Objects, Values, and Types

CSE 142, Summer 2003

Computer Programming 1

http://www.cs.washington.edu/education/courses/142/03su/

Readings and References

- Reading
  - » Chapters 1 and 2, *Intro to Programming and Object-Oriented Design Using Java*, Niño and Hosch

Outline for Today

- Theatrical exposition of object oriented design
  - » *starring members of CSE 142 in leading roles!*
- Major concepts
  - » More about objects (properties and responsibilities)
  - » Types
  - » Values
  - » State
  - » Queries and commands (messages)

images from http://shakespeare.palomar.edu/

Acrobat Role-Playing

- We have several Acrobat-style actions
  - » Clap, Twirl, and Count
- and several implementations of these actions
  - » Acrobat
  - » Choreographer
  - » AcrobatWithBuddy
  - » Actor
  - » Curmudgeon

You are an Acrobat

When you are asked to **Clap**, you will be given a number. Clap your hands that many times.

When you are asked to **Twirl**, you will be given a number. Turn completely around that many times.

When you are asked to **Count**, announce how many actions you have performed. This is the sum of the numbers you have been given to date.

You are an AcrobatWithBuddy

When you are given this card, choose someone else in the demonstration as your **Buddy**.

When you are asked to **Clap**, you will be given a number. Clap your hands that many times. Pass the same instruction to your Buddy

When you are asked to **Twirl**, you will be given a number. Turn completely around that many times. Pass the same instruction to your Buddy

If you are given the **Count** instruction, just pass it to your Buddy.

You are an Actor

When you are asked to **Clap**, you will be given a number. Clap your hands that many times. Say **"Thank You."** Then **take a bow** (as dramatically as you like).

When you are asked to **Twirl**, you will be given a number. Turn completely around that many times. Say **"Thank You."** Then **take a bow** (as dramatically as you like).

When you are asked to **Count**, announce how many actions you have performed. This is the sum of the numbers you have been given to date. Say **"Thank You."** Then **take a bow** (as dramatically as you like).

You are a Choreographer

When you are given any instruction (Twirl, Clap, or Count), pass it on to two other people.

You can pick people at random. You can even give the instruction to the same person twice.

You are a Curmudgeon

When given any instruction (Twirl, Clap, or Count), ignore it and say (as dramatically as you can) "I REFUSE"

Acrobat	AcrobatWithBuddy
Acrobat	AcrobatWithBuddy
Acrobat	Choreographer
Actor	Curmudgeon

Acrobats as objects with properties

- Values
  - » pieces of information manipulated by a program
  - » Examples: numbers, characters, point on a plane
  - » What values did we see?
- State
  - » The collection of property values in an object is called its *state*
  - » Values (state) of objects can change over time
  - » How did values change?

Acrobats as objects with responsibilities

- Commands and Queries
  - » *Commands* can change the state of an object
  - » *Queries* determine values associated with an object
  - » Examples from demonstration?
- Commands and queries are *messages*
  - » also known as *method calls*, *procedure calls*, *subroutine calls*, *jsr*, *etc*, *etc*, *etc*
  - » May include *parameters* to pass information
  - » May include *return values*
  - » Chained messages

Values

- Information manipulated by a program
  - » Examples: numbers, characters, point on a plane
  - » simple (atomic) vs. composite
    - Simple (or atomic) values cannot be broken down by the program into separate smaller parts
    - Composite values composed of simple values
  - » Are the following values atomic or composite?
    - 3, 2.9783, "welcome"
    - The point (3,5) on the (x,y) plane
    - M

Types

- Type: Set of values and associated operations
  - » Example: integers with +, -, /, *
- In Java
  - » Primitive types sample values operations
    - **`int`**
    - **`double`**
    - **`boolean`**
    - **`etc.`**
  - » Object types (composites)
    - **`2D Points, Strings, Acrobats, etc.`**

When designing a system

- Determine objects, properties and responsibilities
  - » Responsibilities can be “knowing” or “doing”
  - » Knowing
    - Properties of object
    - About other objects in system
  - » Doing
    - Computing new value of something interesting
    - Actions to modify state
    - Creating other objects
    - Coordinating activities

Online Retail Store

- Suppose we want to model an online retail store that sells shirts and pants
  - » What objects would you use?

Shirt Model Properties

Let’s model a shirt

Property	Type	Value

Shirt Model Responsibilities

Responsibility	Command or Query	Changes state?

Shopping Cart Properties

Let’s model an online shopping cart

Property	Type	Value

Shopping Cart Responsibilities

Responsibility	Command or Query	Changes state?

Summary

- Values are pieces of information manipulated by a program
- A type is defined by a set of values and the operations on those values
- Objects have properties and responsibilities
  - » properties have values, either simple or composite
  - » The set of property values is the state of the object
  - » The responsibilities are queries and commands that the object can respond to