CS/ENGRD 2110 FALL 2015

Lecture 5: Local vars; Inside-out rule; constructors

http://courses.cs.cornell.edu/cs2110

References to text and JavaSummary.pptx

- Local variable: variable declared in a method body

  B.10–B.11 slide 45

- Inside-out rule, bottom-up/overriding rule C.15 slide 31-32 and consequences thereof slide 45
- Use of **this** B.10 slide 23-24 and **super** C.15 slide 28, 33
- Constructors in a subclass C.9–C.10 slide 24-29
- First statement of a constructor body must be a call on another constructor —if not Java puts in **super();** C.10 slide 29

Homework

Visit course website, click on Resources and then on Code Style Guidelines. Study

- 4.2 Keep methods short
- 4.3 Use statement-comments …
- 4.4 Use returns to simplify method structure
- 4.6 Declare local variables close to first use …

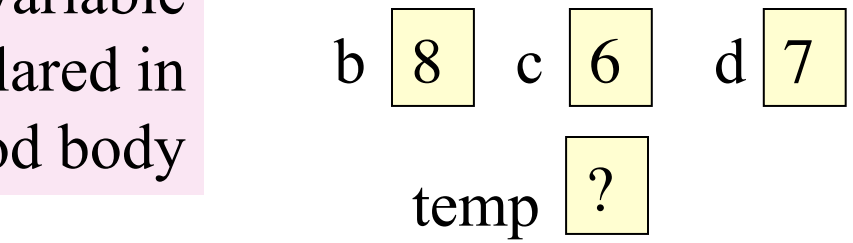
Local variables

middle(8, 6, 7)


```
/** Return middle value of b, c, d (no ordering assumed) */
public static int middle(int b, int c, int d) {
    if (b > c) {
        int temp= b;
        b= c;
        c= temp;
    }
    // { b <= c }
    if (d <= b) {
        return b;
    }
    // { b < d and b <= c }
    return Math.min(c, d);
}
```

Local variable: variable declared in method body

Parameter: variable declared in () of method header



All parameters and local variables are created when a call is executed, *before* the method body is executed. They are destroyed when method body terminates.

Scope of local variables


```
/** Return middle value of b, c, d (no ordering assumed) */
public static int middle(int b, int c, int d) {
    if (b > c) {
        int temp= b;
        b= c;
        c= temp;
    }
    // { b <= c }
    if (d <= b) {
        return b;
    }
    // { b < d and b <= c }
    return Math.min(c, d);
}
```

block

Scope of local variable (where it can be used): from its declaration to the end of the block in which it is declared.

Principle: declaration placement


```
/** Return middle value of b, c, d (no ordering assumed) */
public static int middle(int b, int c, int d) {
    int temp;
    if (b > c) {
        temp= b;
        b= c;
        c= temp;
    }
    // { b <= c }
    if (d <= b) {
        return b;
    }
    // { b < d and b <= c }
    return Math.min(c, d);
}
```

Not good! No need for reader to know about temp except when reading the then-part of the if-statement

Principle: Declare a local variable as close to its first use as possible.

Assertions promote understanding


```
/** Return middle value of b, c, d (no ordering assumed) */
public static int middle(int b, int c, int d) {
    if (b > c) {
        int temp= b;
        b= c;
        c= temp;
    }
    // { b <= c }
    if (d <= b) {
        return b;
    }
    // { b < d and b <= c }
    return Math.min(c, d);
}
```

