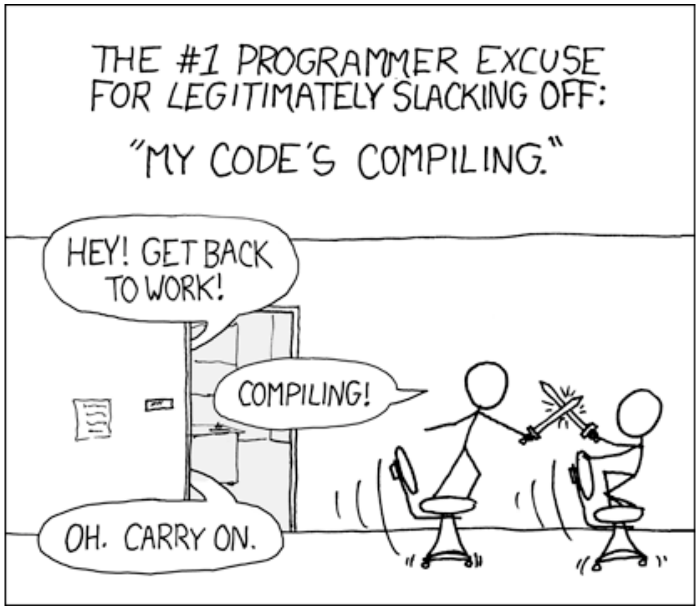
Lecture 4

Classes

Readings for This Lecture

- Section 1.4, 1.5 in text
- Section 3.1 in text
- Plive activities referenced in the text



- Please look at lecture summaries online
  - Handouts are short version
  - Presentation is everything I do in class
- I correct slides after class
  - Fix errors in the slides
  - Clarify confusing points
- Always good to read my slides after class

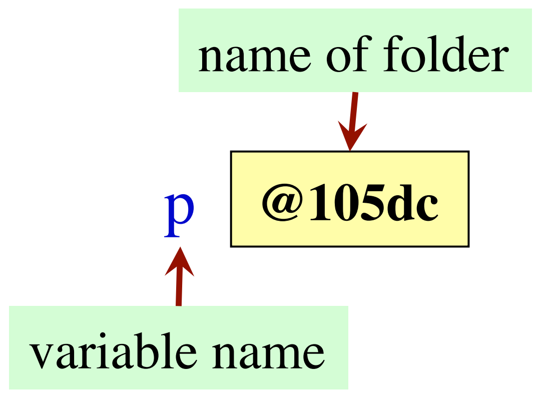
First Assignment Posted Tomorrow

- Due **Tuesday, February 14**
  - Submit earlier so we can start **iterative feedback process**
  - Labs and one-on-ones (next slide) can help you
- Work alone or with **one partner**
  - Partners “group themselves” on the CMS
  - Only one person submits the files.
  - Partners must do the work together, sit next to each other, with each taking turns “driving” (writing the code)
- **Academic Integrity**
  - Never look at someone’s code or show yours to someone else
  - Never possess someone else’s code (except your partner)

