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

Q1

Examples

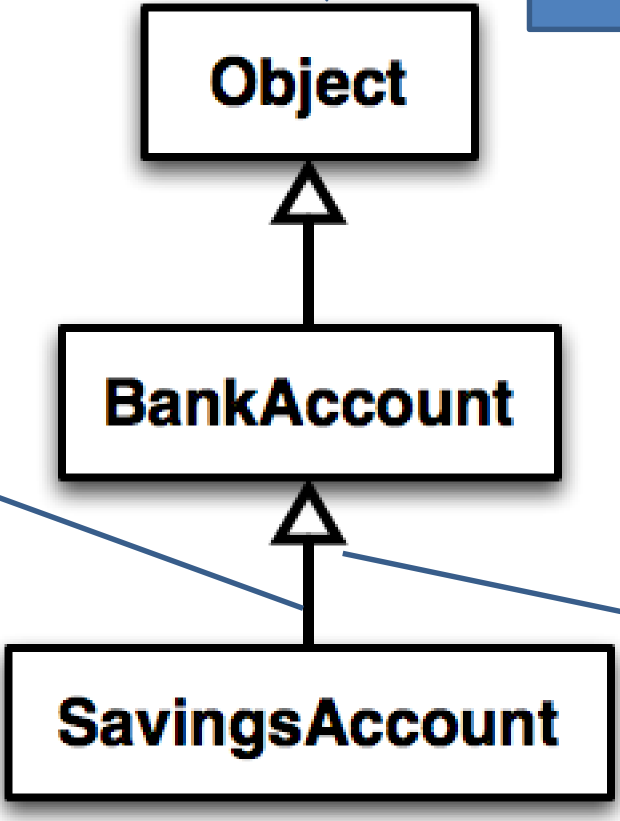
- `class SavingsAccount extends BankAccount`
  - adds interest earning, keeps other traits
- `class Employee extends Person`
  - adds pay information and methods, keeps other traits
- `class Manager extends Employee`
  - adds information about employees managed, changes the pay mechanism, keeps other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



The "superest" class in Java

Solid line shows inheritance

Still means "is a"

Q3

Interfaces vs. Inheritance

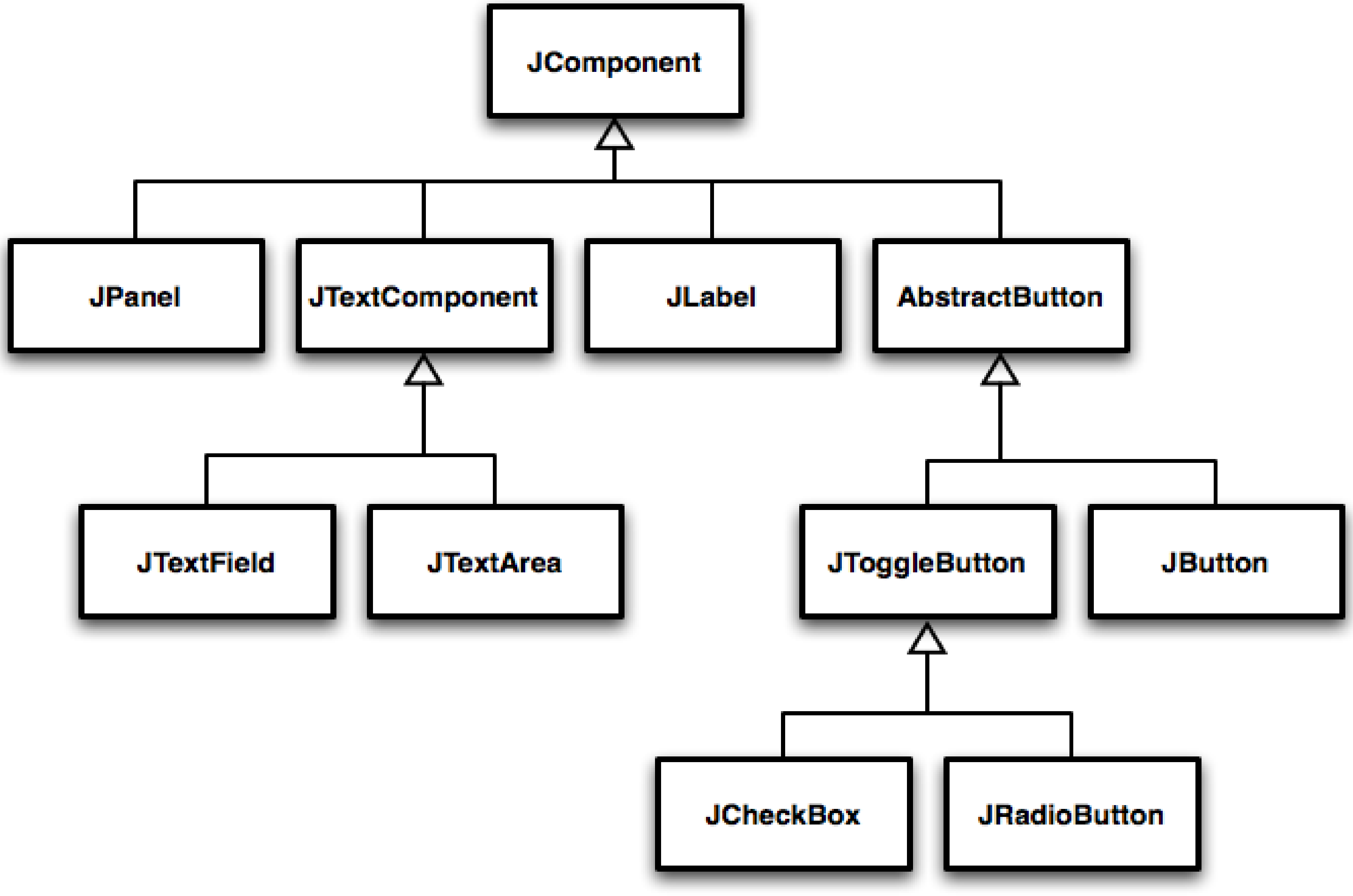
- `class ClickHandler implements MouseListener`
  - ClickHandler **promises** to implement all the methods of MouseListener

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
  - 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!

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);`
- But not the other way around!
  - `CheckingAccount ca = new BankAccount();`
    `ca.deductFees();`

BOOM!

- Why not?

Q7

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 subclasses 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!

Q8

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

Q9-Q10