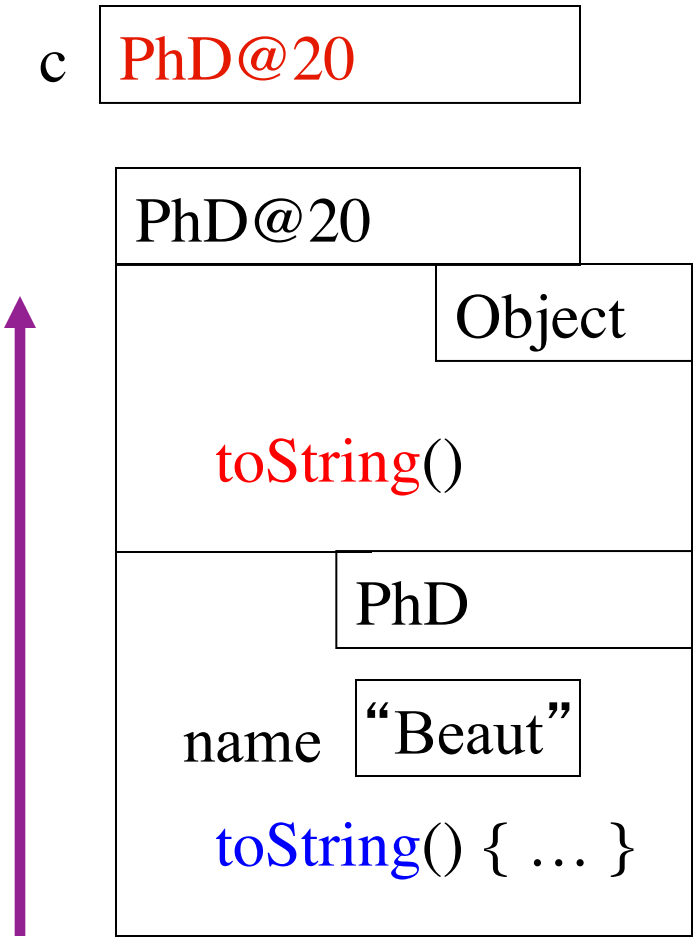
Assertion: Asserting that b <= c at this point. Helps reader understand code below.

Bottom-up/overriding rule

Which method toString() is called by

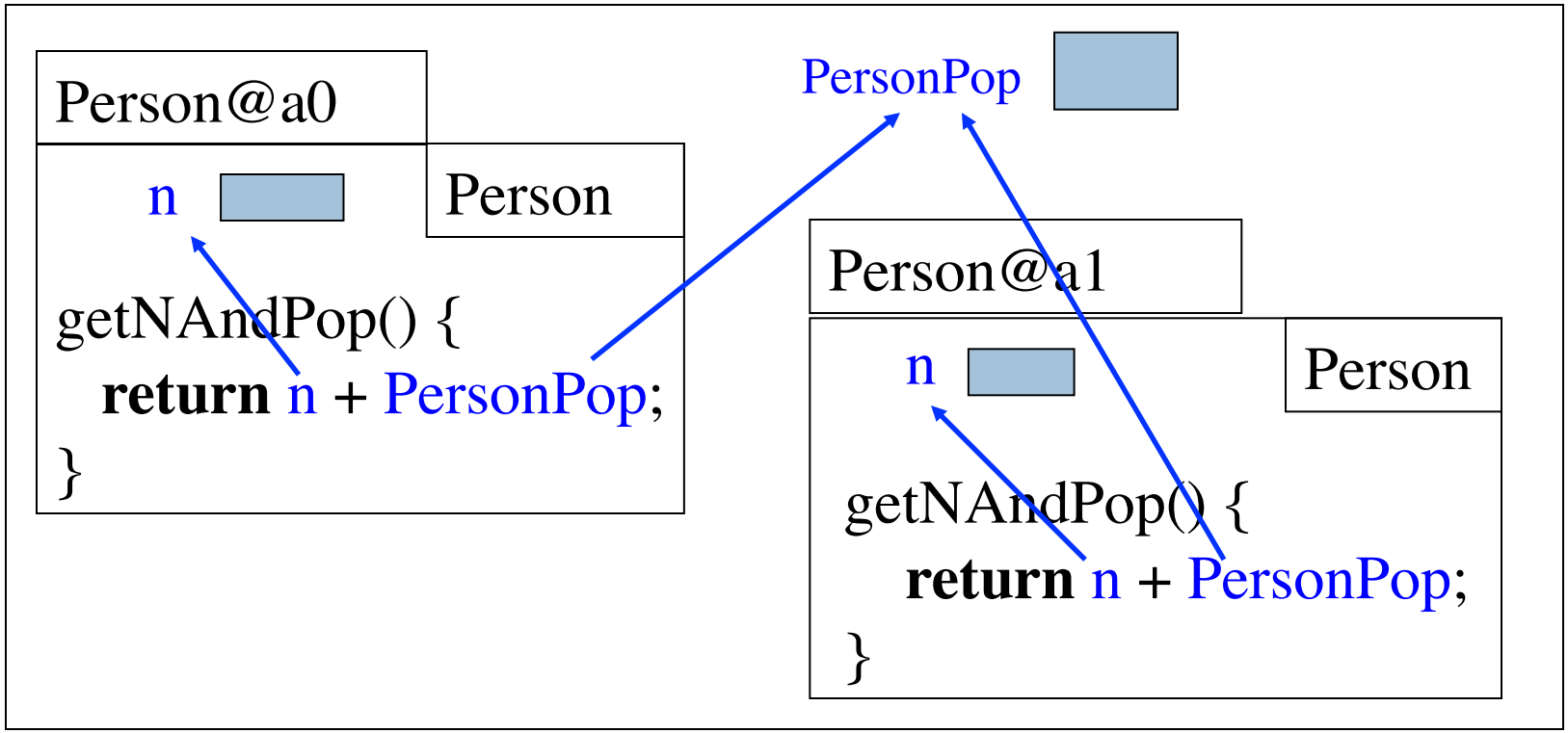
c.toString() ?

