

CSSE 220

Inheritance

Check out *Inheritance* from SVN

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



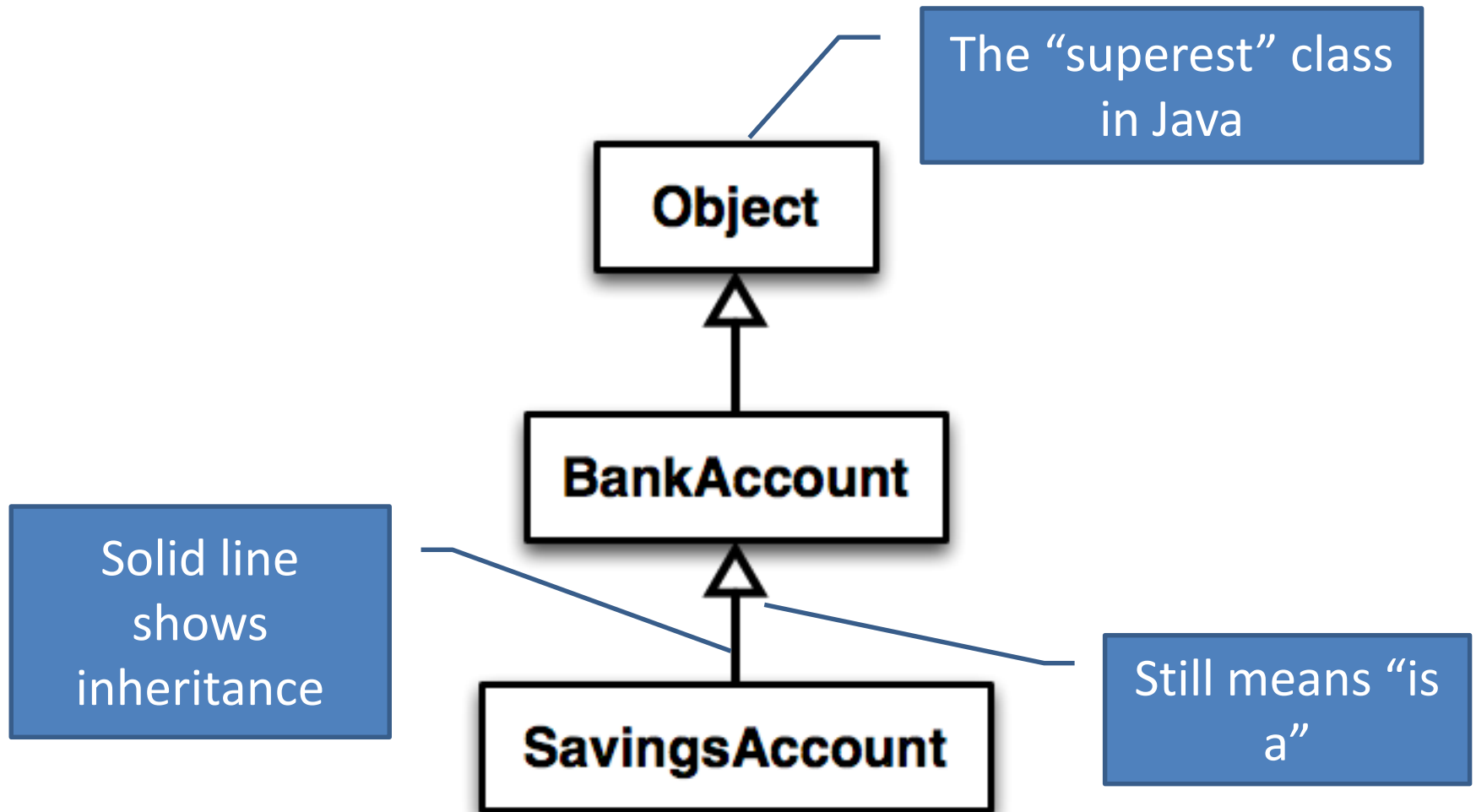
Examples

- **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

Inheritance in UML



The “superest” class
in Java

Solid line
shows
inheritance

Still means “is
a”

