CS 313 Lecture 10

Intro to OO programming
Intro to Smalltalk / Squeak
What is object-oriented programming?


Quora

What is object-oriented programming?

100+ Answers

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Answered August 30, 2016

Originally Answered: What is the definition of object oriented programming?
The best definition I have heard that anyone can understand was in this interview of Steve Jobs

It's a well-known fact that even without any formal engineering training, Steve Jobs had an unmatchable understanding of technology.

Here is how the interview went on

Jeff Goodell: Would you explain, in simple terms, exactly what object-oriented software is?

Steve Jobs: Objects are like people. They're living, breathing things that have knowledge...
Steve Jobs: Objects are like people. They’re living, breathing things that have knowledge inside them about how to do things and have memory inside them so they can remember things. And rather than interacting with them at a very low level, you interact with them at a very high level of abstraction, like we’re doing right here.

Here’s an example: If I’m your laundry object, you can give me your dirty clothes and send me a message that says, “Can you get my clothes laundered, please.” I happen to know where the best laundry place in San Francisco is. And I speak English, and I have dollars in my pockets. So I go out and hail a taxicab and tell the driver to take me to this place in San Francisco. I go get your clothes laundered, I jump back in the cab, I get back here. I give you your clean clothes and say, “Here are your clean clothes.”

You have no idea how I did that. You have no knowledge of the laundry place. Maybe you speak French, and you can’t even hail a taxi. You can’t pay for one, you don’t have dollars in your pocket. Yet, I knew how to do all of that. And you didn’t have to know any of it. All that complexity was hidden inside of me, and we were able to interact at a very high level of abstraction. That’s what objects are. They encapsulate complexity, and the interfaces to that complexity are high level.

History

• OO programming starts with *Simula*: language for simulation
• Simula influenced later OO languages
  • Smalltalk (influenced by LISP)
  • C++ (extension of C)
OO concepts

- **object** - contains data + operations
- **class** - “blueprint” for objects
- **subclass** - subset of a class with additional properties
- **instance** - a specific object of a class
- **method** - a procedure implementing an operation
- **message** - a procedure call (execute method)
- **instance variables** - hold state of object
Objects vs. records

- Record / struct
  - collection of variables

- Object
  - collection of (instance) variables
  - methods
  - access control

```java
struct point {
    int x, y;
}
...
struct point p;
p.x = 5;  p.y = 7;

class Point {
    private int x, y;
    public Point (int x, int y) {
        this.x = x;  this.y = y;
    }
    public void reflect() {
        this.x *= -1;
    }
}
...
Point p = new Point(5, 7);
p.reflect();
```
Procedural vs. OO

• Procedural
  \[ \text{reflect}(p); \]

• OO:
  \[ p.\text{reflect}(); \]
  Point q;
  q.\text{reflect}();
Inheritance

• Can define class hierarchy
• subclasses:
  • inherit instance variables and methods of superclass
  • can add additional instance variables and methods
  • can override methods of superclass
Inheritance

**Figure 7.2** Classification of shape objects.

**Figure 7.3** A class hierarchy corresponding to the nested classification of objects in Fig. 7.2.
Inheritance

**Figure 7.6** Class *Shape* and its subclasses or derived classes.
Smalltalk / Squeak
Intro to Smalltalk

• Everything is an object

• $3 + 4$ send message “+ 4” to integer object 3
• $3 + 4 \rightarrow 7$
• $3 + 4 \times 5 \rightarrow 35$ evaluates left to right!!!
• $3 + (4 \times 5) \rightarrow 23$ need parentheses!
• $3 \text{ sign} \rightarrow 1$ one of -1, 0, 1
• $3 \text{ class} \rightarrow \text{Integer}$
• $3 \text{ class superclass} \rightarrow \text{Number}$
Smalltalk class hierarchy

Figure 7.16 A portion of the Smalltalk class hierarchy, from Goldberg and Robson [1983].

[more complex in Squeak]
Smalltalk basic types

3  Integer
5.2  Float
$b  Character b
‘Hello’  String
“Hello”  Comment!
$(4 10 2.5 $x)  Array with 4 elements
Squeak demo