CSSE 220 Day 19

Inheritance

Check out *Inheritance* from SVN

Questions?

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 info. and methods, keeps other traits
- `class Manager extends Employee`
  - adds info. about employees managed, changes pay mechanism, keeps other traits

Notation and Terminology

- ```
  class SavingsAccount extends BankAccount {
      // added fields
      // added methods
  }
  ```

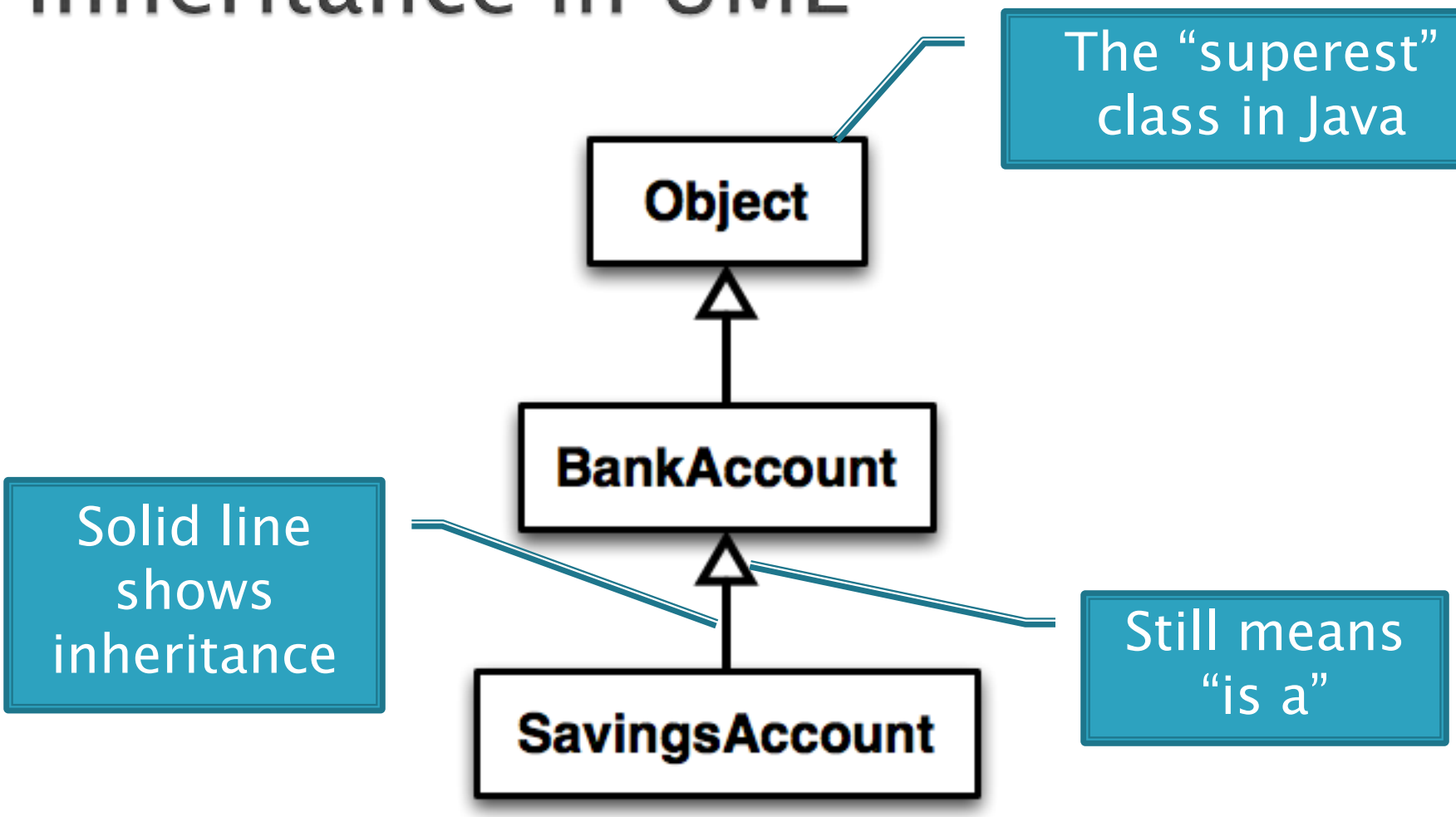
- Say "`SavingsAccount` **is a** `BankAccount`"

