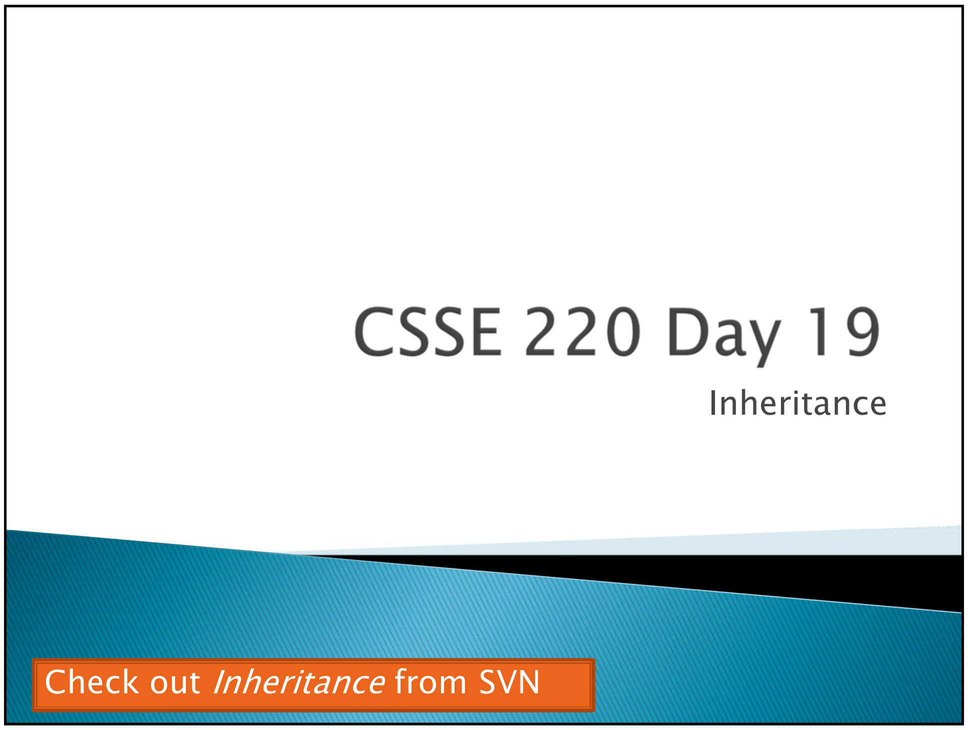
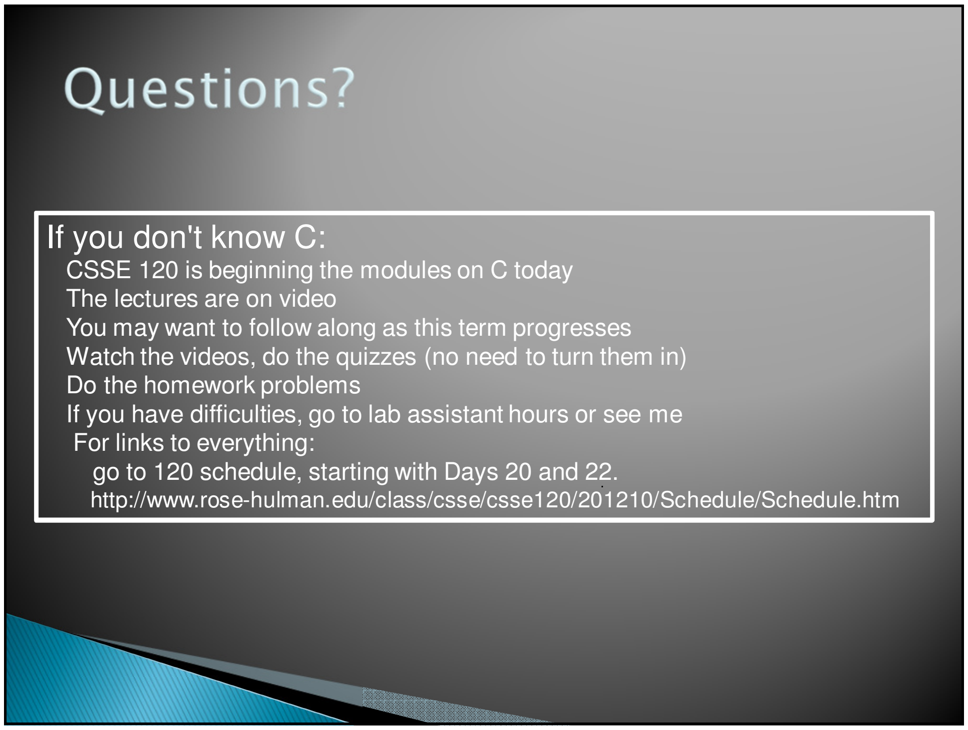


