# CS/ENGRD 2110 SPRING 2019

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

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

# Announcements



- A1 is due Thursday

  If you are working with a partner: form a group **well before submitting** on CMS. After forming group, **only one** you needs to submit.

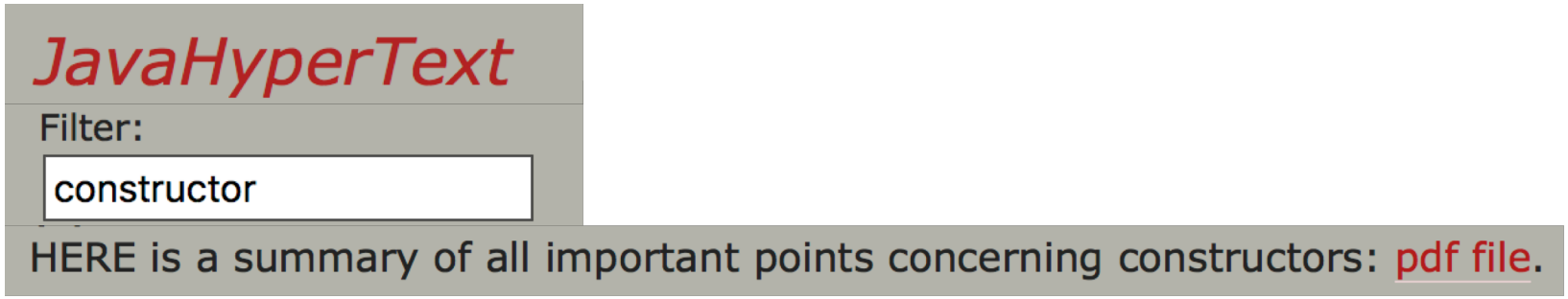
- This week's recitation is on testing. No tutorial/quiz this week.
- A2 is out now

# Today's Topics



- Scope, local variables, inside-out rule
- Overloading, bottom-up rule
- Constructors, this, default, super

All searchable in JHT!



# Local Variables

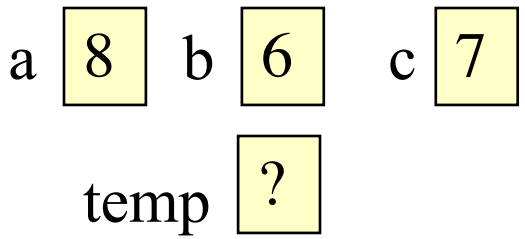
middle(8, 6, 7)



```
/** 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 limited in **scope**…

# 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);
}
```