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



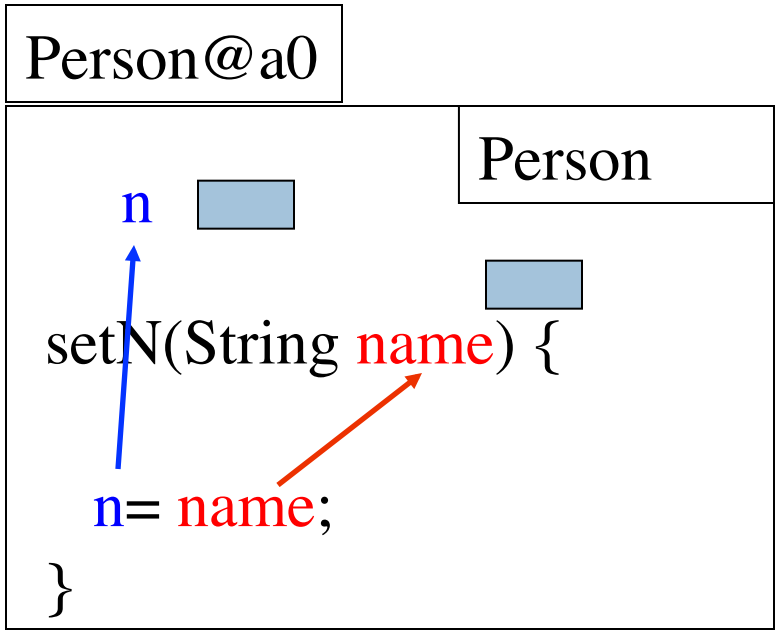
Inside-out rule

Inside-out rule: Code in a construct can reference names declared in that construct, as well as names that appear in enclosing constructs. (If name is declared twice, the closer one prevails.)