CSSE 220 Day 19

Inheritance

Check out *Inheritance* from SVN



Questions?

If you don't know C:

CSSE 120 is beginning the modules on C today
The lectures are on video
You may want to follow along as this term progresses
Watch the videos, do the quizzes (no need to turn them in)
Do the homework problems
If you have difficulties, go to lab assistant hours or see me
For links to everything:
go to 120 schedule, starting with Days 20 and 22.
http://www.rose-hulman.edu/class/csse/csse120/201210/Schedule/Schedule.htm

Inheritance

- Sometimes a new class is a special case of the concept represented by another
- Can "borrow" from an existing class, changing just what we need
- The new class inherits from the existing one:
  - all methods
  - all instance fields

Q1

Examples

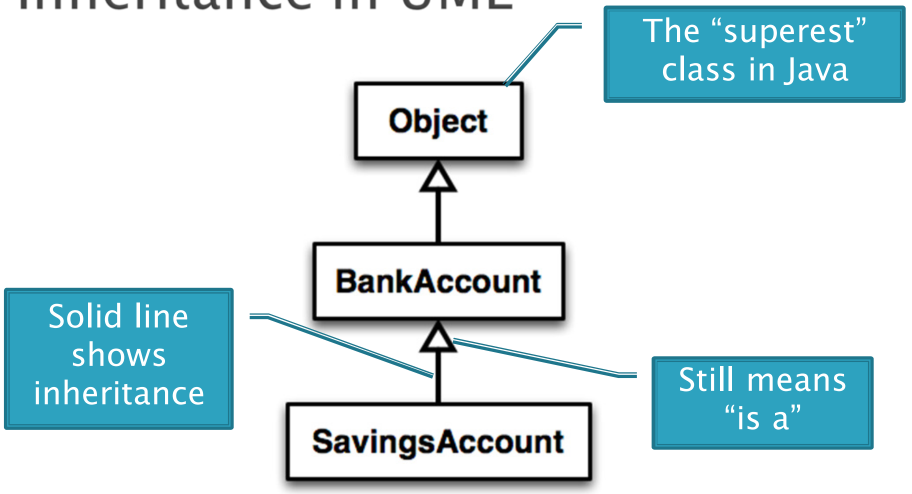
- `class SavingsAccount extends BankAccount`
  - adds interest earning, keeps other traits
- `class Employee extends Person`
  - adds pay information and methods, keeps other traits
- `class Manager extends Employee`
  - adds information about employees managed, changes the pay mechanism, keeps other traits