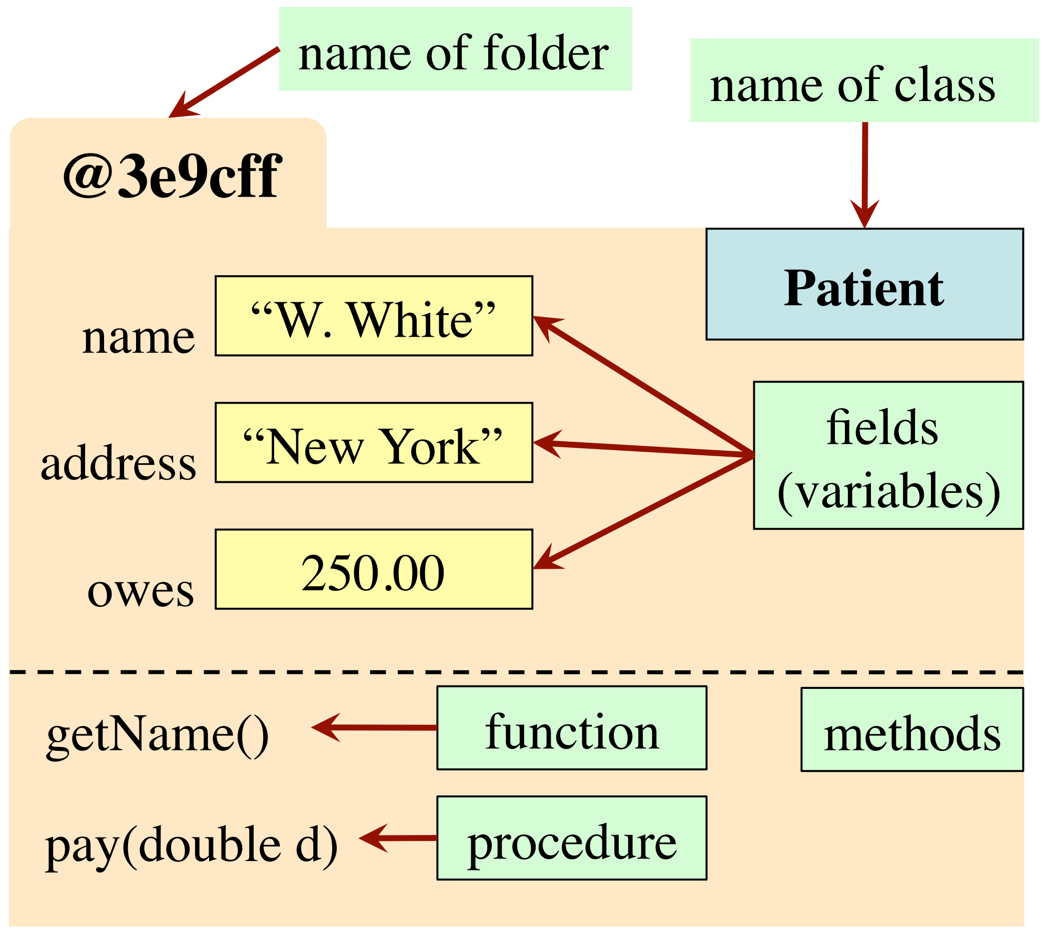
One-on-One Sessions

- Starting Monday: 1/2-hour one-on-one sessions
  - Bring computer and work with instructor, TA or consultant
  - Hands on exercise to covering Classes to see what you understand and give you help
  - Like assignment, but **not for help on assignment itself**
- **Limited availability: we cannot get to everyone**
  - **Students with experience or confidence should hold back**
- Sign up online in CMS: first come, first served
  - Choose assignment One-on-One
  - Pick a time that works for you; will add slots as possible

