

Object-Oriented Design

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Topics

- During the balance of this semester, we will pursue and follow two learning threads
 - Object-relational databases
 - The Geo-Web
- These two threads are interwoven



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To understand Object-Relational Databases...

- We need to understand both relational concepts and
- Object-oriented concepts (this week)

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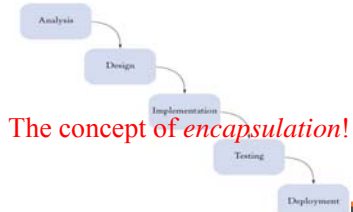
The Early Days...

- Computer programming from the caveman era



Why...Object-Oriented

- A brief history of computer programming...



Today's Goals

- We will dissect "Object-Oriented" to learn what it really is and how it relates to object-relational databases
 - What is a class?
 - What is an object?
- Enable you to identify inheritance, aggregation, and dependency relationships between classes
- Understand class attributes and object properties
- Become familiar with new *terminology*

What is a CLASS?

- A *class* is a computer construct representing a concept bound in a cohesive package
 - Some are concrete (i.e., real world)
 - Bank account
 - Rental item
 - Database item
 - Pile
 - Others are abstract
 - Scanner
 - Stream
 - Math

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Discovering CLASSES

- Simple Rule:
 - Look for *nouns* in descriptions
 - Obviously not all nouns are classes
 - But at least this approach can allow one to create a list of *candidate classes*

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What is an OBJECT


- An *instance* of a CLASS
- That contains meaningful data
- OBJECTS occupy memory space at runtime
 - If not, they are CLASSES
 - For example: data type vs. double

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A little Quiz...

- #1 Class or Object?




Dog

Dog is a generalization of Scooby-Doo

Scooby-Doo

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A little Quiz (cont'd)...

- #2 Class or Object?


Animal

Dog

Dog is a subclass of the Animal class
Animal is a generalization of Dog

Scooby-Doo

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A little Quiz (cont'd)...

- #3 Class or Object?


Animal

The concept of *polymorphism!*

Bird

Dog

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Defining a CLASS

- After a class has been identified we can define:
 - The behavior of each class
 - *Methods (verbs)*
 - And the attributes of each class

BEHAVIOR

Relationships Between CLASSES

- We have learned about inheritance as one (1) relationship between classes
 - There are three (3) important relationships
 - Inheritance
 - Aggregation
 - Dependency

1- Inheritance

- **Is-a** relationship
- Relationship between a more general class (*superclass*) and a more specialized class (*subclass*)
- Every
 - savings account is a bank account
 - DVD rental is a rental

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2- Aggregation

- **Has-a** relationship
 - Each Dog **has a** Paw (dog is not a generalization of paw!)
- One class (Appendages) contains references to another class (Dog)

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Inheritance vs. Aggregation

- Often confused
- Questions?

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Example

- Car is a Vehicle – Inheritance
- Car has a set of Tires – Aggregation

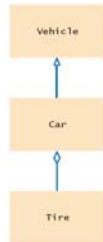
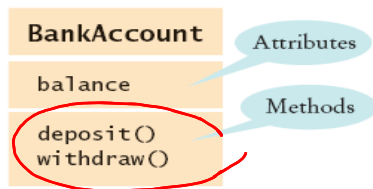


Figure 6
UML Notation for
Inheritance and Aggregation

3- Dependency

- Dependency occurs when a class uses or relies on another class
- This is a *Uses* relationship
 - Example: an application may depend on the `Scanner` class to read input

Class Diagram



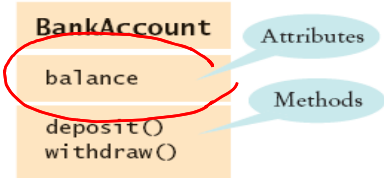
What type of Method behaviors are these?

ATTRIBUTES

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Class Diagram



Attributes

Methods

BankAccount


balance

deposit()

withdraw()


Attributes help define a given class and instantiate it into an object

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Dog example

- Name of the class =
- Methods=
 - Example of inheritance
 - Example of aggregation
 - Example of dependence
- Attributes?



Dog

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Instantiate into an object

- Three features characterize objects:
 - **Identity**: specific attribute (property) settings have been made for the class. This distinguishes it from all other objects.
 - State: Describes the data stored in the object **WHERE DID THIS COME FROM?**
 - Behavior: describes the method in the object's **interface** through which the object can be used (how do we make the dog bark?)

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Instantiating the Dog CLASS

- CLASS (DOG)
- Attributes (Properties)
 - NAME = Scooby-Doo
 - HEIGHT = 36
 - WEIGHT = 145
- Methods
 - [Uses] bark- "Rooby roo"
 - etc.



Scooby-Doo

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Key Concepts

- Understand the difference between a CLASS and an OBJECT
- Understand new terms:
 - Encapsulation, polymorphism, superclass, subclass, behavior, attributes, instantiation
- Understand --and be able to differentiate-- the three types of behaviors

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Questions...



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