Notation and Terminology

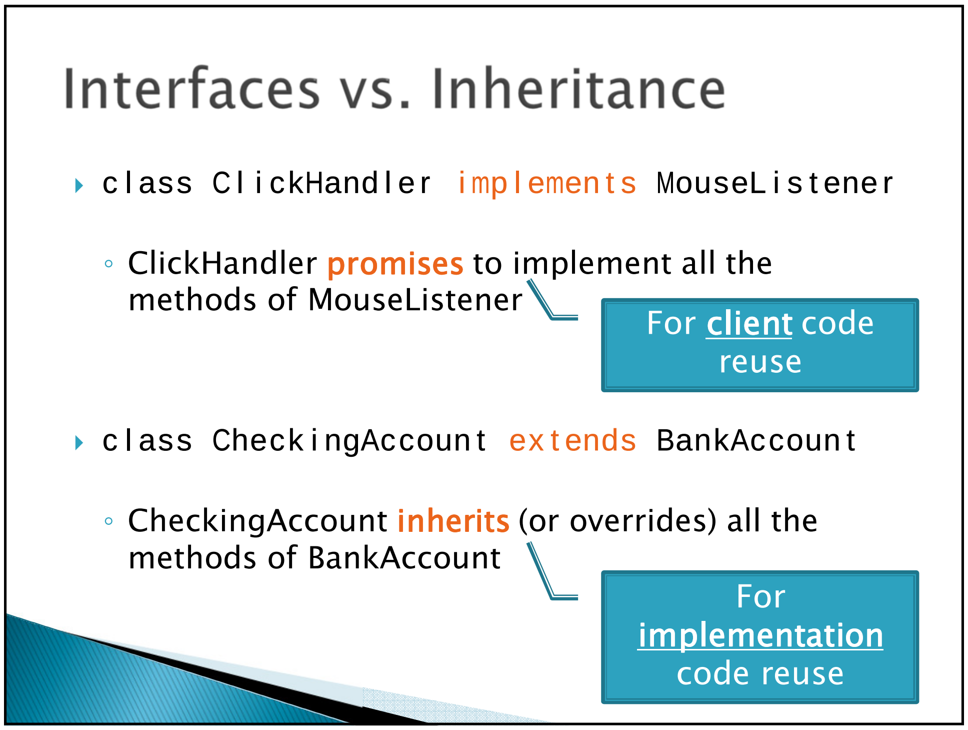
-
  ```
  class SavingsAccount extends BankAccount {
      // added fields
      // added methods
  }
  ```
- Say "SavingsAccount **is a** BankAccount"
- **Superclass**: BankAccount
- **Subclass**: SavingsAccount

Q2

Inheritance in UML



Q3



Interfaces vs. Inheritance

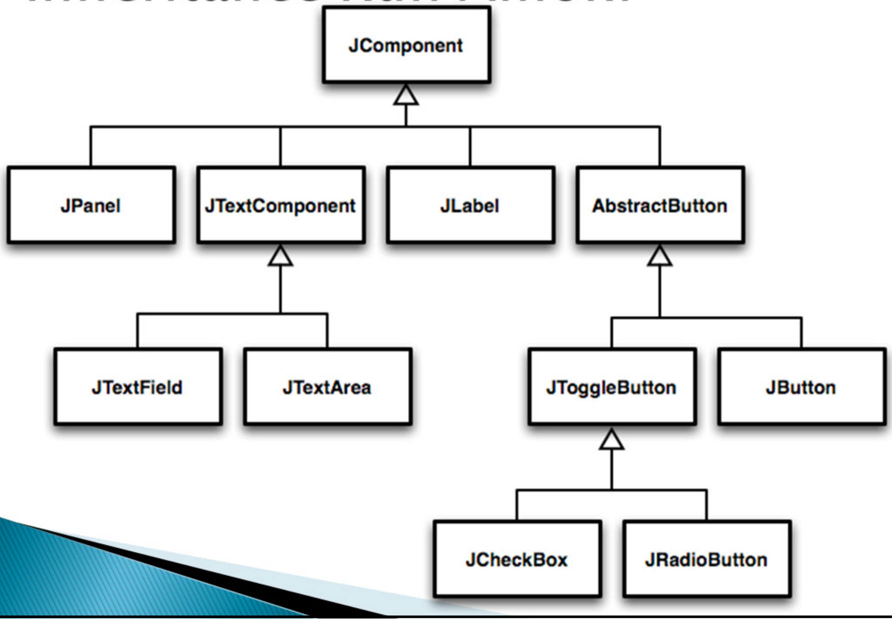
- `class ClickHandler implements MouseListener`
  - ClickHandler **promises** to implement all the methods of MouseListener

For <u>client</u> code reuse

- `class CheckingAccount extends BankAccount`
  - CheckingAccount **inherits** (or overrides) all the methods of BankAccount

For <u>implementation</u> code reuse

Inheritance Run Amok?



