CS/ENGRD 2110
FALL 2018

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

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

Announcements

- A1 is due tomorrow

  If you are working with a partner: form a group on CMS & submit **once**

- A2 is out. Remember to get started early!

  Because of Jewish holidays, the due date for A2 has been changed to Sunday, 16 September.

  ONLY TWO DAYS OF LATENESS ALLOWED.

  Last day to submit is 18 September.

- Next week's recitation is on testing. No tutorial/quiz this week!

Example Constructor: Person Class


```
public class Person {
    private String firstName; //cannot be null
    private String lastName;

    /** Create a person with the given names. */
    public Person(String f, String l) {
        assert f != null;
        firstName= f;
        lastName= l;
    }
}
```

Constructor:
Initializes fields to make class invariants true

JavaHyperText
Filter:
constructor

HERE is a summary of all important points concerning constructors: pdf file.

Adding a Middle Name Option (v1)


```
public class Person {
    private String firstName; //cannot be null
    private String middleName;
    private String lastName;

    public Person(String f, String l) {
        assert f != null;
        firstName= f;
        lastName= l;
    }

    public Person(String f, String m, String l) {
        assert f != null;
        firstName= f;
        middleName= m;
        lastName= l;
    }
```

Want to change body to call first constructor

Adding a Middle Name Option (v2)


```
public class Person {
    private String firstName; //cannot be null
    private String middleName;
    private String lastName;

    public Person(String f, String l) {
        assert f != null;
        firstName= f;
        lastName= l;
    }

    public Person(String f, String m, String l) {
        this(f, l);
        middleName= m;
    }
}
```

Use **this** (*not* Person) to call another constructor in the class.

Must be first statement in constructor body!

Too Busy for Constructors? Java makes one!


```
public class Person {
    private String firstName; //cannot be null
    private String lastName;

    public Person() { };


    public String toString() {
        return firstName + " " + lastName;}
}

Person p= new Person();
```

Wow, every class has an empty Constructor?


```
public class Person {
    private String firstName; //not null
    private String middleName;
    private String lastName;
    public Person(String f, String l) {
        assert f != null;
        firstName= f;
        lastName= l;
    }
    public Person(String f, String m,
        this(f, l);
        middleName= m;
    }
}

Person p= new Person();
```

Nope!

Syntax Error: No constructor in Person matches this invocation

Arguments: ()

Expected return type: Person

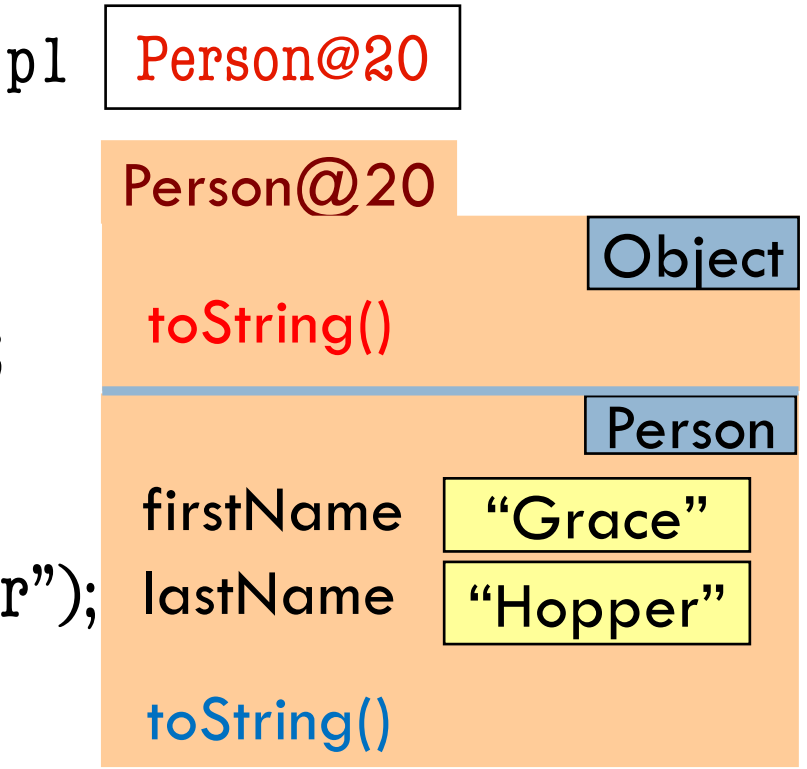
Candidate signatures:

Person(String, String)

Person(String, String, String)

Which toString is called?


```
public class Person {
    private String firstName;
    private String lastName;

    public Person(String f, String l) {
        assert f != null;
        firstName= f; lastName= l;
    }
    public String toString() {
         return firstName + " " + lastName;
    }
}

Person p1= new Person("Grace", "Hopper");

p1.toString();
```