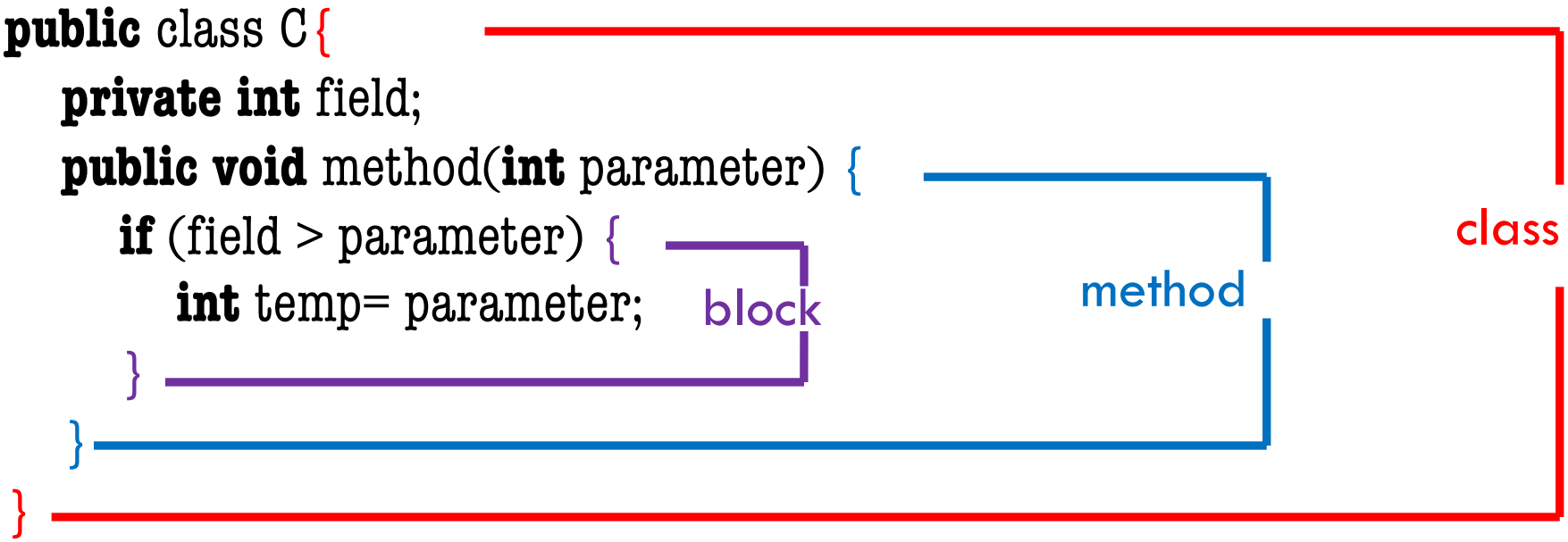
block

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.)



# 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

# Review: Constructor



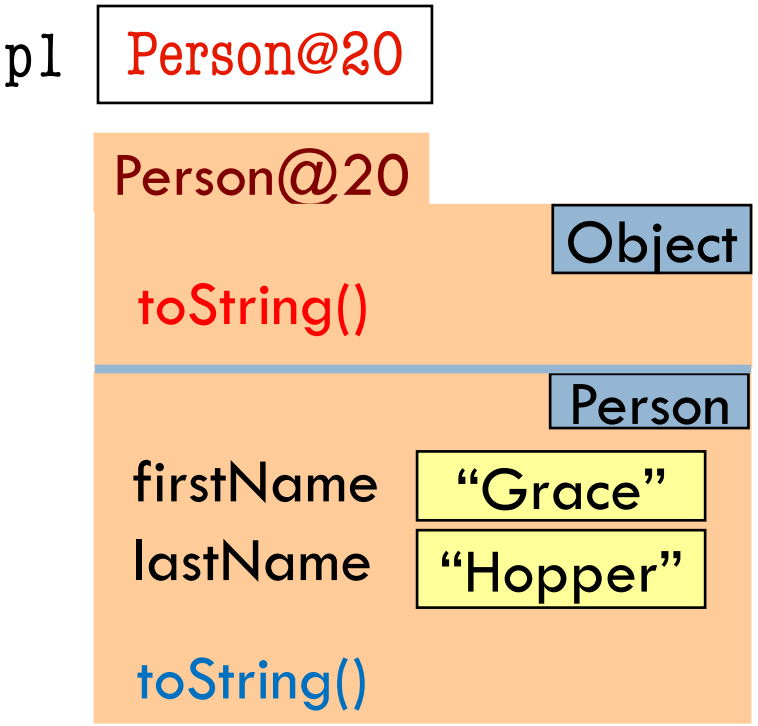
```
public class Person {
    private String firstName; // not null
    private String lastName;

    /** Constructor: a Person with first and last names f, l.
     * Precondition: f is not null. */
    public Person(String f, String l) {
        assert f != null;
        firstName= f;
        lastName= l;
    }
}
```

