CS/ENGRD 2110 SPRING 2017

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

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

Announcements

1. Writing tests to check that the code works when the precondition is satisfied is **not optional.**
2. Writing assertions to verify the precondition is satisfied is **not optional**, and if you do so incorrectly you will lose points.
3. Writing tests to verify that you have done (2) correctly **is optiona**l. Piazza note @129 tells you how.
4. Watch the loop invariant tutorials before next week's recitation. They are linked from the Lecture Notes page.

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 a, b, c (no ordering assumed) */
public static int middle(int a, int b, int c) {
    if (b > c) {
        int temp= b;
        b= c;
        c= temp;
    }

    if (a <= b) {
        return b;
    }

    return Math.min(a, c);
}
```

Parameter: variable declared in () of method header

Local variable: variable declared in method body

a 8 b 6 c 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.

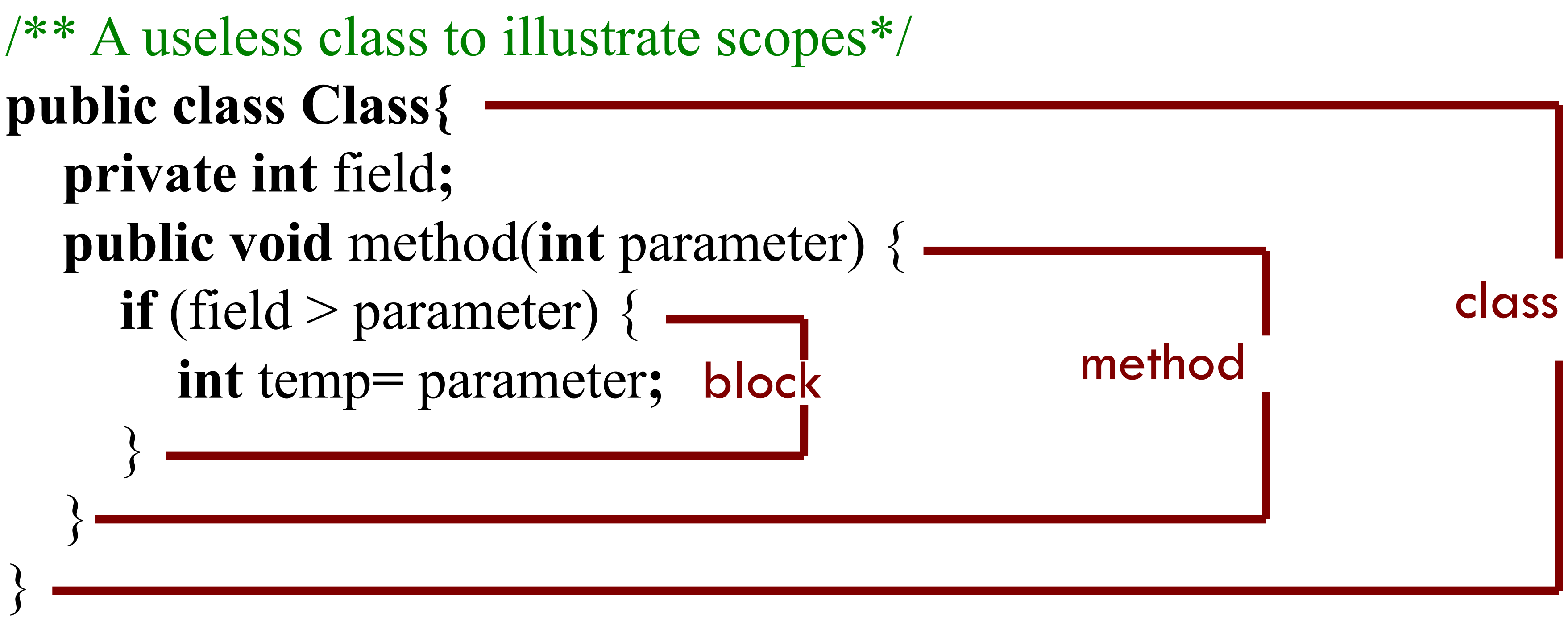
Scope of local variables

```
/** Return middle value of a, b, c (no ordering assumed) */
public static int middle(int a, int b, int c) {
    if (b > c) {
        int temp= b;
        b= c;                        block
        c= temp;
    }

    if (a <= b) {
        return b;
    }

    return Math.min(a, c);
}
```

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

Scope In General: 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.)