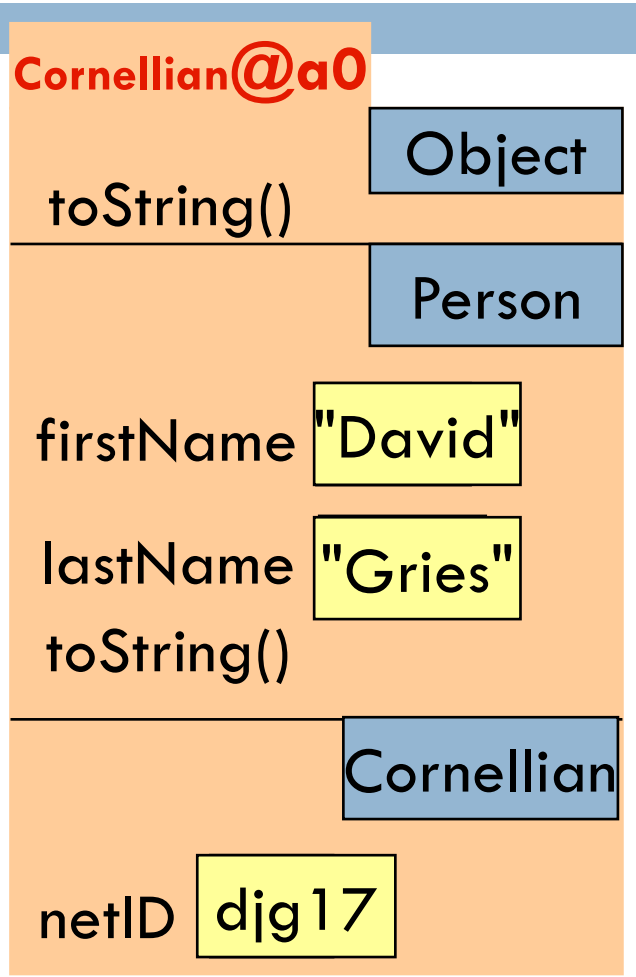


Constructing with a Superclass


```
public class Cornellian extends Person {
   private String netID;


   /** Constructor: Person with a netID. */
   public Cornellian(String f, String l, String id) {
      super(f, l);
      netID= id;
   }

}
```

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

Must be first statement in constructor body!




```
new Cornellian("David", "Gries", “djg17”);
```

Not Feeling Super? Java thinks you are!

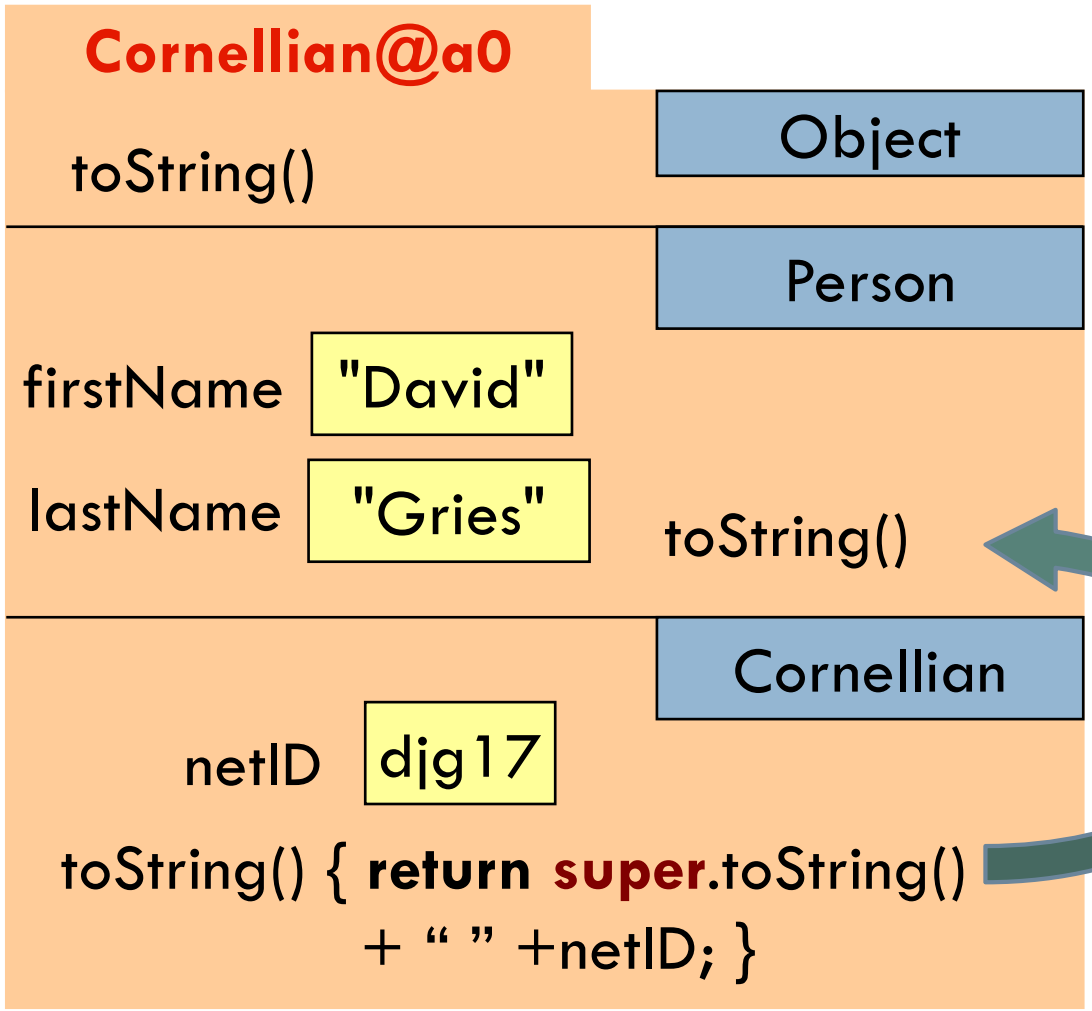

```
public class Cornellian extends Person {
   private String netID;


   /** Constructor: Person with a netID. */
   public Cornellian(String f, String l, String id) {
      super();
      netID= id;
   }

}
```