**Constructor:**
Initialize fields to truthify class invariant

# Review: 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();
```

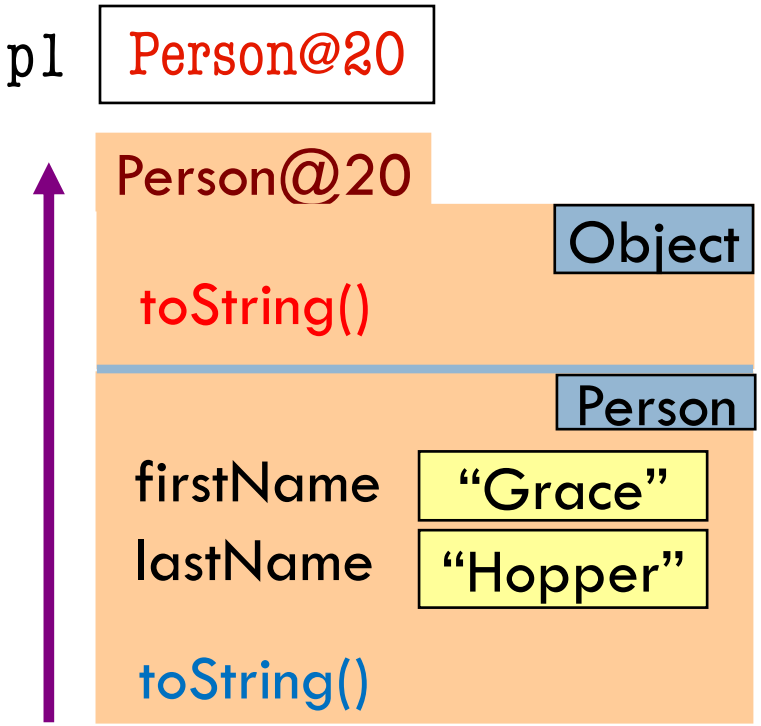


# Which toString : Bottom-up Rule



```
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();
```

Which method is used? Start at bottom of the object and search upward until you find a match.



# Grace Hopper



(1906-1992)
Rear Admiral, US Navy
PhD, Math, Yale, 1934
Pioneering computer programmer
Posthumous Presidential Medal of Freedom (highest civilian honor), 2016

# Grace Hopper: “bug”



9/9

0800 Arctan started
1000 " stopped - arctan ✓
13" sec (032) MP - MC 1.2700 9.037 847 025
9.037 846 995 correct
(033) PRO 2 2.1304764915 4.615925059(-2)
correct 2.1306764915
Relays 6-2 in 033 failed special speed test
in relay " " 10.00 test.
Relays changed
1100 Started Cosine Tape (Sine check)
1525 Started Multy Adder Test.
1545 Relay #70 Panel F
(moth) in relay.

First actual case of bug being found.
1700 closed down.

# Middle Names (v1)



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


Better: reuse first constructor without copying code

# Middle Names (v2)



```
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, 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!

# Default Constructor



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

    public Person() { };
}

Person p= new Person();
```

# Default 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)

# Super Constructor

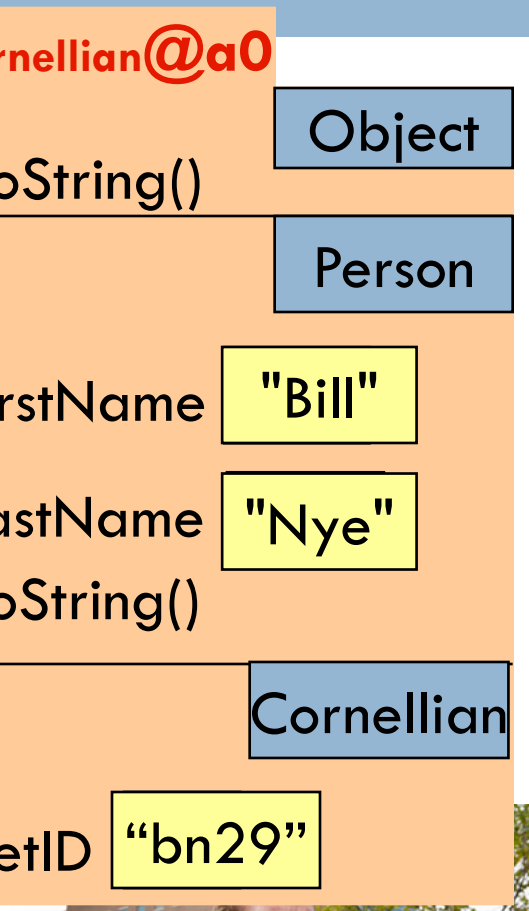


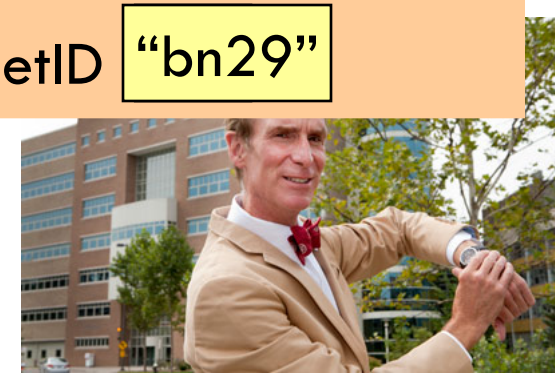
```
public class Cornellian extends Person {
   private String netID;


