

CS 635 Advanced Object-Oriented Design &
Programming
Spring Semester, 2006
Doc 8 Patterns Introduction
Feb 21, 2006

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References

A Pattern Language, Christopher Alexander, 1977

Patterns for Classroom Education, Dana Anthony, pp. 391-406, Pattern Languages of Program Design 2, Addison Wesley, 1996

Smalltalk Best Practice Patterns, Kent Beck, 1997

Design Patterns: Elements of Reusable Object-Oriented Software, Gamma, Helm, Johnson, Vlissides, 1995

Pattern Beginnings

"Each pattern describes a problem which occurs over and over again in our environment, and then describes the core of the solution to that problem, in such a way that you can use this solution a million times over, without ever doing it the same way twice"

"Each pattern is a three-part rule, which expresses a relation between a certain context, a problem, and a solution"

A Pattern Language, Christopher Alexander, 1977

A Place To Wait

The process of waiting has inherent conflicts in it.

Waiting for doctor, airplane etc. requires spending time hanging around doing nothing

Cannot enjoy the time since you do not know when you must leave

Classic "waiting room"

Dreary little room

People staring at each other

Reading a few old magazines

Offers no solution

Fundamental problem

How to spend time "wholeheartedly" and

Still be on hand when doctor, airplane etc arrive

Fuse the waiting with other activity that keeps them in earshot

Playground beside Pediatrics Clinic

Horseshoe pit next to terrace where people waited

Allow the person to become still meditative

A window seat that looks down on a street

A protected seat in a garden

A dark place and a glass of beer

A private seat by a fish tank

A Place To Wait

Therefore:

"In places where people end up waiting create a situation which makes the waiting positive. Fuse the waiting with some other activity - newspaper, coffee, pool tables, horseshoes; something which draws people in who are not simply waiting. And also the opposite: make a place which can draw a person waiting into a reverie; quiet; a positive silence"

Chicken And Egg

Problem

Two concepts are each a prerequisite of the other

To understand A one must understand B

To understand B one must understand A

A "chicken and egg" situation

Constraints and Forces

First explain A then B

Everyone would be confused by the end

Simplify each concept to the point of incorrectness to explain the other one

People don't like being lied to

Solution

Explain A & B correctly by superficially

Iterate your explanations with more detail in each iteration

Patterns for Classroom Education, Dana Anthony, pp. 391-406, Pattern Languages of Program Design 2, Addison Wesley, 1996

Design Principle 1

Program to an interface, not an implementation

Use abstract classes (and/or interfaces in Java) to define common interfaces for a set of classes

Declare variables to be instances of the abstract class not instances of particular classes

