CS1110 lecture 5 13 Sept 2011
Testing; class Object; toString; static variables/methods

Reading for this lecture: Testing with JUnit (Appendix I.2.4 & pp. 385—388),

class Object (pp. 153-154),

function toString (pp. 112-113),

static variables and methods (Sec. 1.5, p. 47).

Reading for next two lectures: Executing method calls, if-statements, the return statement in a function, local variables. Chapter 2 except 2.3.8 and 2.3.9.

This reading will some clarify some concepts, such as method parameters, that we have had to gloss over so far.

A1: due **Sat 17 Sept** on CMS; form groups by Wed.
Ignore "Extended Until" on CMS.

(We put in a fake extension to work around a CMS limitation.)

Testing —using JUnit

Bug: Error in a program. (Always expect them!)

Debugging: Process of finding bugs and removing them.

Testing: Process of analyzing, running program, looking for bugs.

Test case: A set of input values, together with the expected output.

Get in the habit of writing test cases for a method from the method's specification —even *before* writing the method's body.

```
/** = number of vowels in word w.
Precondition: w contains at least one letter and nothing but letters*/
public int numberOfVowels(String w) {
 // (nothing here yet!)
}
```

A feature called **JUnit** in DrJava helps us develop test cases and use them. You *have* to use this feature in assignment A1.

Here are two test cases

1. w1= **new** Worker("Obama", 1, **null**);
   Name should be: "Obama"; SSN: 1; boss: **null**.
2. w2= **new** Worker("Biden", 2, w1);
   Name should be: "Biden"; SSN: 2; boss: w1.

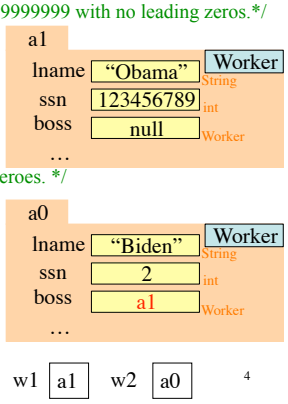
Need a way to run these test cases, to see whether the fields are set correctly. We could use the interactions pane, but then repeating the test is time-consuming.

To create a testing framework: select menu **File** item **new JUnit test case…**. At prompt, put in class name **WorkerTester**. This creates a new class with that name. Save it in same directory as class Worker.

The class imports **junit.framework.TestCase**, which provides some methods for testing.

Spec, headers for methods in class Worker

```
/** Constructor: a worker with last name n ("" if none), SSN s,
    and boss b (null if none).
  Precondition: n is not null, s in 0..999999999 with no leading zeros.*/
public Worker(String n, int s, Worker b)

/** = worker's last name */
public String getLname()

/** = last 4 SSN digits without leading zeroes. */
public int getSsn()

/** = worker's boss (null if none) */
public Worker getBoss()

/** Set boss to b */
public void setBoss(Worker b)
```



w1 a1 w2 a0

Testing the constructor (also getter methods)

File->new JUnit test case … [save in same directory as WorkerTester.java]

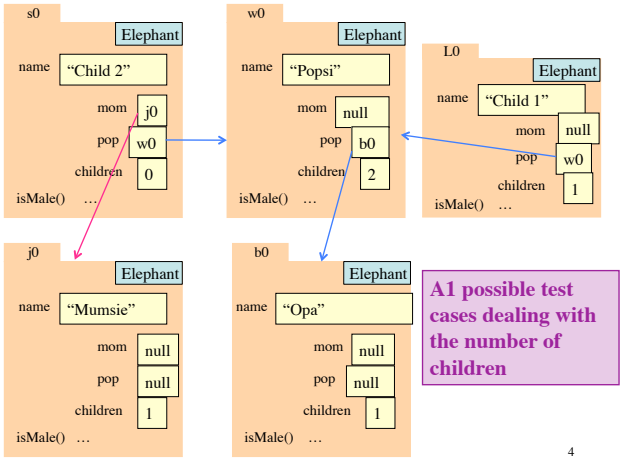
```
/** Test constructor and getters*/
public void testConstructor() {
    Worker w1= new Worker("Obama", 123456789, null);
     assertEquals("Obama", w1.getLname());
     assertEquals(6789, w1.getSSN4());
     assertEquals(null, w1.getBoss());

     Worker w2= new Worker("Biden", 2, w1);
     assertEquals("Biden", w2.getLname());
     assertEquals(2, w2.getSSN4());
     assertEquals(w1, w2.getBoss());
}
```

assertEquals(x, y):

test whether **x** (*expected*) equals **y** (*computed*); print error msg. and stop execution if they are not equal.