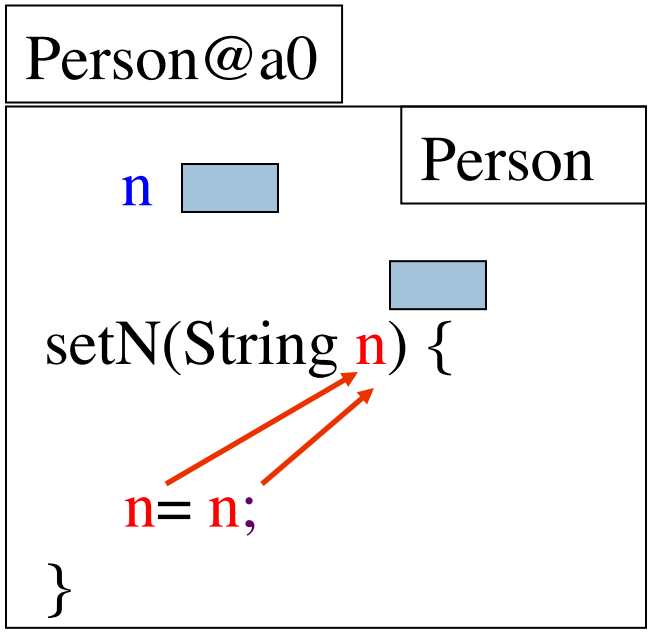


Person's objects and static components

Parameters participate in inside-out rule

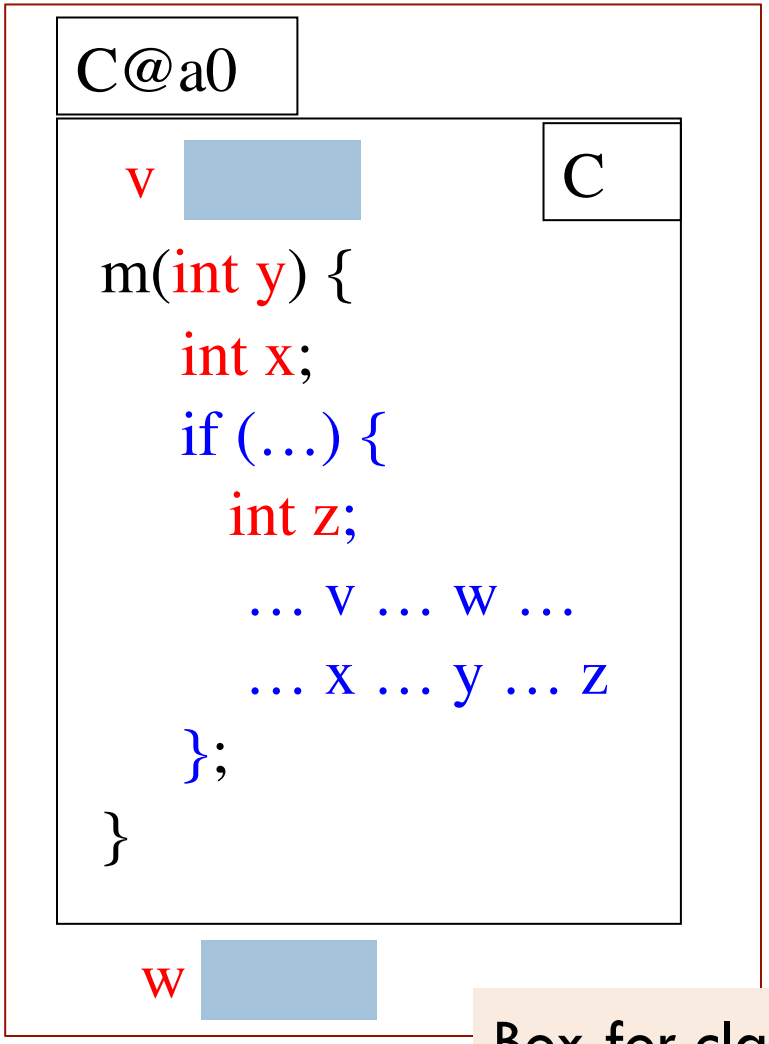


Doesn't work right



Parameter n "blocks" reference to field n.
(n is a "shadowed" variable)

Static items participate in inside-out rule



Variables: static w
field v
parameter y
local variables x and z

To see what declaration each reference v, w, x, y, z refers to, look in inside-out fashion:

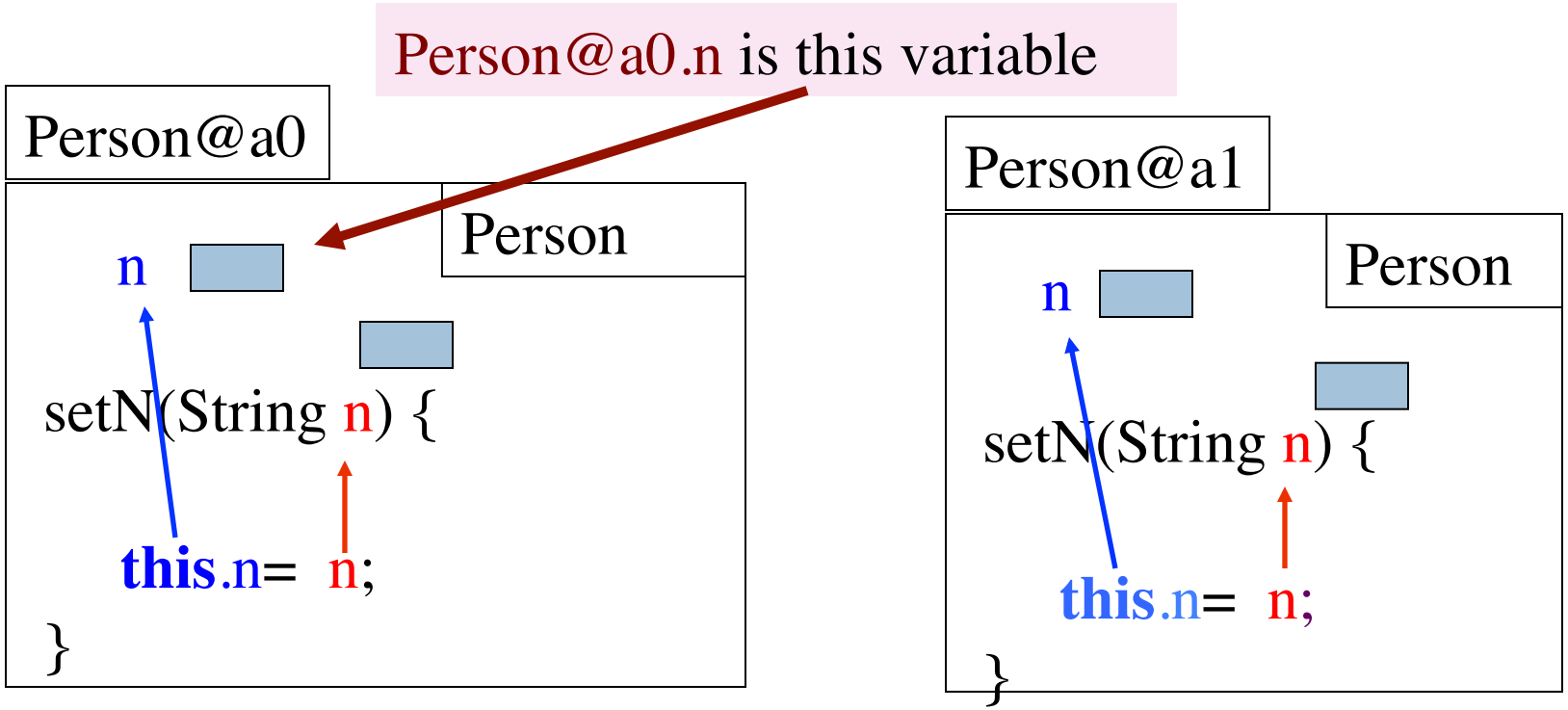
1. then-block
2. method body
3. parameter list
4. fields
5. static variables