```
/** A useless class to illustrate scopes*/
public class Class{
   private int field;
   public void method(int parameter) {
      if (field > parameter) {
         int temp= parameter;
      }
   }
}
```

Principle: declaration placement

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

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 a, b, c (no ordering assumed) */
public static int middle(int a, int b, int c) {
    if (b > c) {
        int temp= b;
        b= c;
        c= temp;
    }
    // b <= c
    if (a <= b) {
        return b;
    }
    // a and c are both greater than b
    return Math.min(a, c);
}
```

write assert to check our assumptions

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

Poll time! What 3 numbers are printed?

```
public class ScopeQuiz {
  private int a;

  public ScopeQuiz(int b) {
    System.out.println(a);
    int a = b + 1;
    this.a = a;
    System.out.println(a);
    a = a + 1;
  }

  public static void main(String[] args) {
    int a = 5;
    ScopeQuiz s = new ScopeQuiz(a);
    System.out.println(s.a);
  }
}
```

0, 6, 6

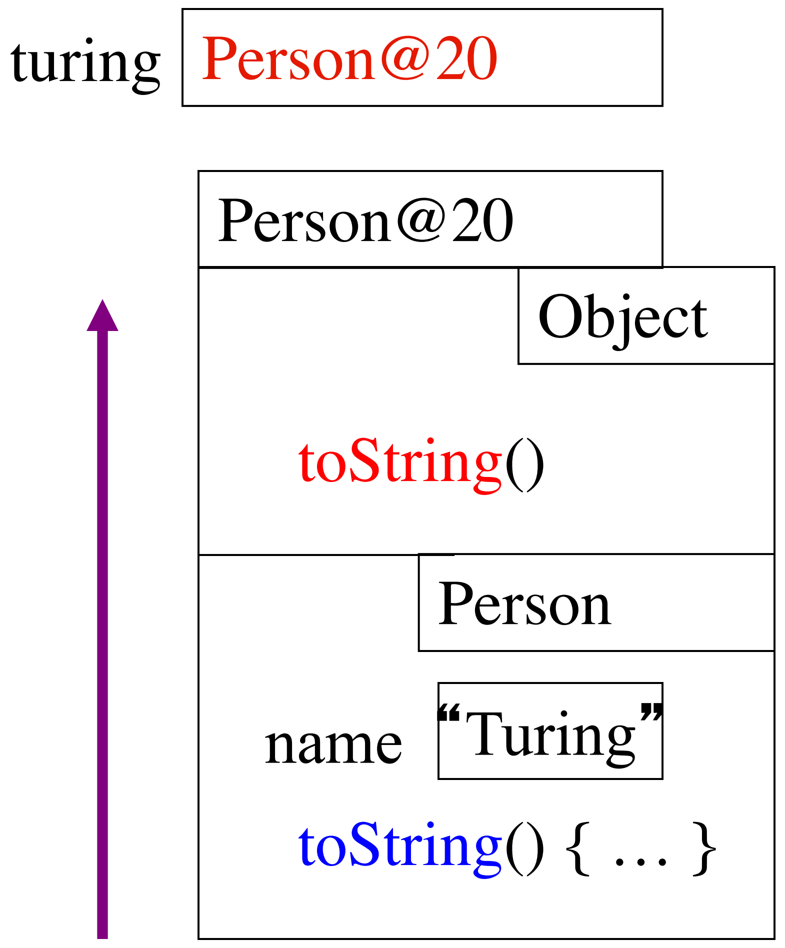
here a is the local variable

Bottom-up/overriding rule

Which method toString() is called by

turing.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.



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) { hr = h; min = m; assert …; }

    /** 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) { hr = h; min = m; assert …; }

