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CS/ENGRD 2110 SPRING 2014

Lecture 4: The class hierarchy; static components
http://courses.cs.cornell.edu/cs2110

References to text and JavaSummary.pptx

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- A bit about testing and test cases
- Class Object, superest class of them all.
  Text: C.23 slide 30
- Function toString() C.24 slide 31-33
- Overriding a method C15–C16 slide 31-32
- Static components (methods and fields) B.27 slide 21, 45
- Java application: a program with a class that declares a method with this signature:
  public static void toString(String[])

Homework

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1. Read the text, Appendix A.1–A.3
2. Read the text, about the if-statement: A.38–A.40
3. Visit course website, click on Resources and then on Code Style Guidelines. Study
   2. Format Conventions
   4.5 About then-part and else-part of if-statement

Specifications of boolean functions

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/** Return true if this Bee is male and false if not. */
public boolean isMale()

/** Return "this Bee is male". */
public boolean isMale()

Says same thing. Shorter, no case analysis. Think of it as return value of sentence "this Bee is male"

abs(-20)

Do you say, "it returns absolute value of -20? Of course not. Mathematicians say simply "that's the absolute value of 60

/** = "this Bee is male". */

Read as: the call isMale() equals the value of the sentence "this Bee is male".

What is "the name of" the object?

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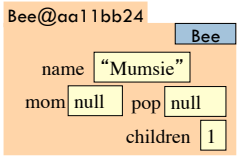
The name of the object below is

Bee@aa11bb24

It contains a pointer to the object –i.e. its address in memory, and you can call it a pointer if you wish. But it contains more than that.

Variable b, declared as Bee b; contains not the object but the name of the object (or a pointer to the object).



A bit about testing

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

Develop test cases for a method from its specification --- even before you write the methods body.

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

Developing test cases first, in "critique" mode, can prevent wasted work and errors.

How many vowels in each of these words?
creek
syzygy

Test cases for number of children

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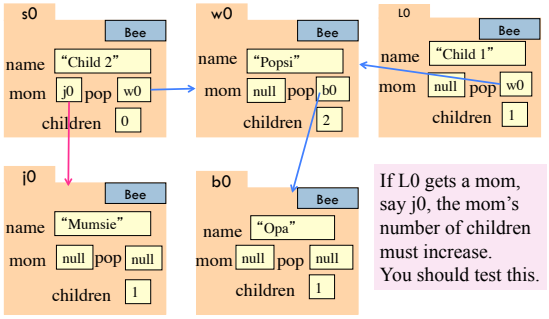

If L0 gets a mom, say j0, the mom's number of children must increase. You should test this.

Class W (for Worker)

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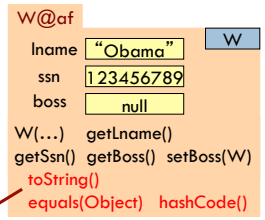
```
/** Constructor: worker with last name n,  SSN s, boss b (null if none).
    Prec:  n not null,  s in 0..999999999 with no leading zeros.*/
public W(String n, int s, W b)

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

/** = last 4 SSN digits */
public String getSsn()

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

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

Contains other methods!



Class Object: the superest class of them all

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

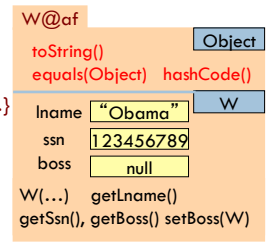
public class W {…}

is equivalent to

public class W **extends** Object {…}

We often leave off the top partition to reduce clutter; we know that it is always there

We draw object like this



Method toString

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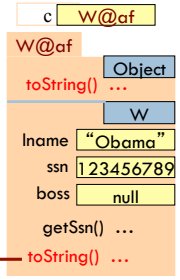
toString() in Object returns the name of the object: W@af

Java Convention: Define toString() in any class to return a representation of an object, giving info about the values in its fields.

New definition of toString() **overrides** the definition in partition Object

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

c.toString() calls this method



Method toString

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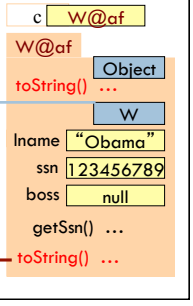
toString() in Object returns the name of the object: W@af

```
public class W {
  …
  /** Return a representation of this object */
  public String to String() {
    return "Worker  " + lname + "." +
      " Soc sec: …" + getSSn() + "." +
      (boss == null ? "" : "Boss " + boss.lname + ".");
  }
```

c.toString() calls this method



Another example of toString()

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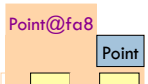
```
/** An instance represents a point (x, y) in the plane */
public class Point {
   private int x;  // x-coordinate
   private int y; // y-coordinate
   …
   /** =  repr. of this point in form "(x, y)" */
   public String toString() {
      return "(" + x + "," + y + ")";
   }
}
```



(9, 5)

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

Intro to static components

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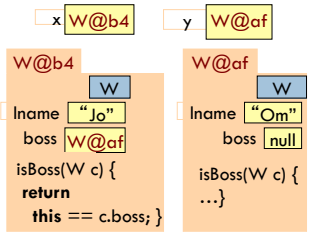
```
/** = "this object is c's boss".
    Pre: c is not null. */
public boolean isBoss(W c) {
    return this == c.boss;
}
```

x.isBoss(y) is **false**

y.isBoss(x) is **true**

Spec: return the value of that true-false sentence. True if this object is c's boss, false otherwise

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



Intro to static components

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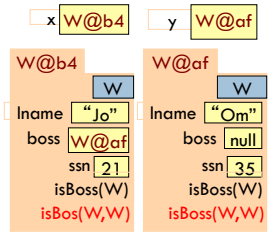
```
/** = "b is c's boss".
    Pre: b and c are not null. */
public boolean isBoss(W b, W c) {
    return b == c.getBoss();
}
```

Body doesn't refer to any field or method in the object. Why put method in object?

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



Intro to static components

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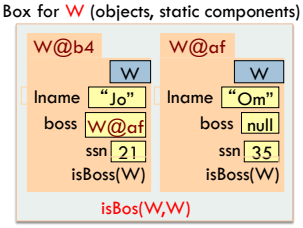
```
/** = "b is c's boss".
    Pre: b and c are not null. */
public static boolean isBoss(W b, W c) {
    return b == c.getBoss();
}
```

static: there is only one copy of the method. It is *not* in each object

x.isBoss(x, y)
y.isBoss(x, y)

Preferred:
W.isBoss(x, y)

Box for W (objects, static components)



Java application

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Java application: bunch of classes with at least one class that has this procedure:

```
public static void main(String[] args) {
    …
}
```

Type String[]: array of elements of type String. We will discuss later

Convention: if method main doesn't use parameter args, then call it with argument **null**

Running the application consists of calling method main

One use of static variable: maintain info about all objects

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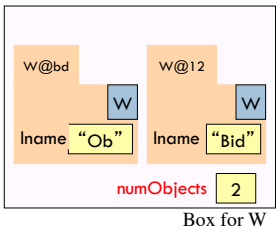
```
public class W {
  private static int numObjects;
    …

  /** Constructor:  */
  public W(…) {
    …
    numObjects=
            numObjects + 1;
  }
}
```

To have numObjects contain the number of Objects of class W that have been created, simply increment it in constructors



Box for W