

Object-Oriented Programming

David Evans
www.cs.virginia.edu/cs205

Midterm Exam

- Out at end of class today
- Due Monday at beginning of class

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from Class 2...


Buzzword Description

"A ~~simple~~, object-oriented, distributed, interpreted, robust, secure, architecture neutral, portable, high-performance, multithreaded, and dynamic language."

Later in the course, we will discuss how well it satisfies these "buzzwords".

[Sun95]

What is Object-Oriented Programming?



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What is an Object?

- Packaging state and procedures
 - state: the rep
 - What a thing is
 - procedures: methods and constructors
 - What you can do with it

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Bjarne Stroustrup (C++)'s Answer

~~"Object oriented programming is programming with inheritance. Data abstraction is programming using user-defined types. With few exceptions, object-oriented programming can and ought to be a superset of data abstraction. These techniques need proper support to be effective. Data abstraction primarily needs support in the form of language features and object-oriented programming needs further support from a programming environment. To be general purpose, a language supporting data abstraction or object-oriented programming must enable effective use of traditional hardware."~~

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"I invented the term *Object-Oriented* and I can tell you I did not have C++ in mind."

Alan Kay

Programming Language History

- Before 1954: twidling knobs, machine code, assembly code, BNF Grammar
- FORTRAN (John Backus, UVA dropout, 1954) – Formula Translation
- Algol (Peter Naur, Alan Perlis, et. al., 1958-1960)
 - Most influential programming language
 - Many of the things Algol did first (types, while, blocks) are in Java

Programming Language History

- Simula (Dahl and Nygaard, 1962-7)
 - First language with subtyping and inheritance
- CLU (Liskov et. al., 1970s)
 - First language with good support for data abstraction (but no subtyping or inheritance)
- Smalltalk (Kay et. al., 1970s)
 - First successful language and programming system to support subtyping and inheritance

Object-Oriented Programming

- Object-Oriented Programming is a *state of mind* where you program by *thinking about objects*
- It is difficult to reach that state of mind if your language doesn't have:
 - Mechanisms for packaging state and procedures
 - Java has **class**
 - Subtyping
 - Java has extends (subtype and subclass) and implements (subtype)
- Other things can help: dynamic dispatch, inheritance, automatic memory management, mixins, good donuts, etc.

Who was the first object-oriented programmer?

By the word operation, we mean any process which alters the mutual relation of two or more things, be this relation of what kind it may. This is the most general definition, and would include all subjects in the universe. Again, it might act upon other things besides number, were objects found whose mutual fundamental relations could be expressed by those of the abstract science of operations, and which should be also susceptible of adaptations to the action of the operating notation and mechanism of the engine... Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent.

Ada, Countess of Lovelace, around 1843

Recap

- Object-Oriented Programming is a state of mind: programming by thinking about objects
- Java provides some language mechanisms that encourage this:
 - **class**: package state and procedures
 - **private**: hide data and operations
 - **extends**: inheritance and subtyping
 - dynamic dispatch
 - automatic memory management