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

   .
}
```

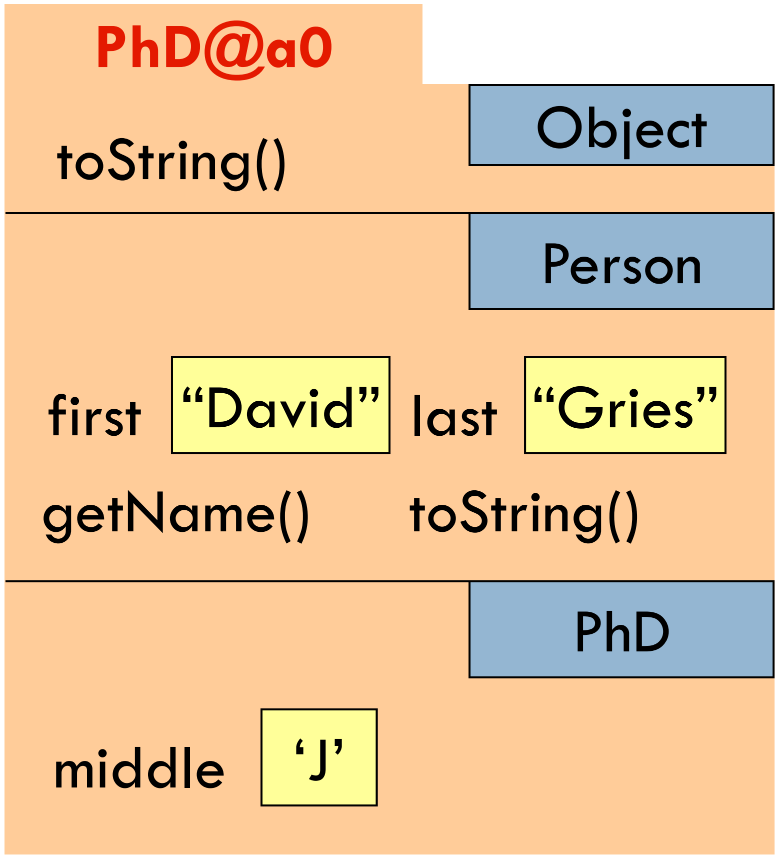
Use **this** (*not* Time) to call another constructor in the class.
Must be first statement in constructor body!

Constructing with a Superclass

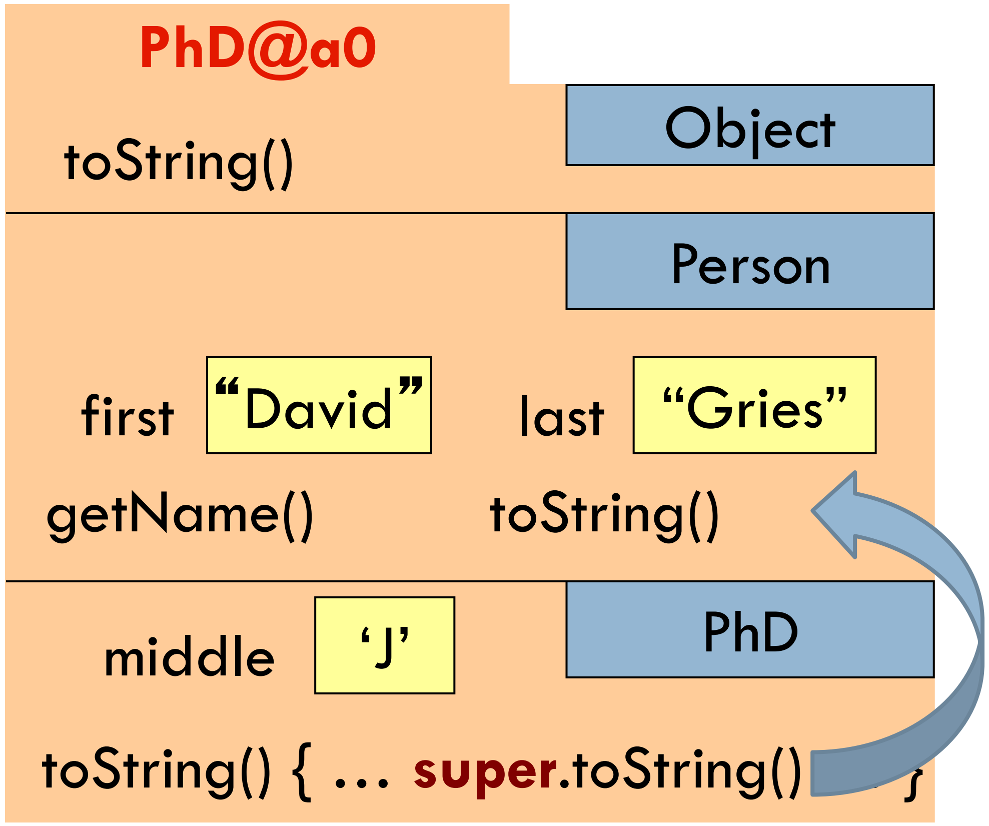
```
/** Constructor: person “f n” */
public Person(String f, String l) {
    first= n;
    last= l;
}

