CS100J Classes, stepwise refinement 16 February 2005

Miscellaneous points about classes.
A bit about stepwise refinement.

Prelim 7:30-9:00 Thursday, 23 Feb.

Review session: 1:00-3:00, Sunday, 19 Feb, in Philips 101

CMS allows you to submit an assignment several times.

We grade only the last one submitted (but access to all of them).

Rsrecah on spleilng

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Help: Get it now if you need it!!

- One-on-one help from TAs. For info, get on the course website and click "Staff-info".
- Call Cindy Pakkala 255-8240 for an appointment with Gries.
- See a consultant in the eng. library 2:30 to 11:00 (to 6:00 on Fri-Sat). They aren't very busy now.
- Peer tutoring (free). On http://www.engineering.cornell.edu, click on "student services". On the page that comes up, click on "Learning Initiatives (L.I.F.E.) in the left column, upper part. Then, click on "peer tutoring" in the left column.
- Take an AEW courses. Ask in Olin 167.

Notes on assignment A2

3. Testing for **null**

```
/** = "fm is this family member's brother". Precondition: fm not null. */
public boolean isBrother(Rhino r) {
    // No need to test for null. It's the caller's duty not to have r null.
}

/** = "r1 and r2 are not null and r1 and r2 are siblings */
public static boolean areSiblings(Rhino r1, Rhino r2) {
    // The result depends on r1, r2 not being null, and the
    // return expression should somehow include that test.

    return ...
}
```

In RhinoTester, when testing areSiblings, need to test calls like

areSiblings(m1, **null**)

areSiblings(**null**, m2)

Content of this lecture

This lecture contains some final miscellaneous points to round out your knowledge of classes and subclasses. There are a few more things to learn after that, but we'll handle them much later.

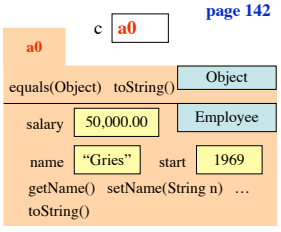
- Inheriting fields and methods and Overriding methods. Sec. 4.1 and 4.1.1: pp. 142–145
- Function toString. Sec. 3.1.4, pp. 112–113.
- Purpose of **super** and **this**. Sec. 4.1.1, pp. 144–145.
- More than one constructor in a class; another use of **this**. Sec. 3.1.3, pp. 110–112.
- Method equals in class Object. Sec. 4.3 and 4.3.1, pp. 154–155. (We do not cover the method at the end of Sec. 4.3.1.)
- Constructors in a subclass —calling a constructor of the super-class. Sec. 4.1.3, pp. 147–148.


```
public class Employee {/** Instance: a person's name, year hired, and salary */
  private String name;      // Employee's name
  private int start;        // Year hired
  private double salary= 50000;    // Salary
  /** Constructor: a person with name n, year hired d, salary s */
  public Employee(String n, int d) { name= n; start= d; salary= s;}
  /** = name of this Employee */
  public String getName() { return name; }
  /** Set the name of this Employee to n */
  public void setName(String n)  { name= n; }
  /** = year this Employee was hired */
  public int getStart() { return start; }
  /** Set the year this Employee was hired to y */
  public void setStart(int y) { start= y; }
  /** = Employee's total compensation (here, the salary) */
  public double getCompensation() { return salary; }
  /** Change this Employee's salary to d */
  public void changeSalary(double d)  { salary= d; }
  /** = String representation of this Employee */
  public String toString()
    { return getName() + ", year " + getStart() + ", salary " + salary; }      }
```

This class is on page 105 of the text.

Employee c= **new** Employee("Gries", 1969, 50000);
c.toString()

Sec. 4.1, page 142



Which method toString() is called?

Overriding rule:
To find out which is used, start at the bottom of the class and search upward until a matching one is found.

Also called the **bottom-up rule**.

Terminology. Employee **inherits** methods and fields from Object. Employee **overrides** function toString.

Purpose of function toString: to give a string representation of the folder (object) in which it appears. **Sec. 3.1.4, page 112**

In Object, all toString can do is to give the name on the folder.

In Employee, toString can tell you the values of the fields

```
/** = String representation of this Employee */
public String toString() {
    return getName() + ", year " + getStart() + ", salary " + salary;
}
```

Nice Java rule. If you use the name c of a folder in a place where a String is needed, Java uses the value of c.toString().

Purpose of super and this **Sec. 4.1, pages 144-145**

Use **this** to refer to the object in which it appears.
Use **super** to refer to components in the super-class partition of the object (and above).

```
/** = String representation of this Employee */
public String toString() {
    return this.getName() + ", year " + getStart() + ", salary " + salary;
}
```

ok, but unnecessary

```
/** = toString value from superclass */
public String toStringUp() {
    return super.toString();
}
```

necessary

A second constructor in Employee
Provide flexibility, ease of use, to user **Sec. 3.1.3, page 110**

```
/** Constructor: a person with name n, year hired d, salary s */
public Employee(String n, int d, double s) {
    name= n; start= d; salary= s;
}
```
First constructor

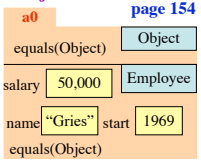
```
/** Constructor: a person with name n, year hired d, salary 50,000 */
public Employee(String n, int d) {
    name= n; start= d; salary= 50000;
}
```
Second constructor; salary is always 50,000

```
/** Constructor: a person with name n, year hired d, salary 50,000 */
public Employee(String n, int d) {
    this(n, d, 50000);
}
```
Another version of second constructor; calls first constructor

Here, **this** refers to the other constructor

Method equals in class Object. **Sec. 4.3.1, page 154**

```
/** = "the name of this object is the same
      as the name of obj */
public boolean equals(Object obj)
    { return this == obj; }
```



Write equals in class Employee

```
/** = "e is an Employee, with the same fields as this Employee */
public boolean equals(Employee e) {
    return e != null
        && this.name.equals(e.name)
        && this.start == e.start
        && this.salary == e.salary;
}
```

Function does not override equals in Object because the parameter has a different type. It's a new, different function. We'll fix redo this function later in the course.

Don't use == with Strings


```
/** An executive: an employee with a bonus. */
public class Executive extends Employee {
    private double bonus; // yearly bonus
    /** Constructor: name n, year hired d, salary 50,000, bonus b */
    public Executive(String n, int d, double b) {
        super(n, d);
        bonus= b;
    }
    /** = this executive's bonus */
    public double getBonus()    { return bonus; }
    /** = this executive's yearly compensation */
    public double getCompensation()
        { return super.getCompensation() + bonus; }
    /** = a representation of this executive */
    public String toString()
        { return super.toString() + ", bonus " + bonus; }
}
```

Subclass Executive

super(n,d) calls a constructor in the superclass to initialize the superclass fields

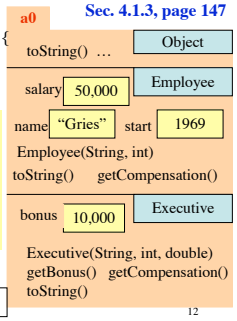
super. means that the function in the superclass will be called.

Calling a superclass constructor from the subclass constructor **Sec. 4.1.3, page 147**

```
public class Executive extends Employee {
    private double bonus;
    /** Constructor: name n, year hired
          d, salary 50,000, bonus b */
    public Executive(String n, int d, double b) {
        super(n, d);
        bonus= b;
    }
}
```

The first (and only the first) statement in a constructor can be a call to a constructor of the superclass. If you don't put one in, then this one is automatically used:

```
super();
```



Principle: Fill in superclass fields first.