CSSE 220 Day 3

Unit Tests and Object References
Implementing Classes in Java, using Documented Stubs, Test-First Programming

Check out *UnitTesting* and *WordGames* from SVN

What Questions Do You Have?

Syllabus

Reading assignments

Homework

Things discussed in class

Anything else

Javadocs: Key Points

- Don't try to memorize the Java libraries
  - Nearly 9000 classes and packages!
  - You'll use a few dozen of them during this course

- Get in the habit of writing the javadocs **before** implementing the methods
  - It will help you think before doing, a vital software development skill
  - This is called programming with ***documented stubs***
  - I'll try to model this. If I don't, call me on it!

Q1

Writing Code to Test Your Code

- Test-driven Development, unit testing and JUnit

Unit Testing

- Using code that you write to test other code
  - Focused on testing individual pieces of code (units) in isolation
    - Individual methods
    - Individual classes

- Why would software engineers do unit testing?

Q2

Unit Testing With JUnit

- JUnit is a unit testing *framework*
  - A *framework* is a collection of classes to be used in another program.
  - Does much of the work for us!
- JUnit was written by
  - Erich Gamma
  - Kent Beck
- Open-source software
- Now used by **millions** of Java developers

Q3

JUnit Example

- *MoveTester* in Big Java shows how to write tests in plain Java
- Look at *JUnitMoveTester* in today's repository
  - Shows the same test in JUnit
  - Let's look at the comments and code together…

Interesting Tests

Important Slide: Use this as a reference!

- Test “boundary conditions”
  - Intersection points: -40℃ == -40℉
  - Zero values: 0℃ == 32℉
  - Empty strings
- Test known values: 100℃ == 212℉
  - But not too many
- Tests things that might go wrong
  - Unexpected user input: “zero” when 0 is expected
- Vary things that are “important” to the code
  - String length if method depends on it
  - String case if method manipulates that

Exercise

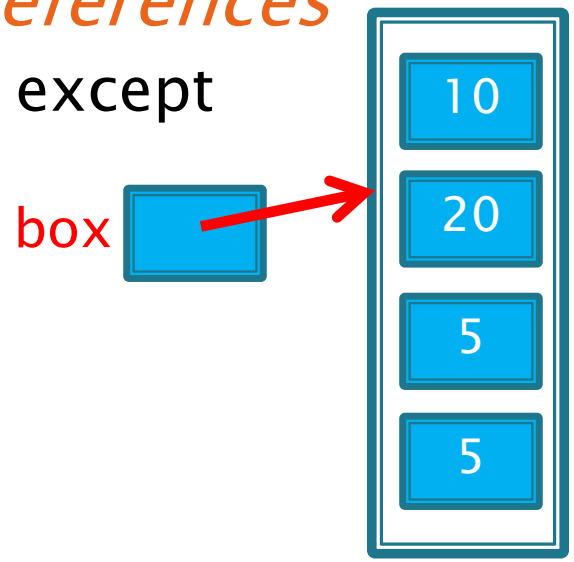
- Unit test *shout*, *whisper*, and *holleWerld* using “interesting” test cases

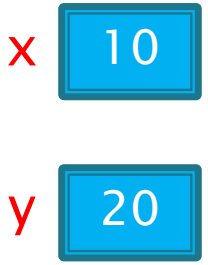
Object References

- Differences between primitive types and object types in Java

What Do Variables Really Store?

- Variables of primitive type store *values*
- Variables of class type store *references*
  - A reference is like a pointer in C, except
    - Java keeps us from screwing up
    - No & and * to worry about (and the people say, "Amen")
- Consider:





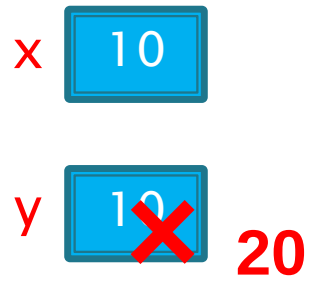

```
1. int x = 10;
2. int y = 20;
3. Rectangle box = new Rectangle(x, y, 5, 5);
```

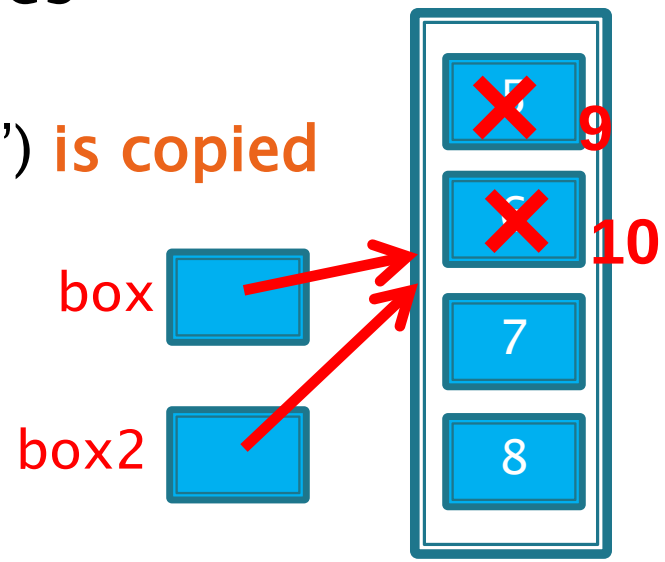
Q4

Assignment Copies Values

- Actual value for number types
- Reference value for object types
  - The actual **object is not copied**
  - The **reference value** ("the pointer") **is copied**
- Consider:

```
1. int x = 10;
2. int y = x;
3. y = 20;
```






```
4. Rectangle box = new Rectangle(5, 6, 7, 8);
5. Rectangle box2 = box;
6. box2.translate(4, 4);
```