With Methods, Subclasses can:

- Inherit methods unchanged
- Override methods
    - Declare a new method with same signature to use instead of superclass method
- Add entirely new methods not in superclass

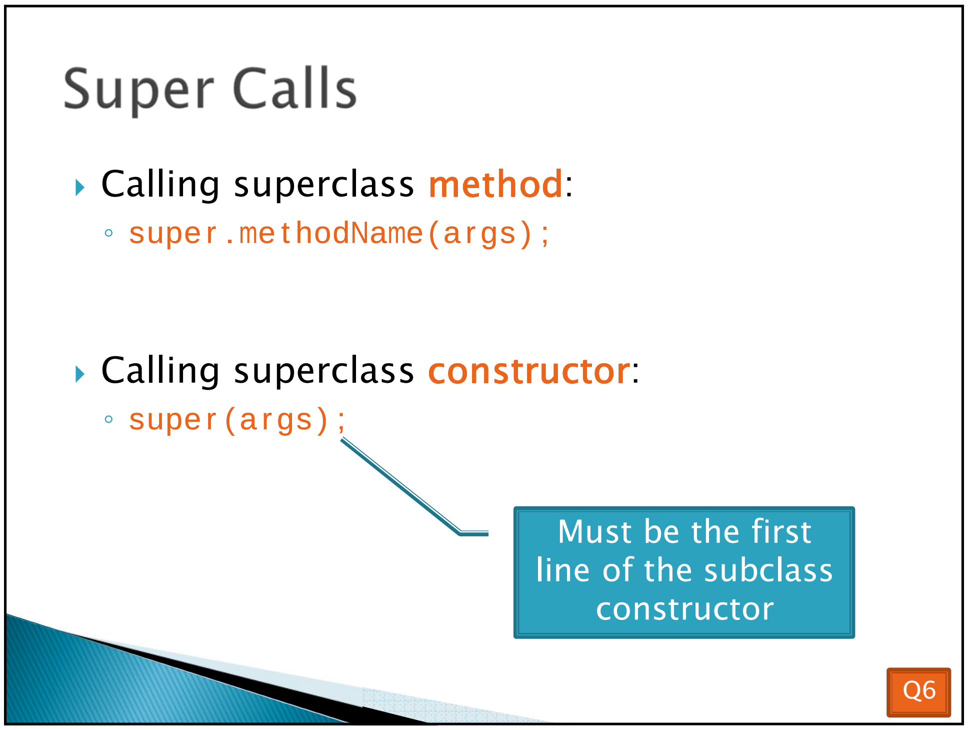
Q4

With Fields, Subclasses:

- ALWAYS inherit all fields unchanged
- Can add entirely new fields not in superclass

DANGER! Don't use the same name as a superclass field!