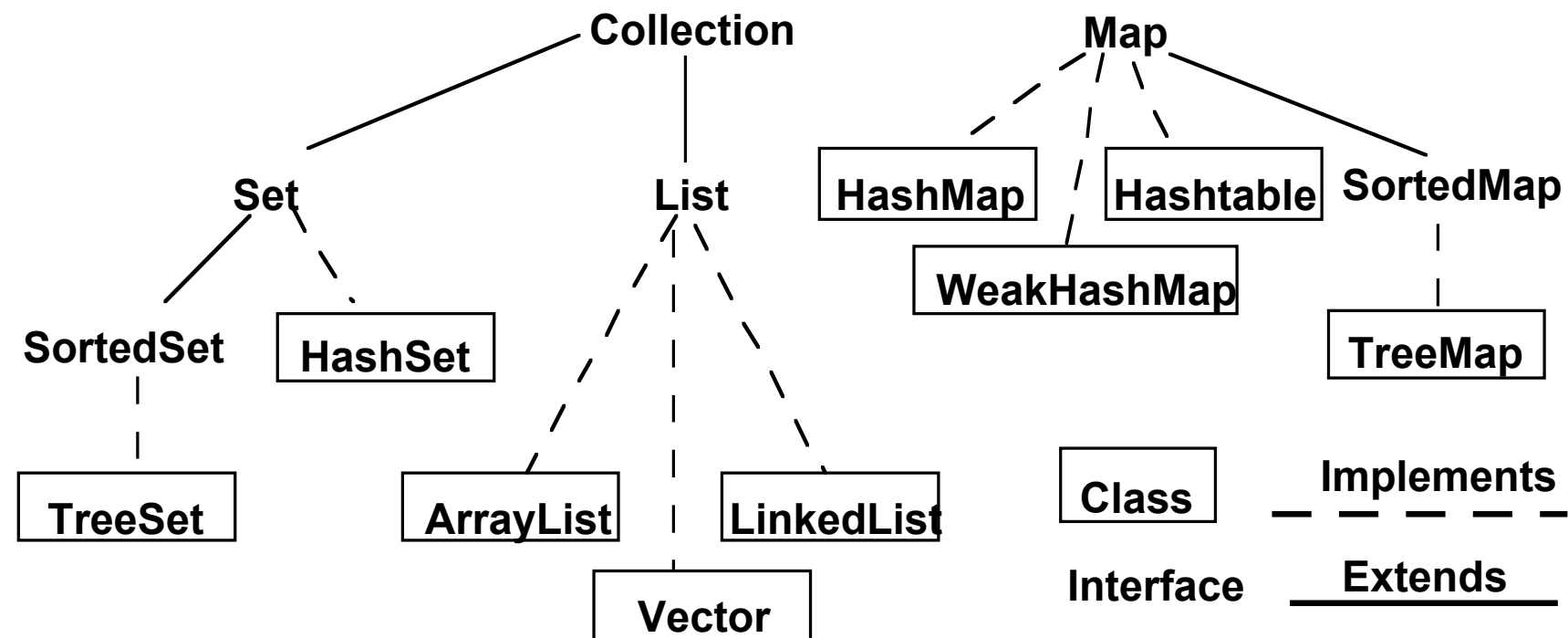
Benefits of programming to an interface

Client classes/objects remain unaware of the classes of objects they use, as long as the objects adhere to the interface the client expects

Client classes/objects remain unaware of the classes that implement these objects.

Clients only know about the abstract classes (or interfaces) that define the interface.

Programming to an Interface



Collection students = new XXX;
students.add(aStudent);

students can be any collection type

We can change our mind on what type to use

Design Principle 2

Favor object composition over class inheritance

Composition

Allows behavior changes at run time

Helps keep classes encapsulated and focused on one task

Reduce implementation dependencies

Inheritance

```
class A {  
    Foo x  
    public int complexOperation() { blah }  
}
```

```
class B extends A {  
    public void bar() { blah }  
}
```

Composition

```
class B {  
    A myA;  
    public int complexOperation() {  
        return myA.complexOperation()  
    }  
  
    public void bar() { blah }  
}
```

Designing for Change

Creating an object by specifying a class explicitly

Abstract factory, Factory Method, Prototype

Dependence on specific operations

Chain of Responsibility, Command

Dependence on hardware and software platforms

Abstract factory, Bridge

Inability to alter classes conveniently

Adapter, Decorator, Visitor

Dependence on object representations or implementations

Abstract factory, Bridge, Memento, Proxy

Algorithmic dependencies

Builder, Iterator, Strategy, Template Method, Visitor

Tight Coupling

Abstract factory, Bridge, Chain of Responsibility,
Command, Facade, Mediator, Observer

Extending functionality by subclassing

Bridge, Chain of Responsibility, Composite,
Decorator, Observer, Strategy

Kent Beck's Rules for Good Style

One and only once

In a program written in good style, everything is said once and only once

Methods with the same logic

Objects with same methods

Systems with similar objects

rule is not satisfied

Lots of little Pieces

"Good code invariably has small methods and small objects"

Small pieces are needed to satisfy "once and only once"

Make sure you communicate the big picture or you get a mess

Rates of change

Don't put two rates of change together

An object should not have a field that changes every second & a field that change once a month

A collection should not have some elements that are added/removed every second and some that are add/removed once a month

An object should not have code that has to change for each piece of hardware and code that has to change for each operating system

Replacing Objects

Good style leads to easily replaceable objects

"When you can extend a system solely by adding new objects without modifying any existing objects, then you have a system that is flexible and cheap to maintain"

Moving Objects

"Another property of systems with good style is that their objects can be easily moved to new contexts"