Q5 - Q6

Encapsulation

- Separating implementation details from how an object is used

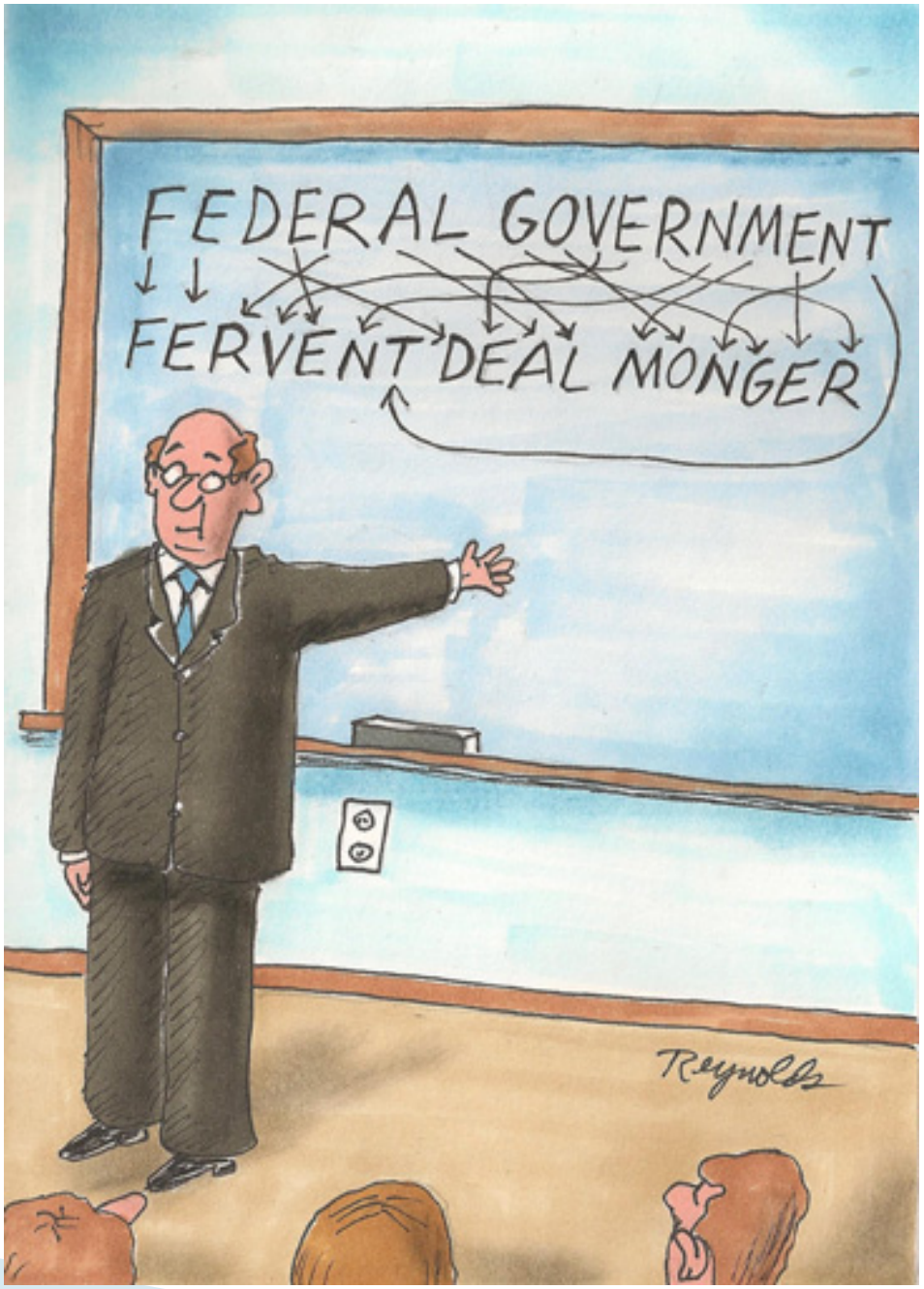
Encapsulation in Object-Oriented Software

- *Encapsulation*—separating implementation details from how an object is used
  - Client code sees a *black box* with a known *interface*
  - Implementation can change without changing client

	Functions	Objects
Black box exposes	Function signature	Constructor and method signatures
Encapsulated inside the box	Operation implementation	**Data storage** and **operation implementation**

Q7 – Q8

Interlude



How To: Implement a Class

1. **Create the** (initially empty) **class**
   - File ⇒ New ⇒ Class
2. Write ***documented stubs*** for the public interface of the class
3. **Implement the class:**
   - Determine and implement instance fields
   - Implement constructors and methods, adding private methods and additional instance fields as needed
4. **Test the class**

3. Test and implement each constructor and method
   - Write the test cases BEFORE implementing the constructor/method

Live Coding

- WordGames Shouter

Censor

- **Censor**: given a string ***inputString***, produces a new string by replacing each occurrence of **charToCensor** with a "*" (an asterisk).

- How do you deal with **charToCensor** ?
  - Can it be a parameter of *transform*?
    - No, that violates the specification
  - Can it be a local variable of *transform*?
    - No, it needs to live for the entire lifetime of the Censor.
  - What's left?
    - Answer: It is a ***field*** ! (What is a sensible name for the field?)

- How do you initialize the field for **charToCensor** ?
  - Answer: by using Censor's constructors!

Live Coding

- WordGames Censor

Wrap up Quiz and Turn it In

- Continue with homework if time permits

Q9 – Q10