Extended Review From Last Time

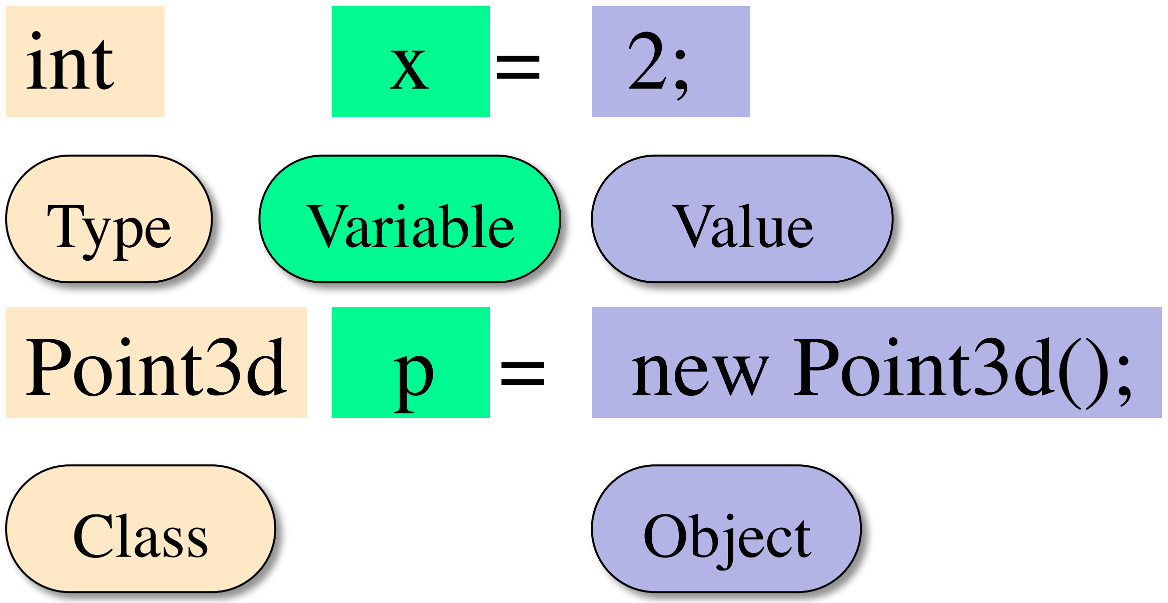


- p.getName()
  - Has value “W. White”
  - **Function**; gives value
- p.pay(250.0);
  - Sets owes to 0
  - **Procedure**;
    it does something



Class versus Object

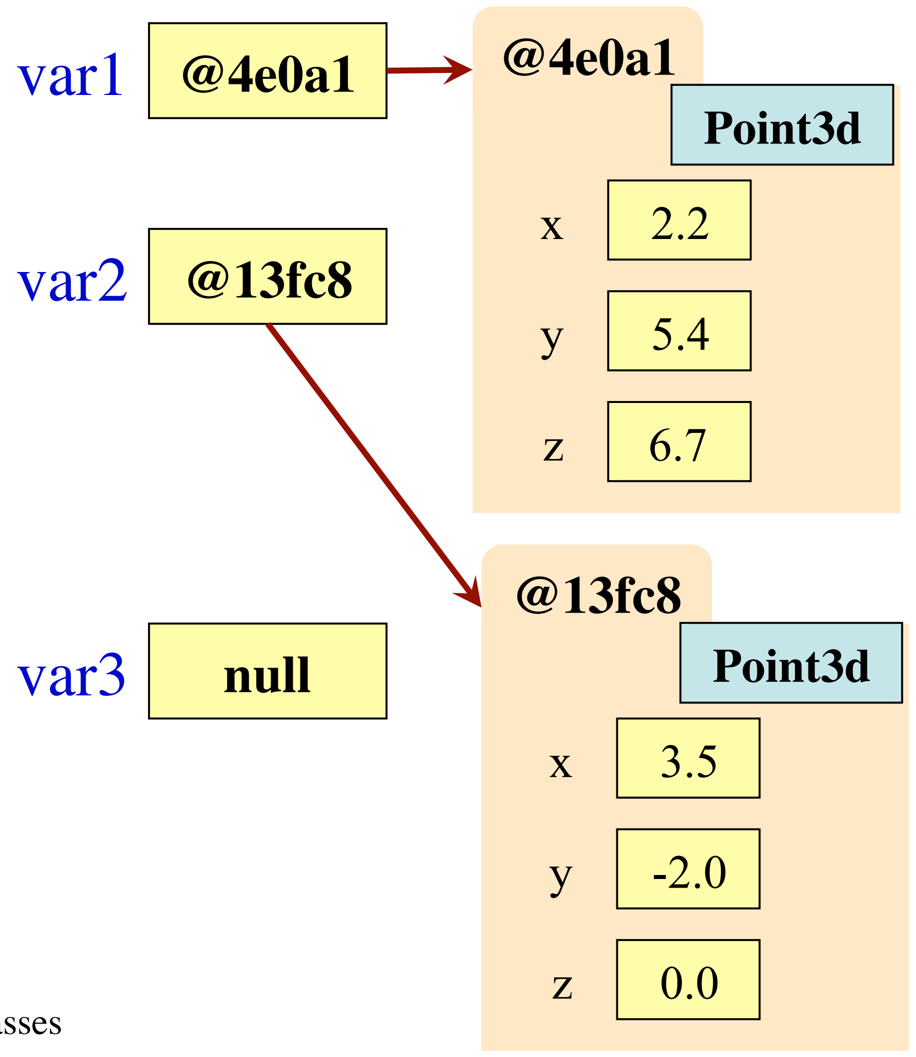
Anatomy of a declaration + assignment statement:



```
int      x = 2;
Point3d  p = new Point3d();
```

