1

CS/ENGRD 2110 SPRING 2014

Lecture 5: Local vars; Inside-out rule; constructors
http://courses.cs.cornell.edu/cs2110

References to text and JavaSummary.pptx

2

- 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

3

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)

4

```
/** 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

b 8 c 6 d 7

temp ?

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 variable

5

```
/** 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 about placement of declaration

6

```
/** 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

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);
}
```

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

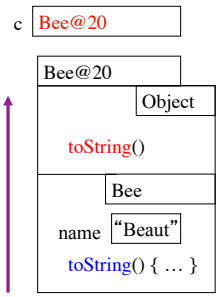
Bottom-up/overriding rule

8

Which method toString() is called by

c.toString() ?

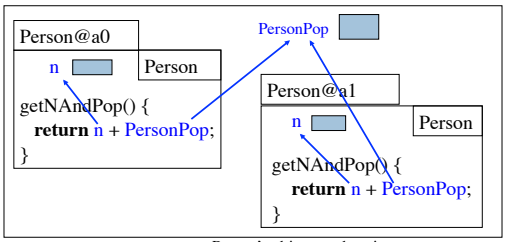
Overriding rule or **bottom-up rule:**
To find out which is used, start at the bottom of the object and search upward until a matching one is found.



Inside-out rule

9

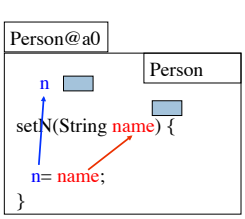
Inside-out rule: Code in a construct can reference any names declared in that construct, as well as names that appear in enclosing constructs. (If name is declared twice, the closer one prevails.)



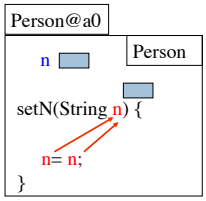
Person's objects and static components

Parameters participate in inside-out rule

10



Doesn't work right



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

A solution: use **this**

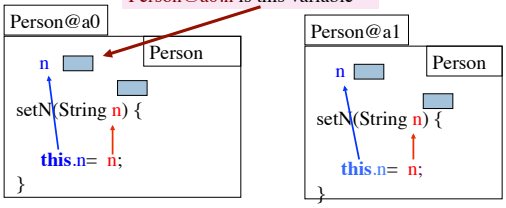
11

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

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

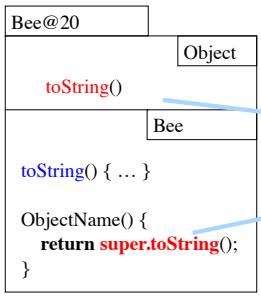
In object Person@a1, **this** evaluates to Person@a1

Person@a0.n is this variable



About **super**

12



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

13

```
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

Time@fa8
hr 9 min 5 Time
… Time(int, int) Time (int)

Calling a constructor from a constructor

14

```
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);
   }
```

Time@fa8
hr 9 min 5 Time
Time(int, int) Time (int)

Use **this** (Instead of Time) to call another constructor in the class.
Must be first statement in constructor body!

Initialize superclass fields first

15

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

Executive@a0
Object
toString() …
Employee
salary 50,000
name "G" start 1969
Employee(String, int)
toString() getCompensation()
Executive
bonus 10,000
getBonus() getCompensation()
toString()

Without OO …

16

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

17

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

Executive@a0
Object
toString() …
Employee
salary 50,000
name "G" start 1969
Employee(String, int, double)
Executive
bonus 10,000
Executive(String, int, double)

Principle: initialize superclass fields first

18

```
/** 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

Executive@a0
Employee
salary
name start
Employee(String, int, double)
Executive
bonus
Executive(String, int, double)

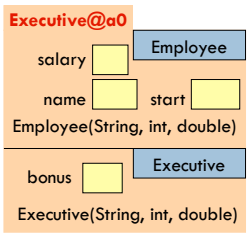
Principle: initialize superclass fields first

19

```
/** 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

20

```
/** 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();