Pg 488 lists some other methods that can be used.

Click button Test in DrJava to call all "testX methods".



A1 possible test cases dealing with the number of children

Class Object: The superest class of them all

A minor mystery: since Worker doesn't extend anything, it seems that it should have only the methods we wrote for it. *But it has some other methods, too.*

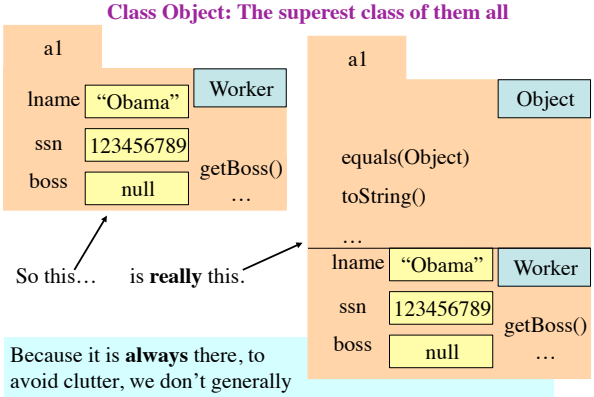
Java feature: Every class that does not extend another one automatically extends class Object. That is,

public class C { … }

is equivalent to

public class C **extends** Object { …}

Class Object: The superest class of them all



Because it is **always** there, to avoid clutter, we don't generally draw the partition for superclass Object. (A2 will be an exception).

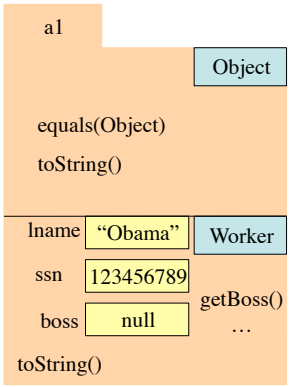
Method toString()

Convention: c.toString() returns a representation of folder c, giving info about the values in its fields.

Put following method in Worker.

```
/** = representation of this Worker
* [etc., see full program] */
public String toString() {
   return …;
}
```

In appropriate places, the expression c automatically does c.toString()



Another example of toString()

```
/** An instance represents a point (x, y) in the plane */
public class Point {
   private int x;  // the x-coordinate
   private int y; // the y-coordinate
   /** Constructor: An instance for point (xx, yy) */
   public Point(int xx, int yy) {
      …
   }
   /** = a representation of this point in form "(x, y)" */
   public String toString() {
      return …;
   }
}
```

(getter and setter methods not given on this slide)

Fill these in

Example: "(3, 5)"

Function toString should give the values in the fields in a format that makes sense for the class.

A **static method** appears not in each folder but only once, in *the file drawer.*
Make a method static if it doesn't need to be in a folder because it doesn't reference the contents of the "containing" folder.

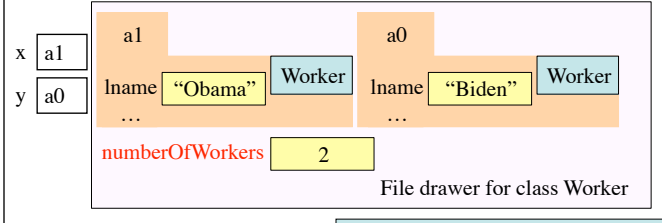
```
/** = "this object is the c's boss".
      Precondition: c is not null. */
public boolean isBoss(Worker c) {
   return this == c.getBoss();
}

/** = "b is c's boss".
      Precondition: b and c are not null. */
public static boolean isBoss(Worker b, Worker c) {
   return b == c.getBoss();
}
```

keyword **this** refers to the name of the object in which it appears

A **static** variable appears not in each folder but as a *single entity in the file drawer.* It can be used to maintain information about all the folders.

Declaration: (goes inside class definition, just like field declarations)

```
private static int numberOfWorkers; // no. of Worker objects created
…
```



Class, not var holding folder name

Reference the variable by Worker.numberOfWorkers.