A solution: use this

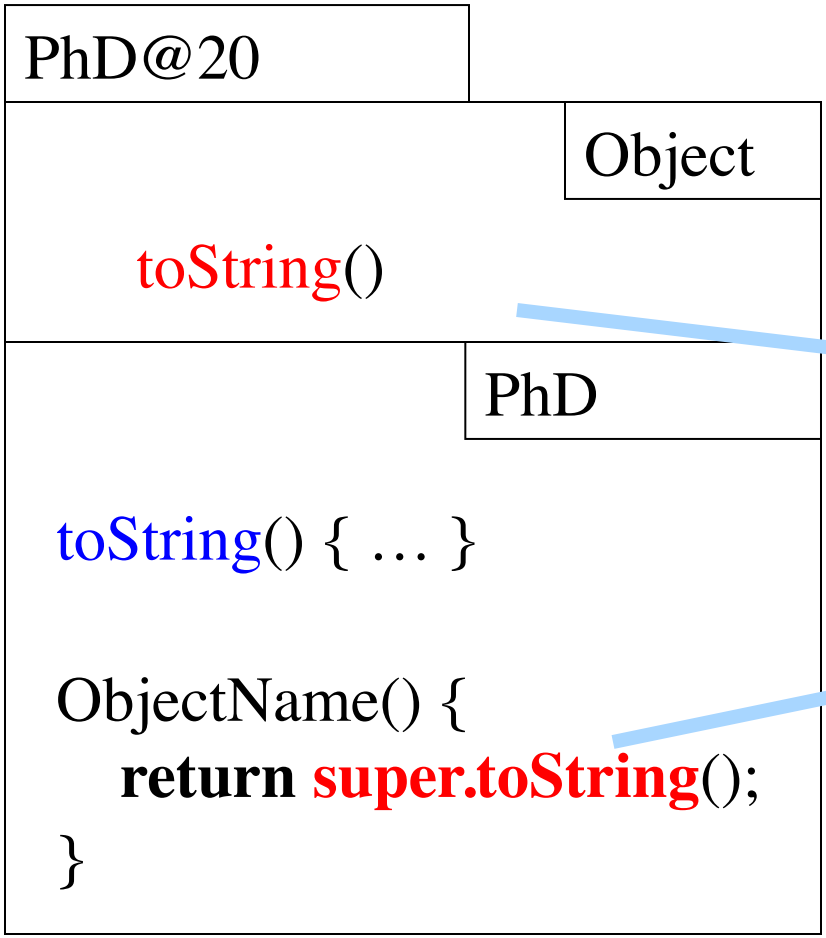
Memorize: Within an object, this evaluates to the name of the object.

In object Person@a0,
this evaluates to Person@a0

In object Person@a1,
this evaluates to Person@a1



About super



Within a subclass object, **super** refers to the partition above the one that contains **super**.

Because of the key-word **super**, this calls toString in the Object partition.

