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
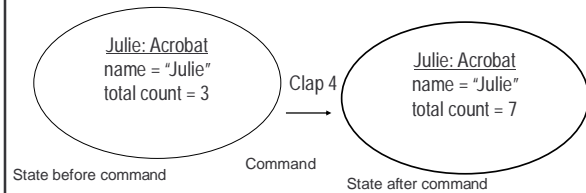
Object Review

- 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

Julie: Acrobat
name = "Julie"
total count = 3

Clap 4

Julie: Acrobat
name = "Julie"
total count = 7

State before command   Command   State after command

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

Classes

- <u>Classes</u> 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 <u>instance</u> 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
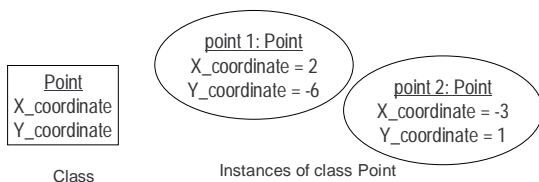 - *Dozens* of building instances

Drawing Classes and Objects

- Computer scientists are always drawing pictures!
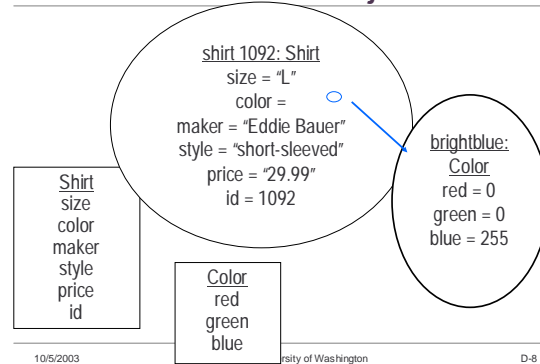- Drawing: rectangle for class, blob for objects

Point
X_coordinate
Y_coordinate

point 1: Point
X_coordinate = 2
Y_coordinate = -6

point 2: Point
X_coordinate = -3
Y_coordinate = 1

Class   Instances of class Point

Shirt Class and Objects

shirt 1092: Shirt
size = "L"
color =
maker = "Eddie Bauer"
style = "short-sleeved"
price = "29.99"
id = 1092

brightblue:
Color
red = 0
green = 0
blue = 255

Shirt
size
color
maker
style
price
id

Color
red
green
blue

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 or denotes an object
      The color property in the Shirt object refers to a Color object

Color = ○ ———→ brightblue: Color
    red = 0
    green = 0
    blue = 255
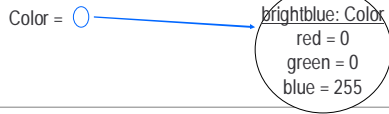
Type Review

- 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

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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

Mira: Student
name = "Mira Smith"
student ID = "123456"
schedule =
total Credits = 14

Mira's Schedule: CourseList
course 1 =
course 2 =
course 3 =
Course 4 =

Called a null reference

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: 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: 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 call these methods

  - Now 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 can be properties of other objects
  - Defines a relation between objects