CSE 142

Objects, Values and Types

Outline for Today

- Role-Playing Demonstration
- Discussion of Demonstration

- Major concepts
  - More about objects (properties and responsibilities)
  - Types
  - Values
  - State
  - Queries and commands (messages)

Acrobat Role-Playing

- We have Acrobat objects that are responsible for knowing how to:
  - Clap
  - Twirl
  - Count
- We have different types of Acrobat objects:
  - Acrobat
  - Choreographer
  - AcrobatWithBuddy
  - Actor
  - Curmudgeon

What did we see? (1)

- Acrobats as objects
  - What are their properties?
  - What are their responsibilities?
- 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?

What did we see? (2)

- Commands and Queries
  - Examples from demonstration?
  - *Commands* can change the state of an object
  - *Queries* determine values associated with an object
- Commands and queries are *messages*
  - May include *Parameters* to pass information
  - May include *Return values*
    - Queries always return a value
  - Chained messages
- Errors
  - Did we see any errors?

Technical Terminology

- *type, value, object, state, message, command, query, parameter, return value...*
- These are not just random English words
- They are widely used in programming, with specific technical meanings
- Unfortunately, giving precise technical definitions for some of them is difficult, especially at this stage of the course
- Nevertheless, try to use the terms, and use them appropriately!
- {Are those previous two statements contradictory??}

Values

- Information manipulated by a program
- May describe a property of an object
- Examples: numbers, characters, point on a plane
- Simple vs. Composite values
  - *Simple* (or elementary) values: cannot be broken down
  - *Composite* values: composed of multiple simple values

Are the following values atomic or composite?
a. 3
b. "welcome"
c. The point (3,5) on the Cartesian plane
d. M
e. 2.9783

State

- At any given time, a particular object can be described by the *values* of its properties.
- The set of all an object's values is called its *state*
- The state of an object changes over time

Types

- Type: Set of possible *values* and associated *operations*
- Example: integers with +, -, /, *
  - The *values* are the numbers 0, 1, -1, 2, -2, etc.
  - The *operations* are addition, subtraction, division, and multiplication
- The operations have to be defined somehow
  - For addition, it may be obvious
  - For division... not necessarily obvious. What is 4/3?

Some Java Types

Primitive types

type name	sample values	operations
int		
double		
char		
boolean		
etc.		

Object types (composites)

type name	sample values	operations
2D Points		
Strings		
Acrobats		
etc.		

Objects and Design

- 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
    - Actions to modify state
    - Creating other objects
    - Coordinating activities
  - Give examples of knowing and doing responsibilities in the role-playing

Online Retail Store (1)

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

Online Retail Store (2)

- Let's model a shirt:
  - <u>Property</u>   <u>Type</u>   <u>Value</u>

Online Retail Store (3)

- Shirt
  - <u>Responsibility</u>   <u>Command or Query</u>   <u>Changes state?</u>

Online Retail Store (4)

- Let's model an online shopping cart
  - <u>Property</u>   <u>Type</u>   <u>Value</u>

Online Retail Store (5)

- Online shopping cart
  - <u>Responsibility</u>   <u>Command or Query</u>   <u>Changes state?</u>

Summary

- Values are pieces of information manipulated by a program
- A type consists of a set of values and operations on those values
- Objects have properties with associated values
- The set of property values is the state of the object
- Objects have responsibilities that consist of queries and commands (messages that are passed to the object)

10/5/2003   (c) 2001-3, University of Washington   C-17