The Value `null`

- You can declare a class variable w/o using new
  - Example: Point3d var3;
- Value in variable is **null**
  - **null**: Absence of a name
- var3.getX() gives error!
  - There is no name in var3
  - Does not know which Point3d to access
  - **NullPointerException**



Class Definition

- Describes the format of a folder (instance, object) of the class.

```
/**
 * Description of what the class is for
 */
public class <class-name> {

      declarations of fields and methods (in any order)
}
```

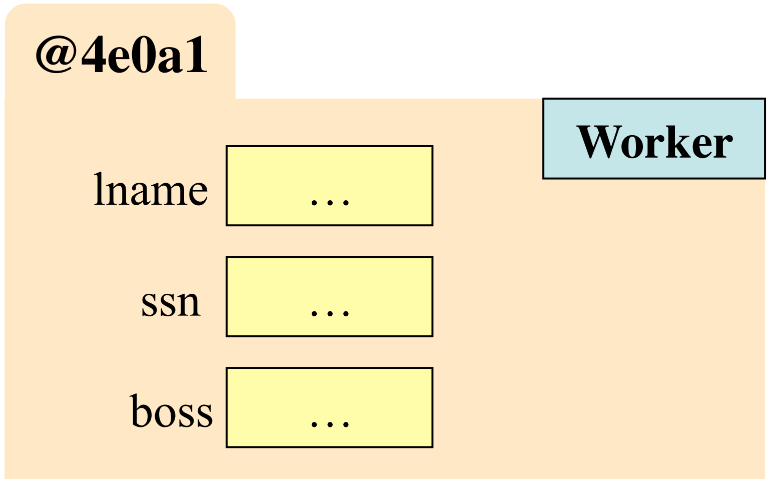
This is a **comment**
It does nothing.
It is a note to yourself

- The class and every method has a comment of the form

  / specification */**

- **This is a Javadoc comment** (Part of Lab next week).

Field: A Variable in each Folder of a Class



Declarations of fields

Invariants: Properties that are always true

```
/** An instance is a worker in a certain organization. */
public class Worker {
        private String lname;    // Last name ("" if none; never null)
        private int ssn;         // Social security #: in 0..999999999
        private Worker boss;     // Immediate boss (null if none)
}
```

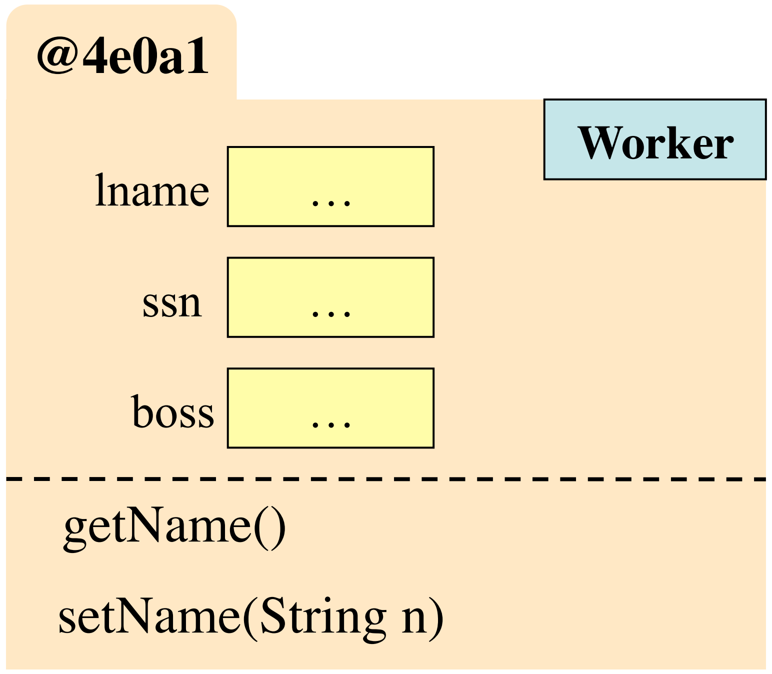
Note the **private** and **public** keywords.
They are important but we will explain them later.

