Data Abstraction and Object-Oriented Languages

Prof. Evan Chang
Meeting 26, CSCI 3155, Fall 2009

Announcements
- HW9 due tonight at 11:55pm
- HW7 grades posted
- FCQs today

Review Data Abstraction

One-Slide Summary
- An abstract data type (ADT) is a type definition with a set of operations manipulating values of that type
- The representation or implementation type is hidden from clients. This is known as information hiding.
- An ADT allows developers to impose a representation invariant—a property of the data structure preserved across operations
- Objects give rise to a related but different form of data abstraction

Simple Example
- Built-in types, like float, are abstract data types. Why?
  
  \[
  \begin{align*}
  3.14 & \quad \text{up to compilation how to represent this} \\
  + : \text{float} \times \text{float} & \to \text{float} \\
  * : \text{float} \times \text{float} & \to \text{float} \\
  / : \text{float} \times \text{float} & \to \text{float}
  \end{align*}
  \]

User-Defined ADTs
- Example: A stack of values
  
  ![Diagram of stack operations]

  - push a new value
  - pop a value
ADTs in SML

- Signatures and Structures

Data Abstraction in OO Languages

- Java-like languages permit information hiding through access control

```java
class Stack {
    private int top;
    private int size;
    public Stack() {
        top = -1;
        size = 0;
    }
    public void push(int item) {
        if (top < size - 1)
            top++;
        size = size + 1;
    }
    public int pop() {
        if (top == -1)
            return 0;
        size = size - 1;
        return top;
    }
}
```

(Implementation) Information Hidden?

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            return 0;
        size = size - 1;
        return top;
    }
}
```

Why is Information Hiding Useful?
What is different about Abstract Data Types and Objects with public interfaces?

- i.e., SML-style data abstraction and Java-style data abstraction

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- Objects give rise to a related but different form of data abstraction.

For Next Time

- Reading
- Forum comment
- HW9