5009	5 credits	Mary Gates 095 room capacity: 40
MUSIC 160	Course ID: 5669	5 credits	Music 126 room capacity: 220

Example Object: Jason

Jason Johnson, Student ID: 234567

Schedule:

MATH 120	Course ID: 5009	5 credits	Mary Gates 095 room capacity: 40
CSE 142	Course ID: 2520	4 credits	Guggenheim 224 room capacity: 275
MUSIC 310	Course ID: 4216	4 credits	Music 126 room capacity: 220
DANCE 105	Course ID: 2655	2 credits	Meany 267 room capacity: 45

Example Model of Mira and Jason

Queries about Mira and Jason

- What is the room number of Mira's first course?
- What department teaches Jason's second course?
- How many seats does the room for Mira's second course have?
- What is the course ID for Jason's third course?
- How many courses is Jason taking?

- To think about:
  - What would happen if the course ID for CSE 142 changed?
  - What if the room capacity for MUSIC 126 changed?

Classes and Objects in Java

- Preview of what's to come:
  - Objects have properties
  - In Java, we'll call these instance variables
  - Objects have responsibilities
  - In Java, we'll turn these into methods
  - Next up: we'll begin studying Java directly

    Now you have a solid foundation of concepts we'll use throughout the quarter

Summary

- Objects are instances of classes
- Classes serve as templates for creating objects
  - Objects in a class share the same properties and responsibilities
- Objects have state
- Objects can be properties of other objects
  - Defines a relation between objects
- Drawings help us understand classes, objects, and their relationships