Getter and Setter Methods

```
/** Yields: worker's last name*/
public String getName() {
        return lname;
  }
 /** Set worker's last name to n
   * Cannot be null; can be "" */
public void setName(String n) {
        lname= n;
 }
```

/** Yields: last 4 SSN digits, as int *

- *Try writing it yourself.*
- Full code on website



Getter methods (functions) **get** or retrieve values from a folder.

Setter methods (procedures) **set** or change fields of a folder

Getter and Setter Methods

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```

value of function

procedure; no value

/** Yields: last 4 SSN digits, as int *

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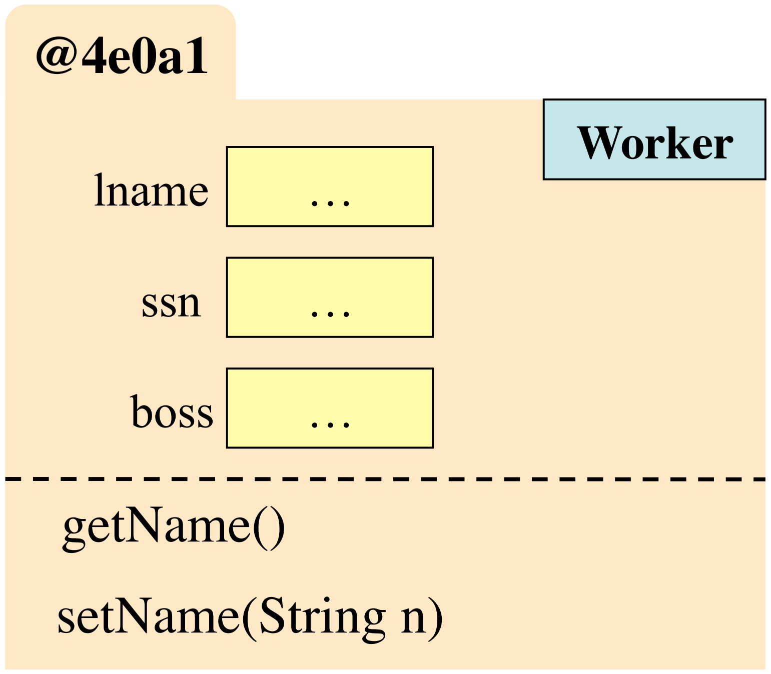


Getter methods (functions) **get** or retrieve values from a folder.