Q5

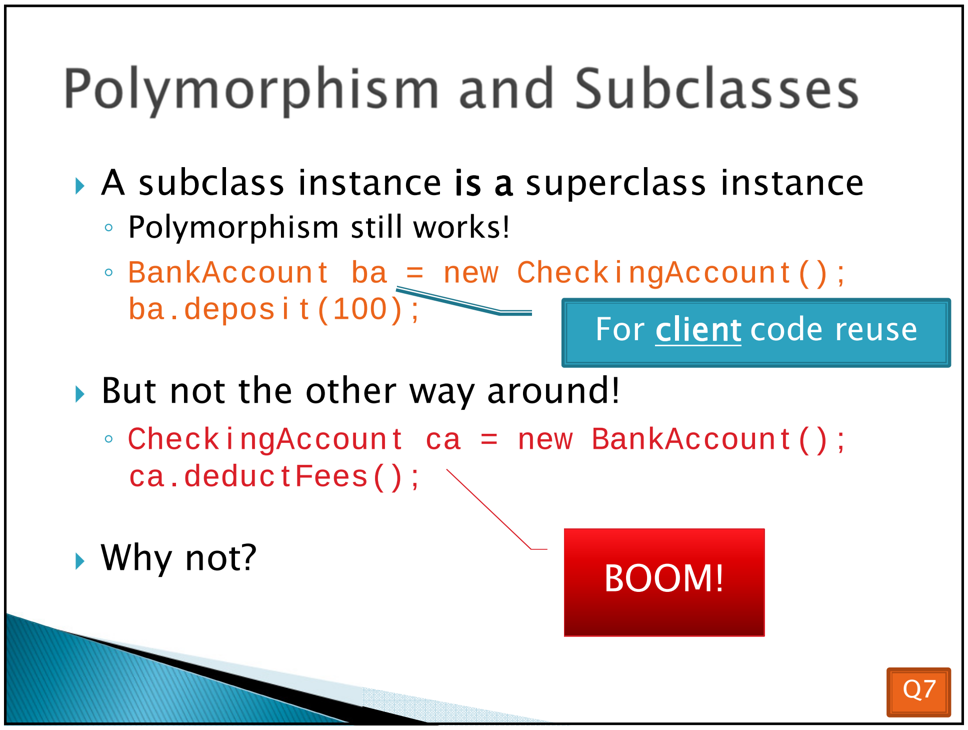


Super Calls

- Calling superclass **method**:
  - `super.methodName(args);`
- Calling superclass **constructor**:
  - `super(args);`

Must be the first line of the subclass constructor

Q6



Polymorphism and Subclasses

- A subclass instance **is a** superclass instance
  - Polymorphism still works!

  -
    ```
    BankAccount ba = new CheckingAccount();
    ba.deposit(100);
    ```

For **client** code reuse

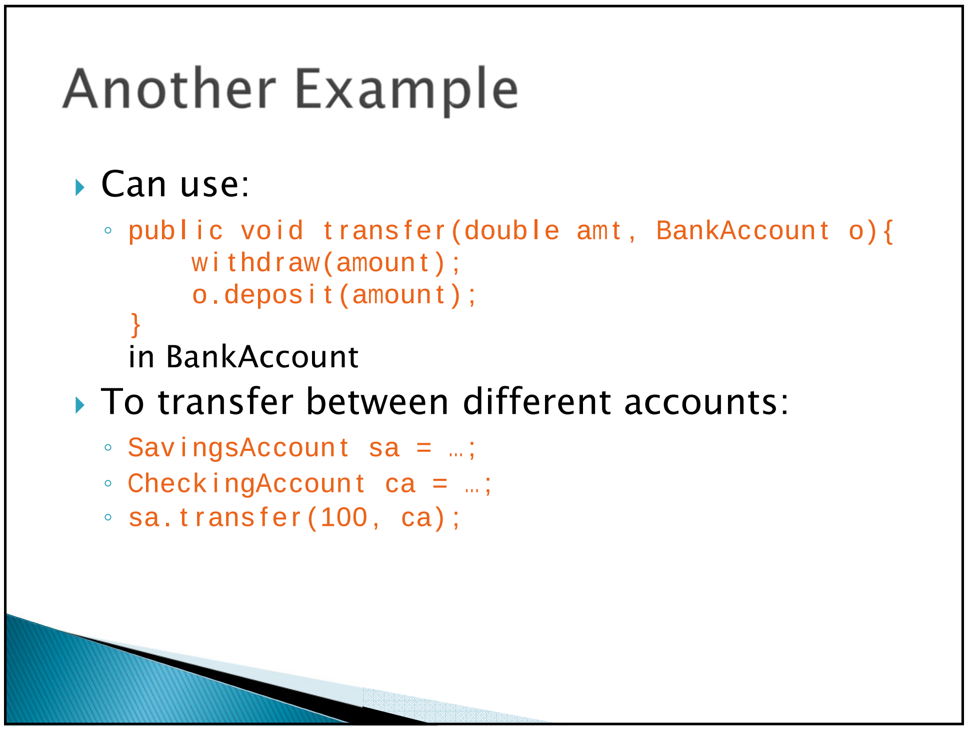
- But not the other way around!