Interfaces vs. Inheritance

- `class ClickHandler implements MouseListener`

- ClickHandler **promises** to implement all the methods of MouseListener

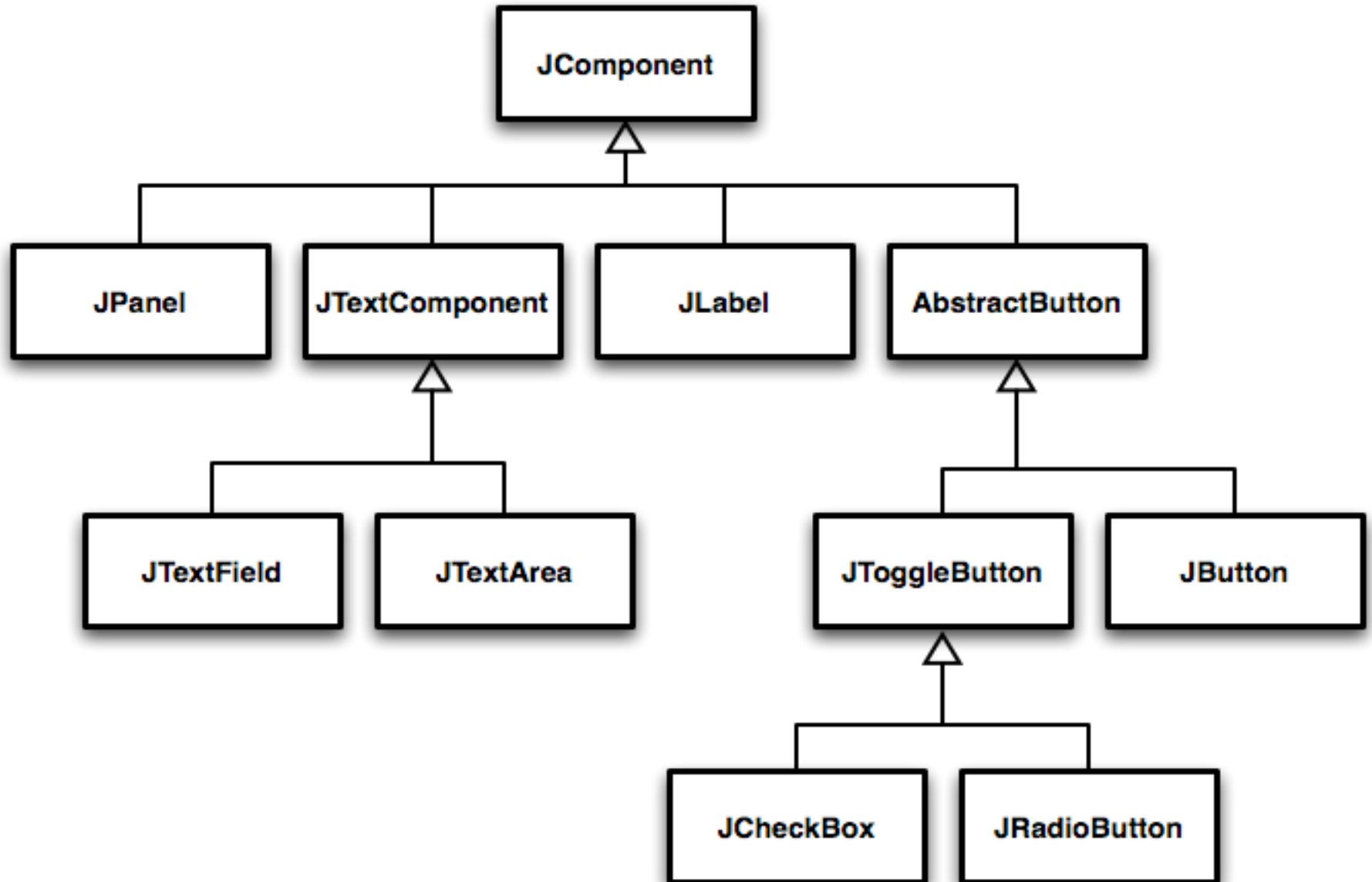
For client code reuse

- `class CheckingAccount extends BankAccount`

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

For implementation code reuse

Inheritance Run Amok?

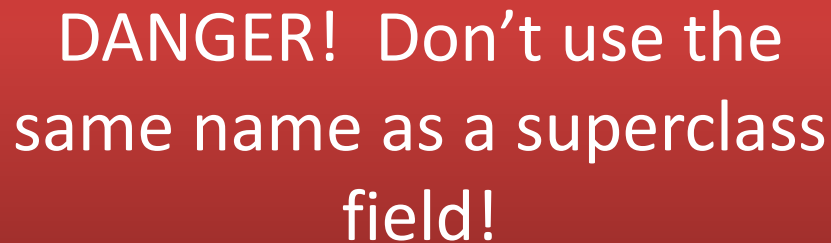


With Methods, Subclasses can:

- **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

With Fields, Subclasses:

- **ALWAYS inherit** all fields unchanged
 - Only have access to protected, public, and package level fields
- **Can add** entirely new fields not in superclass



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

Super Calls

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



Must be the first line of the subclass constructor

Polymorphism and Subclasses

- A subclass instance **is a** superclass instance
 - Polymorphism still works!
 - `BankAccount ba = new CheckingAccount();`
`ba.deposit(100);`
- But not the other way around!
 - `CheckingAccount ca = new BankAccount();`
`ca.deductFees();`
- Why not?



BOOM!

Another Example

- Can use:
 - `public void transfer(double amount, BankAccount o){`
 `this.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

- **public**—any code can see it
 - **protected**— package and children can see it
 - **default**—anything in the package can see it
 - **private**—only the class itself can see it
- Notes:
 - **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!

Look at shape hierarchy

- All shapes have an upper left coordinate, plus width and height
- They all have an abstract method to compute their area and perimeter
- They all have a method `printData` that prints their height, width, area, and perimeter
- Review code for `Shape`, `Rectangle`, `Circle`
- Things to do:
 - Add tests for `Rectangle` and `Circle`
 - Make `CoolCircle` a non-abstract subclass of `Circle` which overrides one method to do something different and test it

Linear Lights Out

It's a solo project, but feel free to talk with others as you do it.

And to ask instructor/assistants for help

WORK TIME