
CSE 142

Objects, Values and Types

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Outline for Today

- Role-Playing Demonstration
- Discussion of Demonstration

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

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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

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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?

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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?

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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??)

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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?

- 3
- "welcome"
- The point (3,5) on the Cartesian plane
- M
- 2.9783

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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

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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 $4/3$?

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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.		

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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

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Online Retail Store (1)

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

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Online Retail Store (2)

• Let's model a shirt:

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Online Retail Store (3)

• Shirt

• Responsibility Command or Query Changes state?

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Online Retail Store (4)

• Let's model an online shopping cart

• Property Type Value

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Online Retail Store (5)

• Online shopping cart

• Responsibility Command or Query Changes state?

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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)