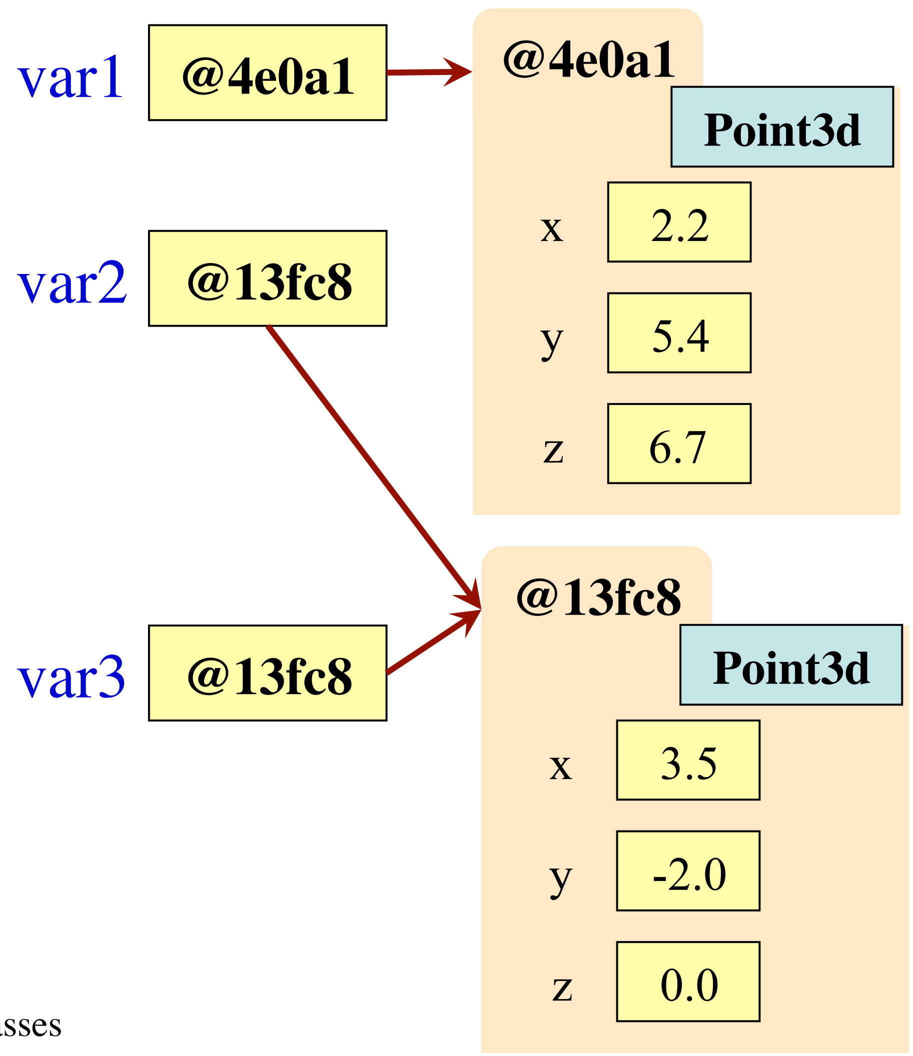
Setter methods (procedures) **set** or change fields of a folder

How Methods Work

Memorize This!

Write it down several times.

- **Example**: var1.getX()
  - Gets object (folder) name from the variable
  - Searches class (file drawer) for object (folder)
  - Executes commands inside the method on that object
- Methods apply to the **object** (folder), not the variable!
  - Execute var2.setX(8.2);
  - Makes var3.getX() == 8.2



Initializing the Fields of an Object (Folder)

- Creating a new Worker is now a multi-step process:
  - Worker w = new Worker();
  - w.setName("White");
  - …

lname is **null**
violates invariant

- We would like to be able to use something like

  Worker w = new Worker("White", 1, null);

  - Create a new Worker, sets the last name to "White", the SSN to 000000001, and the boss to **null**.
  - Need a special kind of method: **the constructor**

Initializing the Fields of an Object (Folder)

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- Creating a new Worker is now a mult
  - Worker w = new Worker(); ← I
  -
  -
- W
  -

the SSN to 000000001, and the boss to **null**.
  - Need a special kind of method: **the constructor**

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e”,

Invariants must always be true. **Always.**

Purpose of the Constructor

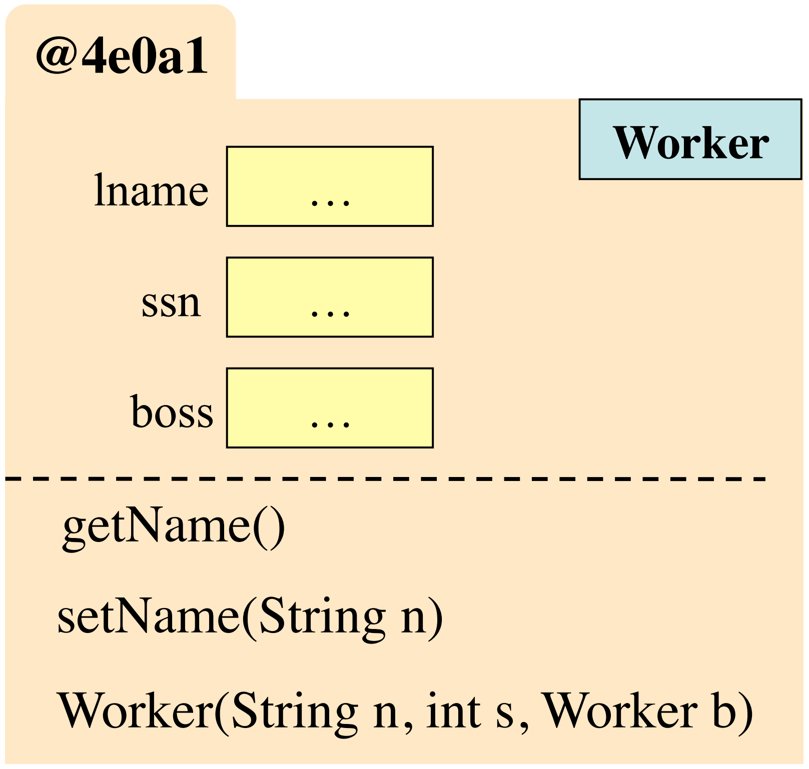
- Initialize the fields of a newly created object
- Make sure that the invariants are true

