

CS497REJ

Object-Oriented Programming and Design

Ralph Johnson - 3109 DCL -
johnson@cs.uiuc.edu

<http://st-www.cs.uiuc.edu/users/johnson/>

Goals

- Learn how to model world with objects
- Learn how to design for reuse
- Learn Smalltalk
 - Learn a set of tools and components
 - Learn a new culture
- **Have fun**

Why Objects?

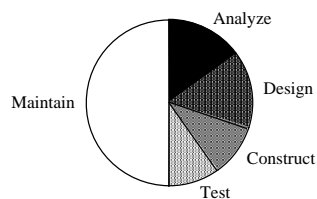
A new way to think about software

Industrial revolution -- reuse software, not rewrite

Increase

- programmer productivity
- quality of software
- understandability of software
- lifetime of software

The Software Lifecycle



What is important?

maintainability

extensibility

understandability

Old Paradigm

Computer system consists of data and programs.

Programs manipulate data.

Programs organized by

- functional decomposition
- dataflow
- modules

New Paradigm

Computer system consists of a set of objects.

Objects are responsible for knowing and doing certain things.

Objects collaborate to carry out their responsibilities.

Programs organized by classes, inheritance hierarchies and subsystems

What is an object, anyway?

Mystical view

Computing systems are made up of objects that communicate only by sending messages between each other. All computation is message sending.

What is an object, anyway?

Scandinavian view

A program is a simulation. Each entity in the system being simulated is represented by an entity in the program.

What is an object, anyway?

Programming language view

An object-oriented system is characterized by

- data abstraction
- inheritance
- polymorphism by late-binding of procedure calls

Heart of Object-Oriented Programming

Don't make a new language, extend your old one.

Objects should be abstractions of problem domain.

Modeling

All phases of software life-cycle are modeling

- analysis - modeling of problem
- design - modeling of solution
- implementation - making model run on a computer
- maintenance - fixing/extending your model

Assumption about Modeling

Basing system design on structure of problem makes system

- more reusable
- more extensible

Modeling

Claim: people model the world with "objects"

- objects
- classes
- relationships between objects
- relationships between classes

Modeling

Advantages of object-oriented software development

- more natural - matches the way people think
- single notation - makes it easy to move between software phases

Objects and Relationships

John is Mary's father. Mary is John's daughter.

Bob is Mary's dog. Mary is Bob's owner.

Ann is John's employer. John is Ann's employee.

Objects and Attributes

John's name is "John Patrick O'Brian".

John's age is 27.

John's address is 987 N. Oak St,
Champaign IL 61820

What about John's employer? John's wife?

What is an attribute, and what is a relationship?

Objects and Behavior

John goes on a trip.
John makes reservations.
John buys tickets.
John travels by airplane.
John checks into hotel.

What Really is an Object?

Reservation -- a promise to give
service to a customer
Ticket -- proof that customer has paid
for service in advance
Flight
Payment -- an event (transaction?) in
which money is exchanged

What Really is an Object?

Anything we can talk about can be an object, including relationships ("the husband of the first party", "first-born son").

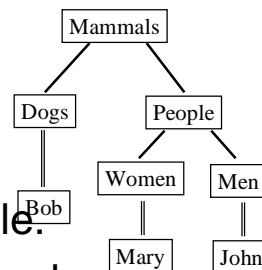
What are we trying to model?

Models should be as simple as possible, but no simpler.

Classification

We naturally put objects into classes that have similar characteristics.

- John is a man.
- Mary is a woman.
- Bob is a dog.
- All women are people.
- All people are mammals.



Classification

- John is an employee.
- John is a father.
- John is a sky-diver.
- John is under 30.

Is John an instance of Employee, Father, Sky-diver, and Under30?

Summary

Objects

- have identity
- have attributes
- have behavior
- have relationships with other objects

Summary

Classes

- describes the attributes, behavior, and relationships of a set of objects
- subclasses/superclasses form graph of generalizations

Homework

For details, look on home page.

[http://st-www.cs.uiuc.edu/
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Purpose: Start reading textbook, start using VisualWorks.

Due at next class.