If first statement in constructor body is not a constructor call, Java inserts super(); for you!

👍 or 👎 ?

```
new Cornellian("David", "Gries", “djg17”);
```

More 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.

Without OO …

Without OO, you would write a long involved method:

```
public double getName(Person p) {
  if (p is a CornellUndergrad)
    { … }
  else if (p is a CornellFaculty)
    { … }
  else if (p prefers Cornellian)
    { … }
  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

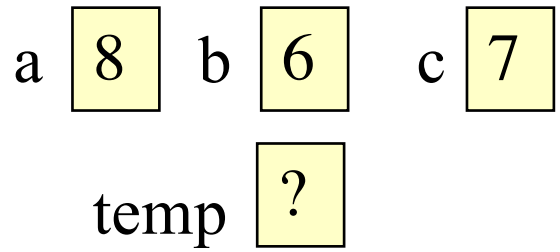
Local variables

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);
}
```

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 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);
}
```

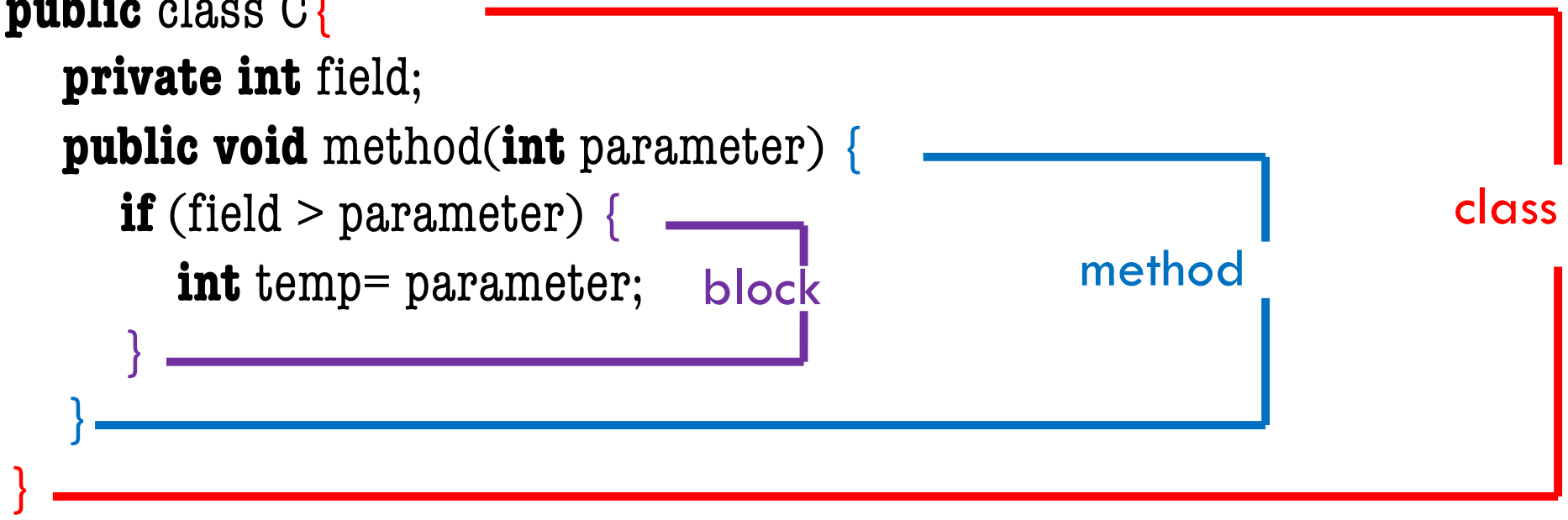
block

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 C{
   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.

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);
  }
}
```

A: 5, 6, 6
B: 0, 6, 6
C: 6, 6, 6
D: 0, 6, 0