Example Constructor

```
/**
 * Constructor: an instance with last
 * name n (can't be null, can be ""),
 * SSN s (an int in 0..999999999), and
 * boss b (null if none)
 */
public Worker(String n, int s,
              Worker b) {
    lname = n;
    ssn   = s;
    boss  = b;
}
```

name of constructor = name of class

no void or type!



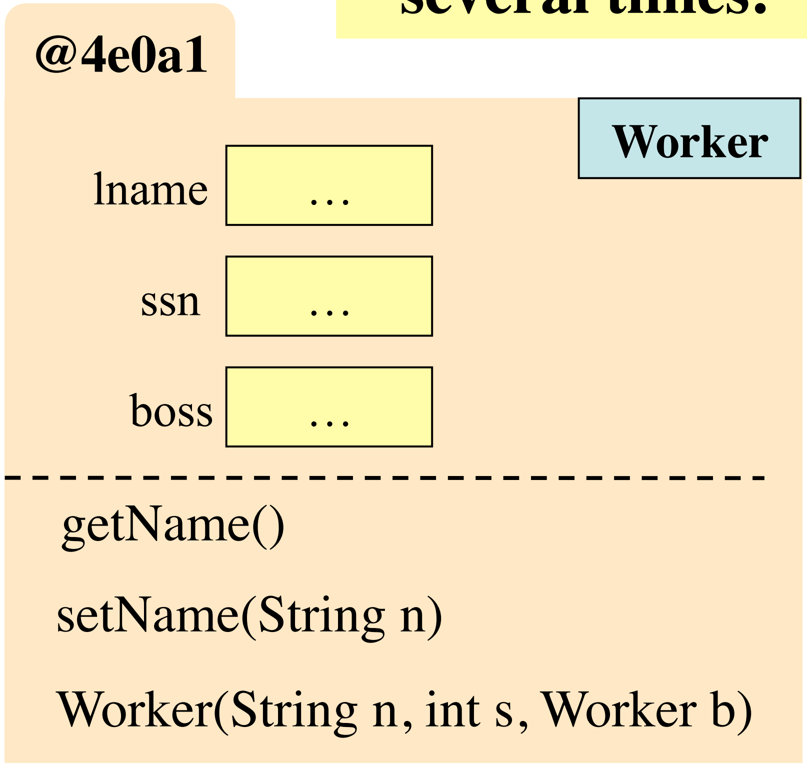
How “new” Is Evaluated

Memorize This!

Write it down several times.

new Worker(“White”, 1, null)

- Create a new object (folder) of class Worker
  - Initializes fields to default values
  - e.g. 0 for int, null for String
- Put the folder in file drawer
- Execute the constructor call
  Worker(“White”, 1, null)
  - Executes the (assignment) commands in constructor body
- Uses **the name** of the object as the final value of this expression



Quiz Next Week

- All about definitions; taken from these slides
  - Everything that says "Memorize This!"
  - Want English descriptions of the steps
- How do method calls work?
  - Handout slide 7
- What is the purpose of the constructor?
  - Handout slide 9
- How is **new** evaluated?
  - Handout slide 11