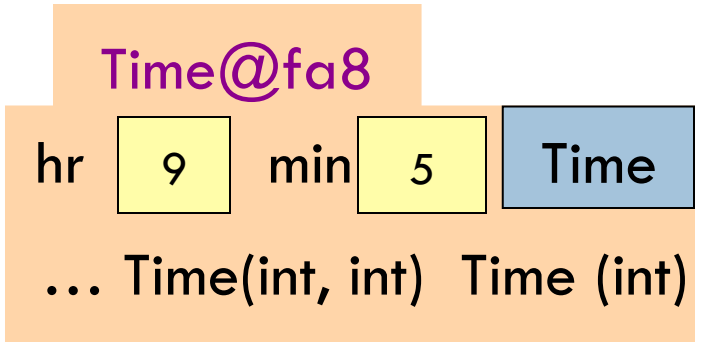
Calling a constructor from a constructor


```
public class Time
    private int hr;    //hour of day, 0..23
    private int min; // minute of hour, 0..59

    /** Constructor: instance with h hours and m minutes */
    public Time(int h, int m) { …}

    /** Constructor: instance with m minutes … */
    public Time(int m) {
        hr    = m / 60;
        min = m % 60;
    }
    …
}
```

Want to change body to call first constructor

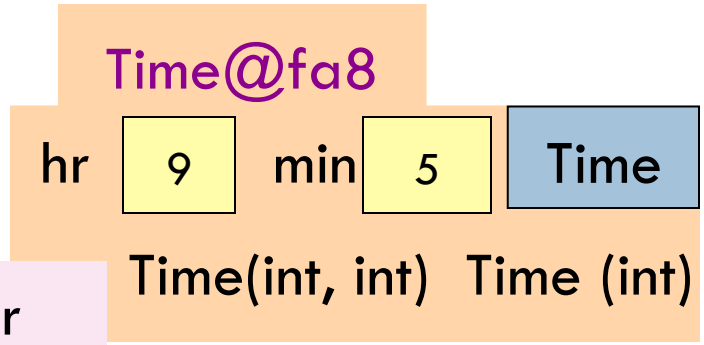


Calling a constructor from a constructor


```
public class Time
    private int hr;    //hour of day, 0..23
    private int min; // minute of hour, 0..59

    /** Constructor: instance with h hours and m minutes … */
    public Time(int h, int m) { …}

    /** Constructor: instance with m minutes … */
    public Time(int m) {
        this(m / 60, m % 60);
    }
```



Use **this** (Instead of Time) to call another constructor in the class.

Must be first statement in constructor body!

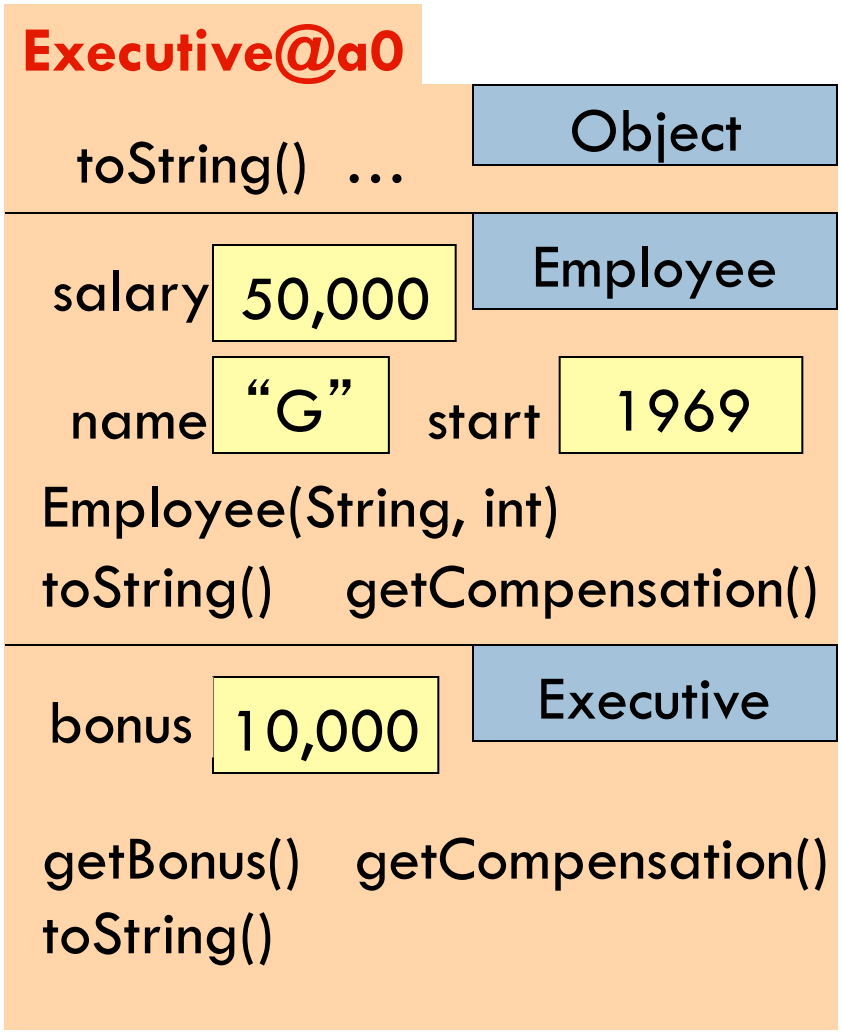
Principle: Initialize superclass fields first