- **Superclass**: `BankAccount`

- **Subclass**: `SavingsAccount`

Q2
  ```

Inheritance in UML



Q3

Interfaces vs. Inheritance

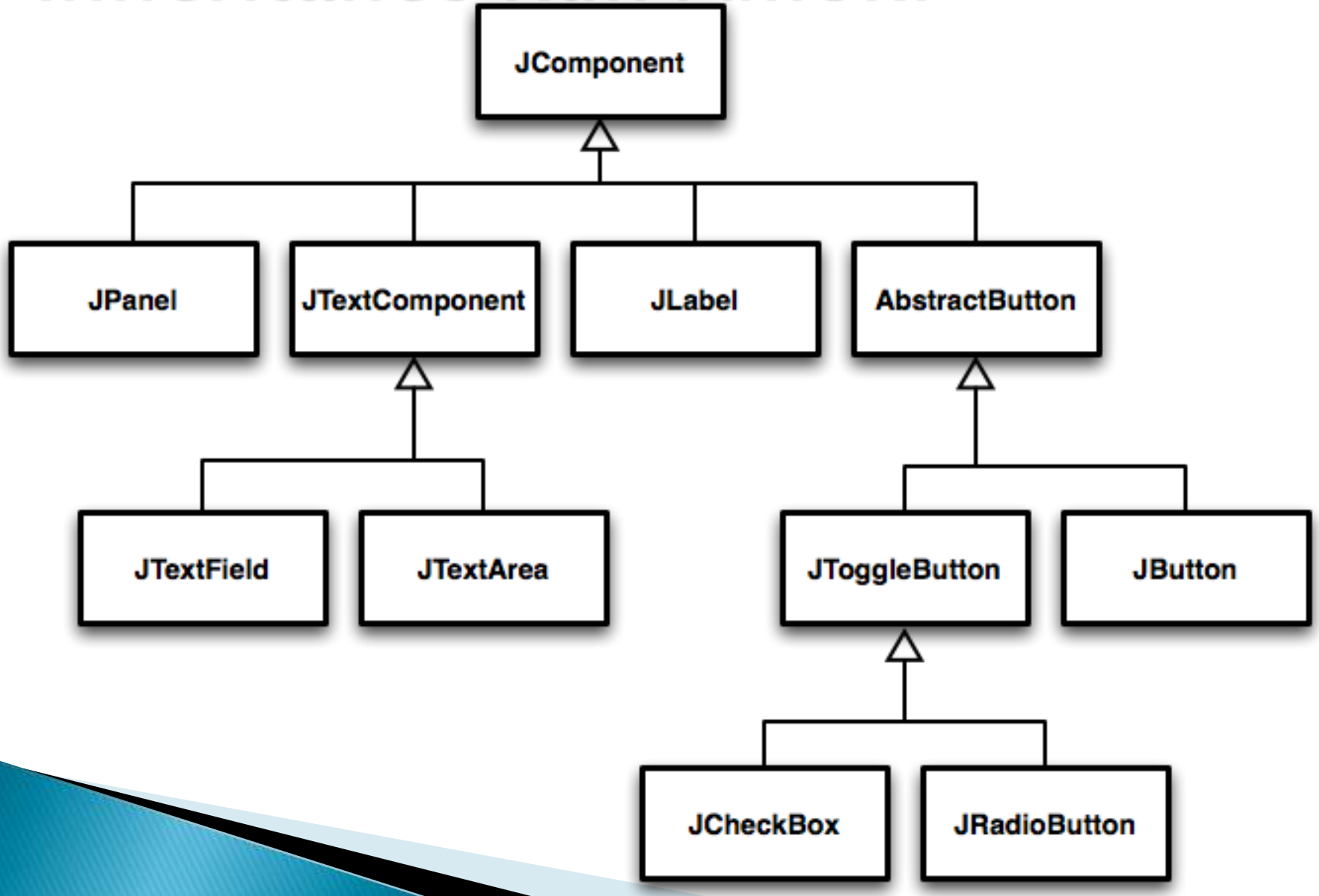
- `class ClickHandler implements MouseListener`
  - ClickHandler **promises** to implement all the methods of MouseListener

For **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

Q4

With Fields, Subclasses:

- **ALWAYS inherit** all fields unchanged

- **Can add** entirely new fields not in superclass

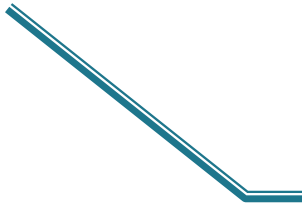
DANGER! Don't use the same name as a superclass field!

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 SavingsAccount();
    ba.deposit(100);
    ```

For client code reuse

- But not the other way around!
  - ```
    SavingsAccount sa = new BankAccount();
    sa.addInterest();
    ```
- Why not?

BOOM!

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

- Hybrid of superclasses and interfaces
  - Like regular superclass:
    - 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