  -
    ```
    CheckingAccount ca = new BankAccount();
    ca.deductFees();
    ```

BOOM!

- Why not?

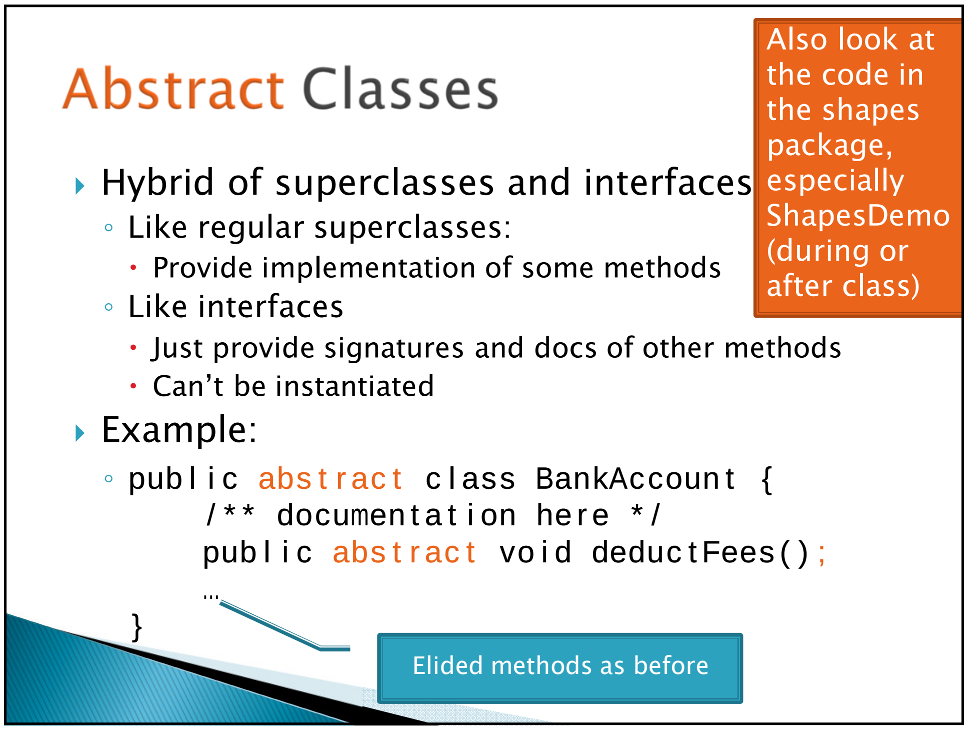
Q7



Another Example

- Can use:

  -
    ```
    public void transfer(double amt, BankAccount o){
        withdraw(amount);
        o.deposit(amount);
    }
    ```
    in BankAccount
- To transfer between different accounts:
  - `SavingsAccount sa = …;`
  - `CheckingAccount ca = …;`
  - `sa.transfer(100, ca);`



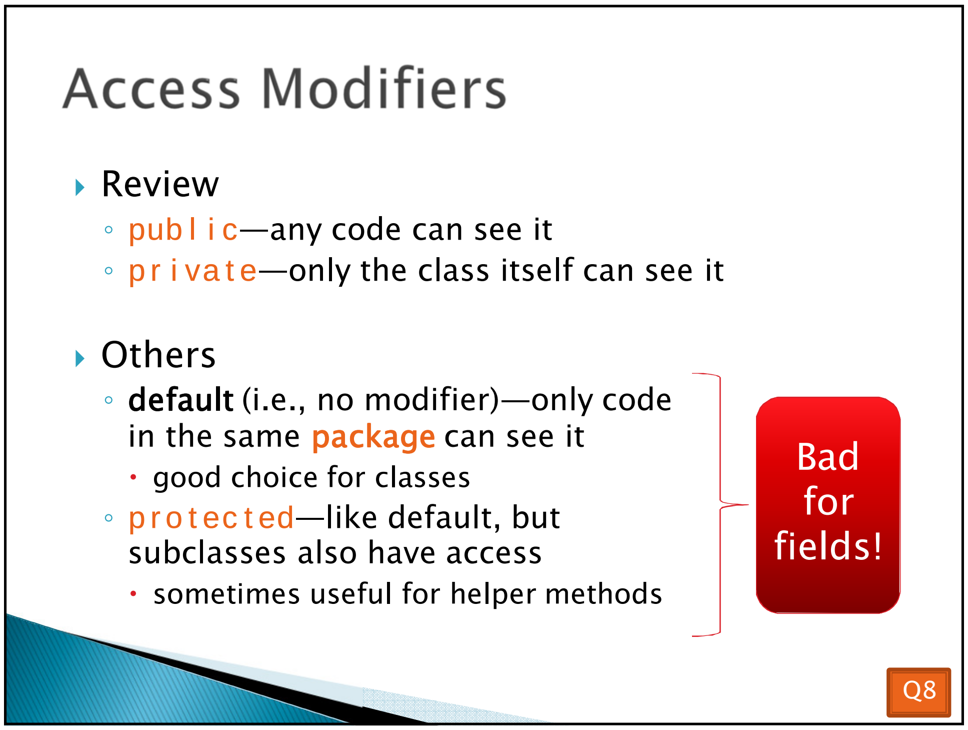
Abstract Classes

Also look at the code in the shapes package, especially ShapesDemo (during or after class)

- Hybrid of superclasses and interfaces
  - Like regular superclasses:
    - Provide implementation of some methods
  - Like interfaces
    - Just provide signatures and docs of other methods
    - Can't be instantiated
- Example:

  -
    ```
    public abstract class BankAccount {
        /** documentation here */
        public abstract void deductFees();
        …
    }
    ```

