Object-Oriented Design

IT4GIS

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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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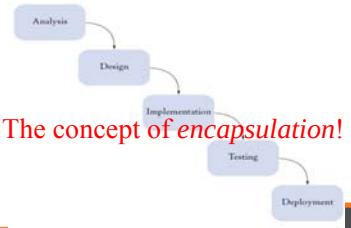
The Early Days…

- Computer programming from the caveman era

Why…Object-Oriented

- A brief history of computer programming…



The concept of *encapsulation*!

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

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*

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

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?

The concept of *subclass*!

Dog

Animal

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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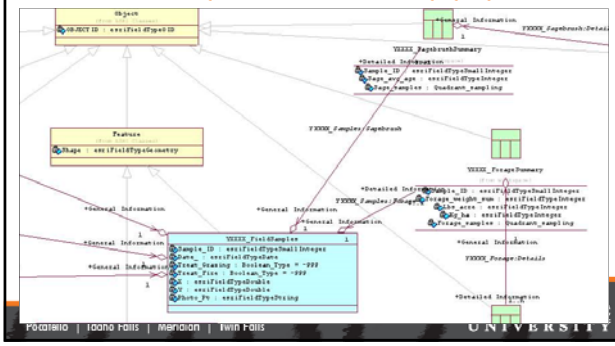
Questions so far…

Key Points

- Many classes already exist and are at our disposal when we design a database
- We use *inheritance* to add capabilities to our projects
  - A *subclass* inherits from its *superclass*
  - i.e., a *child* inherits from its *parent*

Inheritance in the Geodatabase



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

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)

Inheritance vs. Aggregation

- Often confused
- Questions?

Example

- Car **is a** Vehicle – Inher
- Car **has a** set of Tires – Aggregation

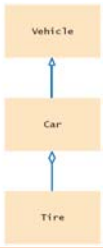
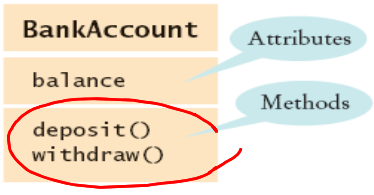


Figure 6
UML Notation for Inheritance and Aggregation

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

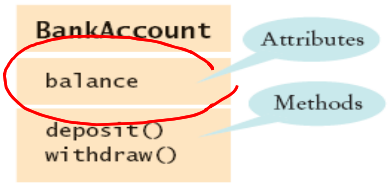
Class Diagram



What type of Method behaviors are these?

ATTRIBUTES

Class Diagram



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

Dog example

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

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?)

Instantiating the Dog CLASS

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

Scooby-Doo

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

Questions…