Class Employee contains info that is common to all employees — name, start date, salary, etc.

getCompensation gives the salary

Executives also get a bonus. getCompensation is overridden to take this into account

Could have other subclasses for part-timers, temporary workers, consultants, etc., each with a different getCompensation



Without OO …

Without OO, you would write a long involved method:

```
public double getCompensation(…) {
  if (worker is an executive)
    { … }
  else if (worker is part time)
    { … }
  else if (worker is temporary)
    { … }
  else …
```

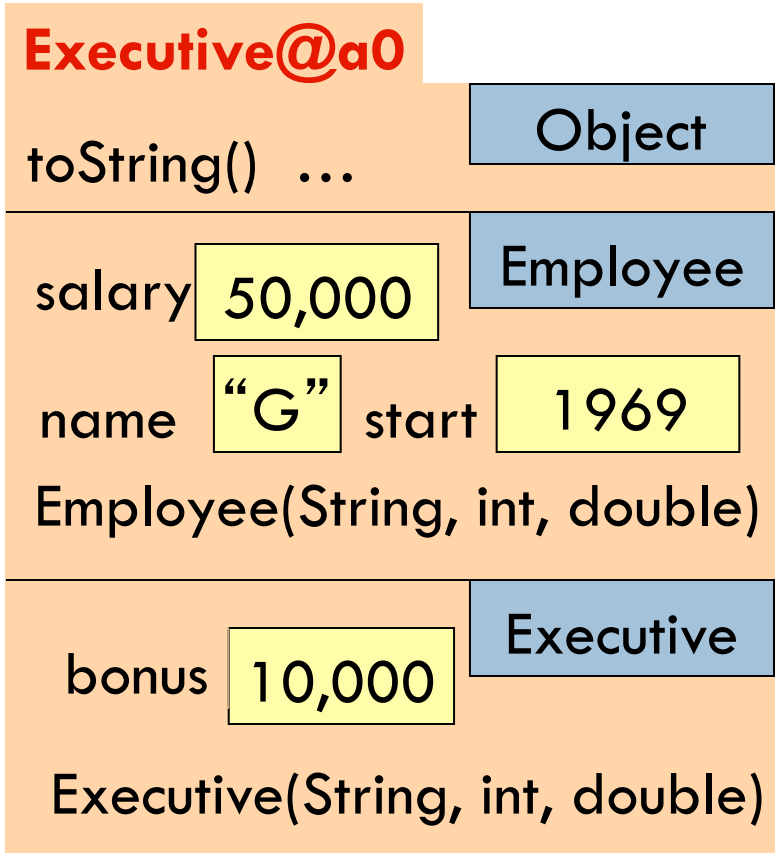
OO eliminates need for many of these long, convoluted methods, which are hard to maintain.

Instead, each subclass has its own getCompensation.