Elided methods as before

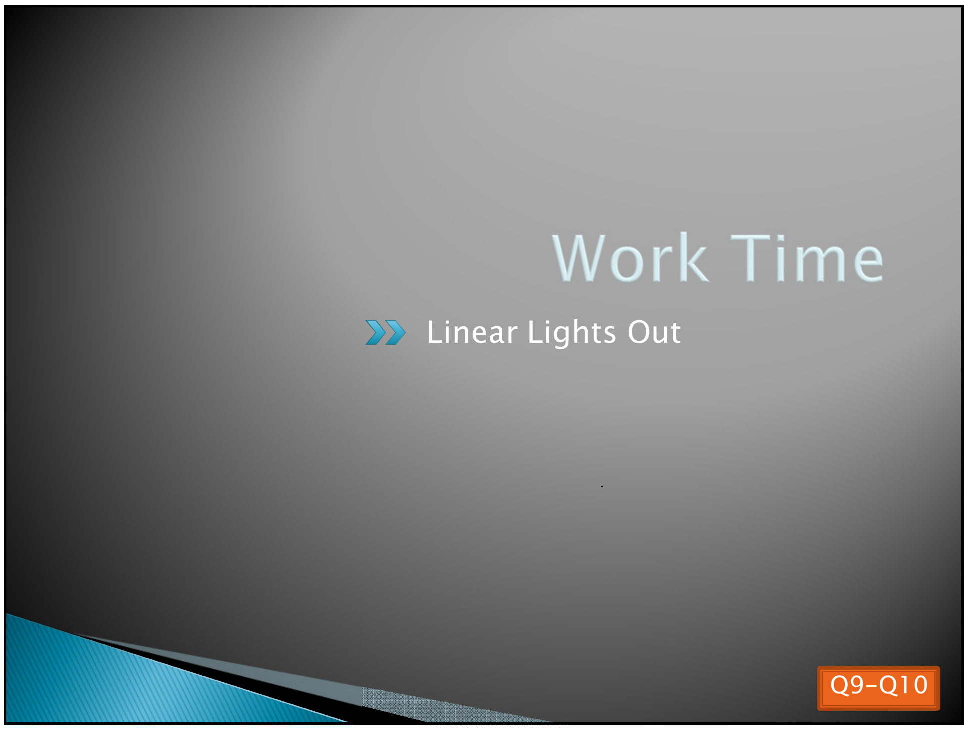


Access Modifiers

- Review
  - public—any code can see it
  - private—only the class itself can see it
- Others
  - **default** (i.e., no modifier)—only code in the same **package** can see it
    - good choice for classes
  - protected—like default, but subclasses also have access
    - sometimes useful for helper methods

Bad for fields!

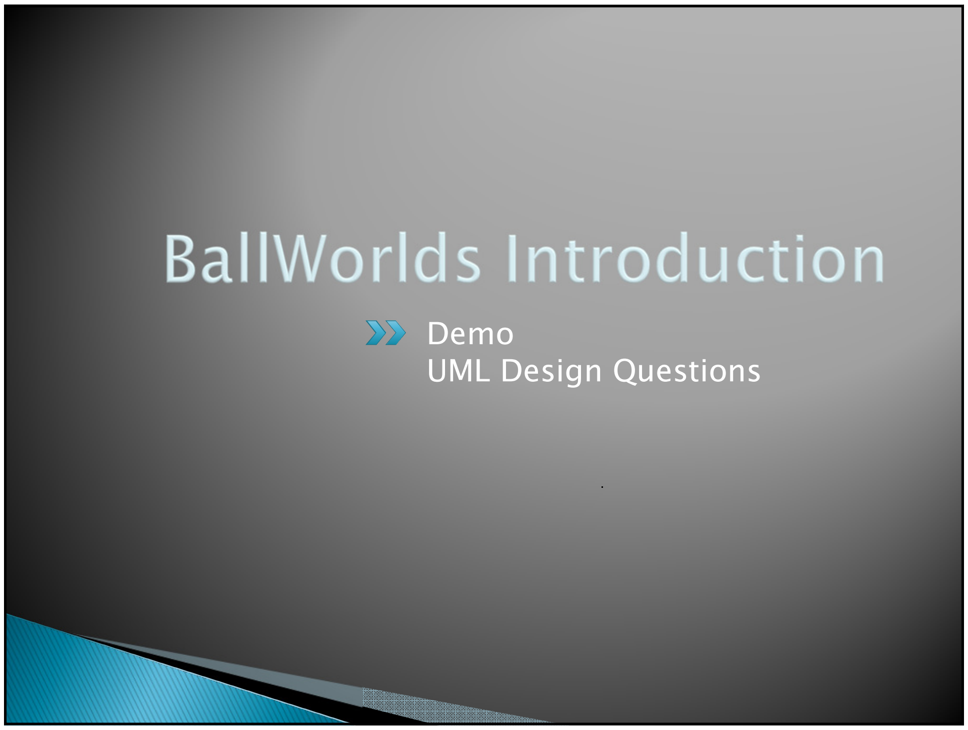
Q8



Work Time

- Linear Lights Out

Q9–Q10



BallWorlds Introduction

- Demo
  UML Design Questions