/** Constructor: PhD “Dr. f m. l”*/
public PhD(String f, char m, String l) {
    super(f, l);
    middle= m;
}

new PhD(“David”, ‘J’, “Gries”);
```

Use **super** (*not* Person) to call superclass constructor.

Must be first statement in constructor body!



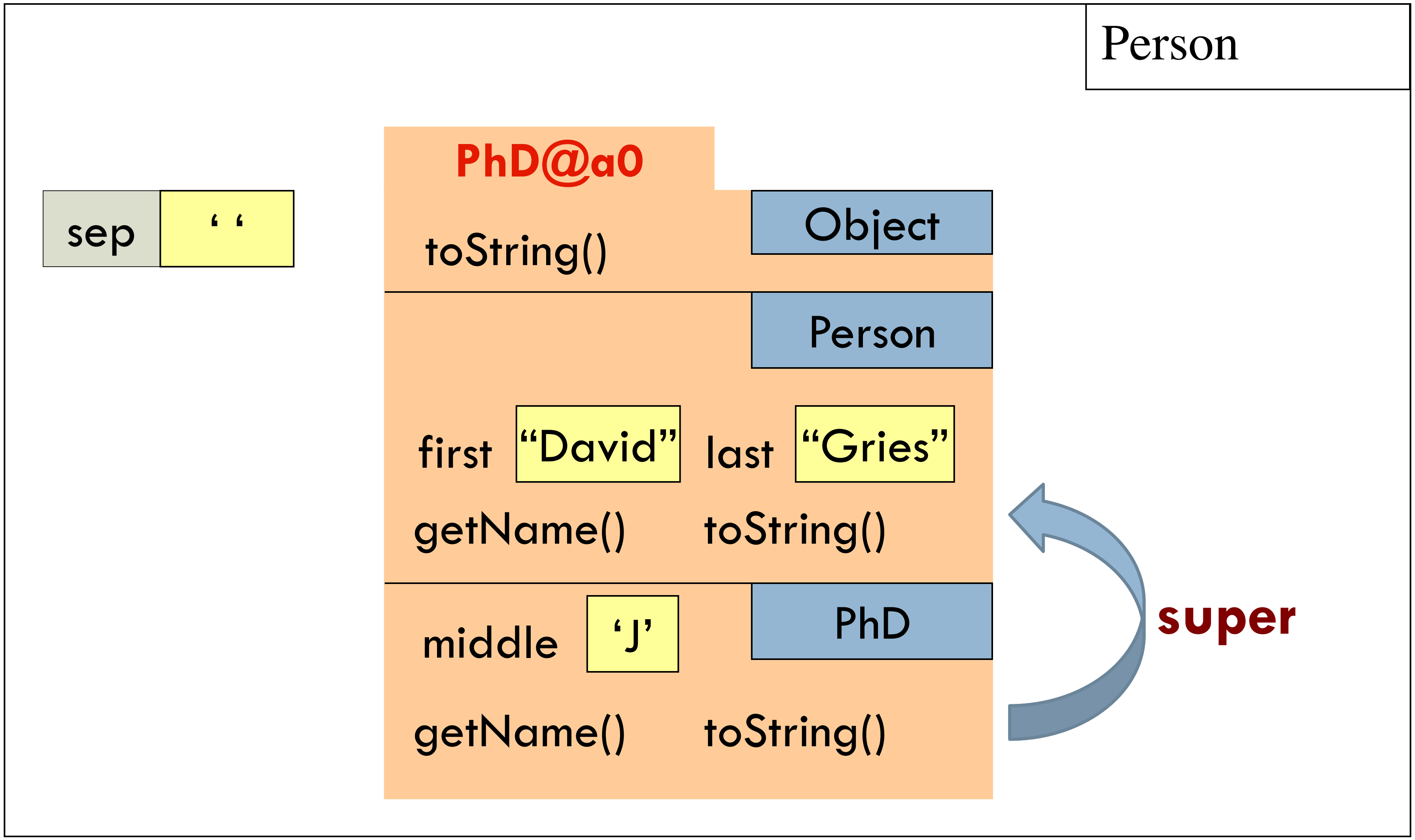
About **super**



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

Because of keyword **super**, the call toString here refers to the Person partition.

Bottom-Up and Inside-Out



Without OO …

Without OO, you would write a long involved method:

```
public double getName(Person p) {
  if (p is a PhD)
    { … }
  else if (p is a GradStudent)
    { … }
  else if (p prefers anonymity)
    { … }
  else …
}
```

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

Instead, each subclass has its own getName.

Results in many overriding method implementations, each of which is usually very short