   /** 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("Bill", "Nye", “bn29”);
```



# Super Constructor



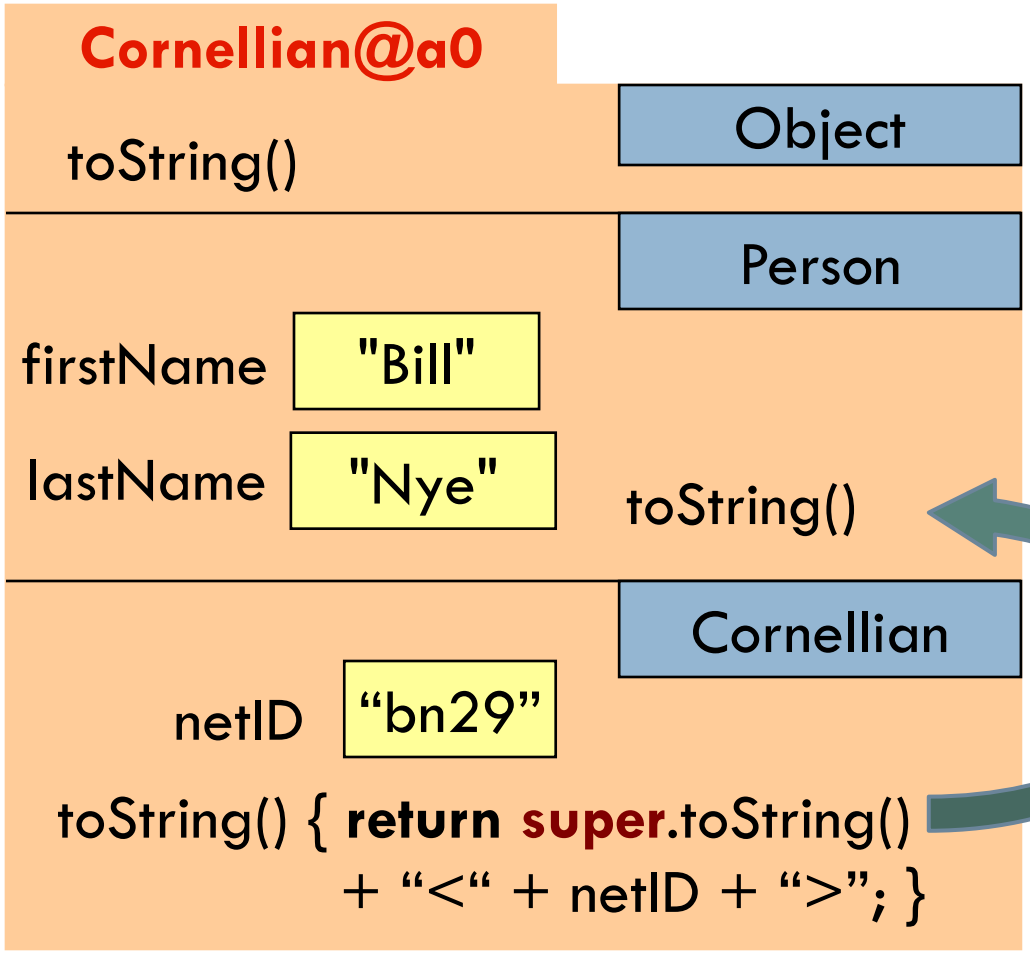
```
public class Cornellian extends Person {
   private String netID;


   /** 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  ?

# 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.

# Grace Hopper