End up with many more methods, which are usually very short

Principle: initialize superclass fields first


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



Principle: initialize superclass fields first

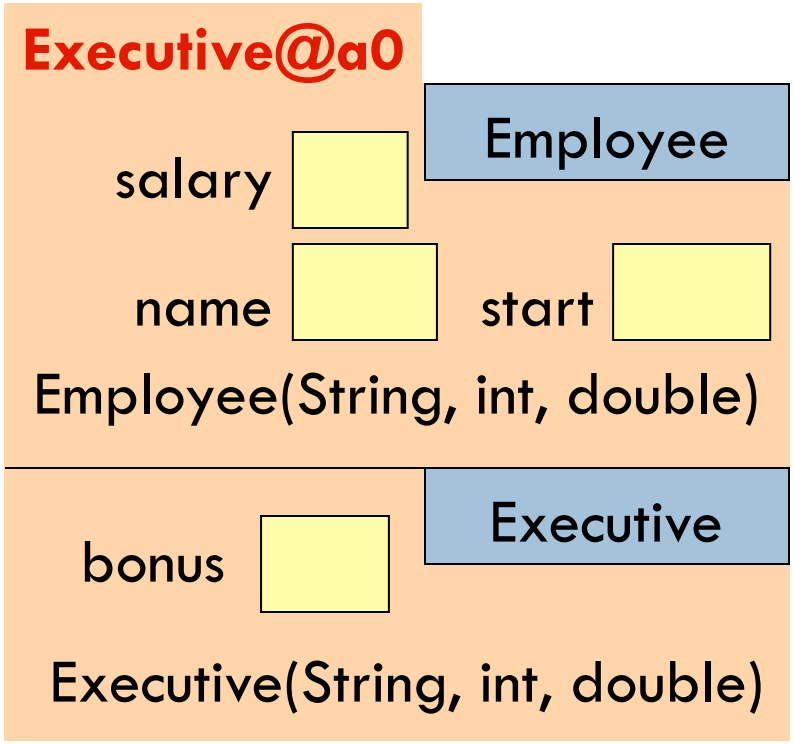

```
/** Constructor: employee with name n, year hired d, salary s */
public Employee(String n, int d, double s)

/** Constructor: executive with name n, year hired d, salary of
                 $50,000, bonus b */
public Executive(String n, int d,
                 double b)
```

Principle: **In subclass constructor, fill in the superclass fields first**

How to do that if they are private?

Call constructor in superclass

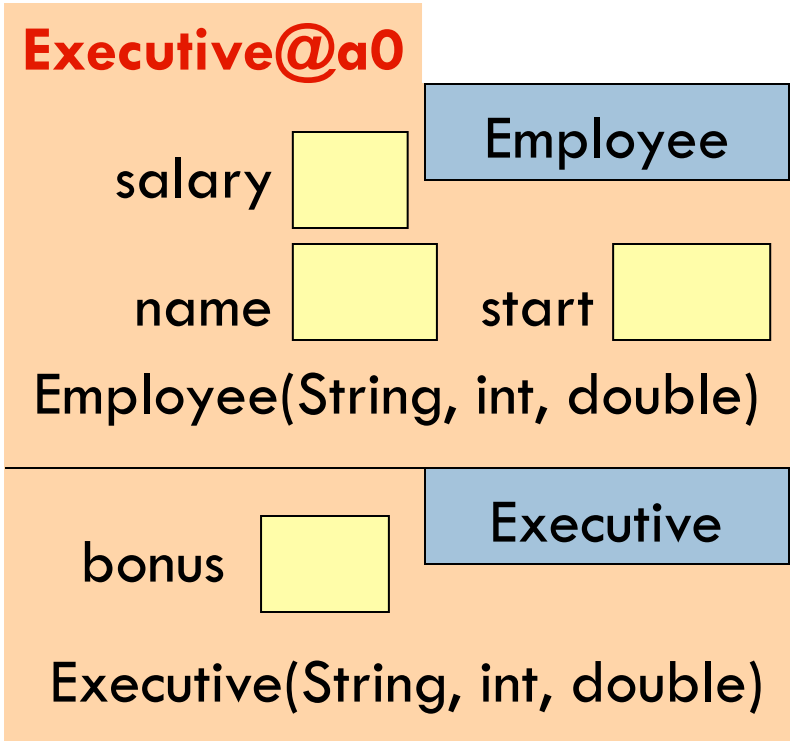


Principle: initialize superclass fields first


```
/** Constructor: employee with name n, year hired d, salary s */
public Employee(String n, int d, double s)

/** Constructor: executive with name n, year hired d, salary of
                 $50,000, bonus b */
public Executive(String n, int d,
                 double b) {
        super
    Employee(n, d, 50000);
    bonus= b;
}
```

To call a superclass constructor, use **super(…)**



Principle: initialize superclass fields first


```
/** Constructor: an instance with …*/
public C (…) {
    super();
    S0;
    S1;
    …
}
```

Java syntax: First statement of any constructor you write must be a call on another constructor

this(…); or **super**(…);

If you don't put one in, Java silently inserts this one:

super();