COMP 110/L Lecture 7

Maryam Jalali

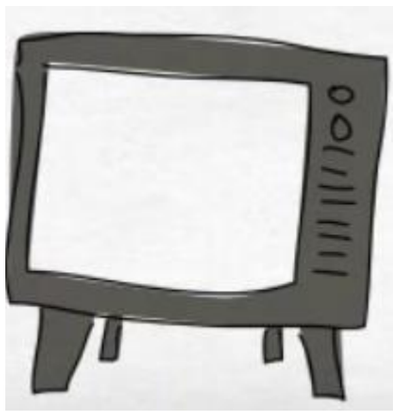
Some slides adapted from Dr. Kyle Dewey

Outline

- Introduction to objects
  - Constructors and `new`
  - Instance variables
  - Instance methods
  - `static` vs. non-`static`

Object-Oriented Programming

What is an Object?



- On the most fundamental level, the way we represent these objects and how we use them is defined in the classes.

These classes are blueprints for the objects that we want to create.

Real-world objects has 2 characteristics

1 - State

int Breed
String Age
String Color

2 – Behavior

(Something the dog does)

Bark()

Variables (Fields)

Methods (Functions)

Object Oriented Programming

- From this class blueprint we can create several different type of dogs.

Dog A	Dog B
Breed: "German Shepherd"	Breed: "Golden Retriever"
Age: 3	Age: 5
Color: Brown	Color: Yellow

Dog A and Dog B: Instances of Dog

- Dog A and Dog B have a breed, age, and color, but the value of theses different attributes are different.

- Each dog can call the bark method

- Dog A and Dog B are *instances* of the Dog class

Example

Class: Human — Object: Man, Woman, Child

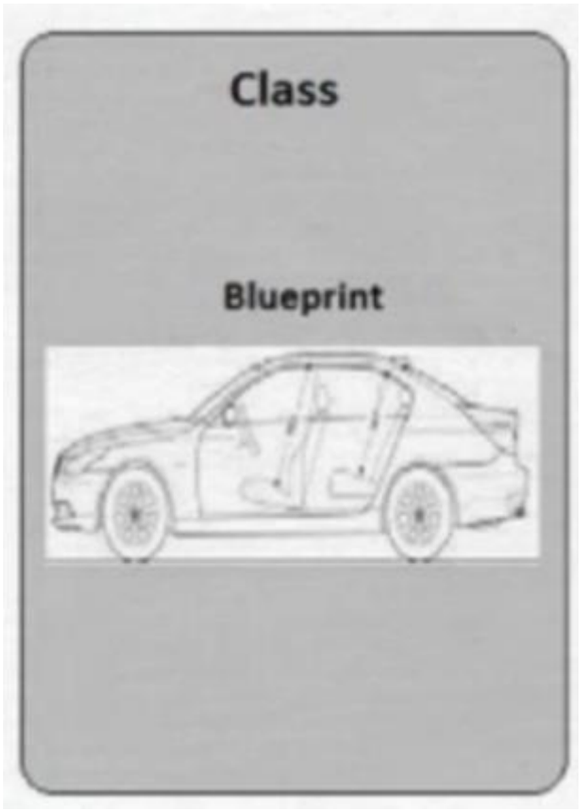
Class Fruit — Object: Apple, Banana, Mango

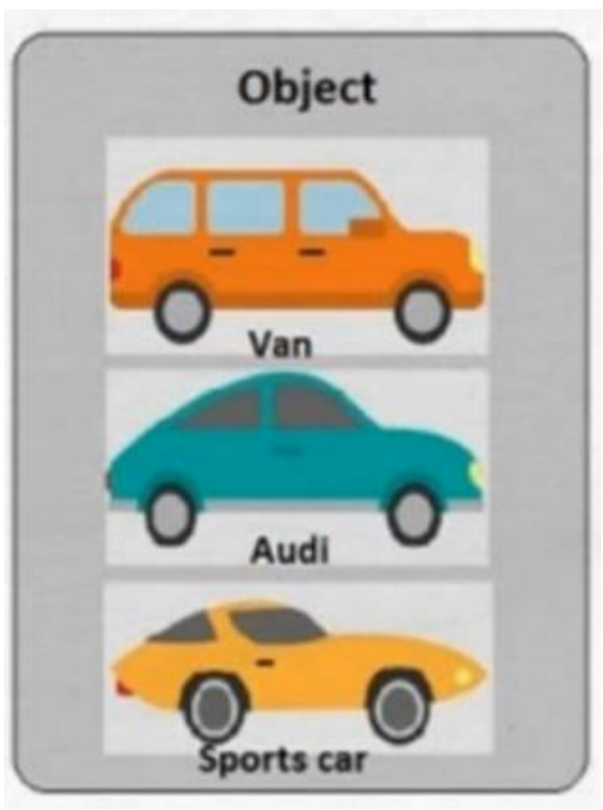
Class: Mobile Phone — Object: iPhone, X Samsung S10

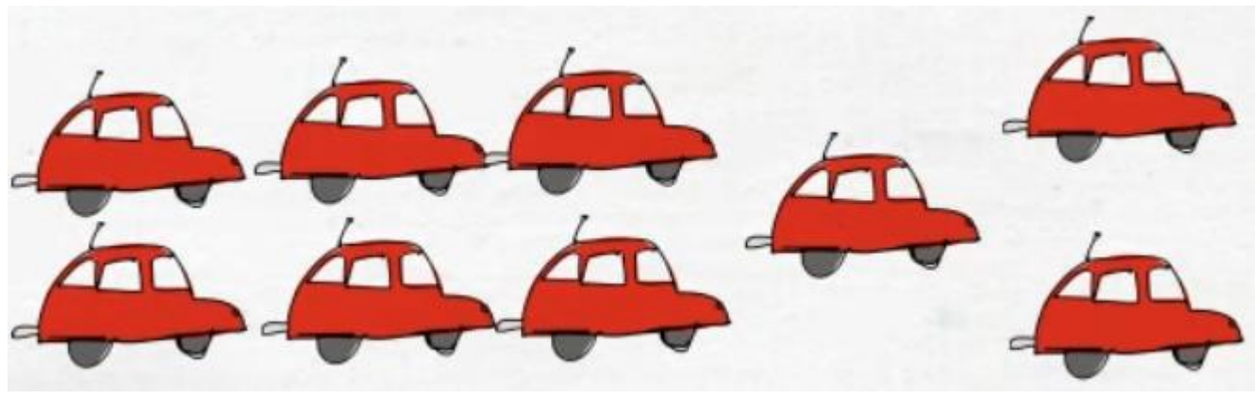
Class: Food — Object: Pizza, Burger, Rice

What is Class?

A class is the **blueprint** which individual objects are created.
Allows you to define your own "user-defined" object.







In real-world car is an object and will have 2 characteristics.

1 - State

Size
Color
Make
Model

2 - Behavior

Move
Accelerate
Turn
Reverse
Shift

Variables (Fields)

Methods (Functions)

In Programming

```
public class Car {
        int size;
        String color;

        public void setSize(int s){
           this.size = s;
        }

        public void setColor(String c){
            this.color = c;
         }
        //more code goes here
}
```

Variables (state)

Methods (behavior)

```
public static void main(String[] args) {

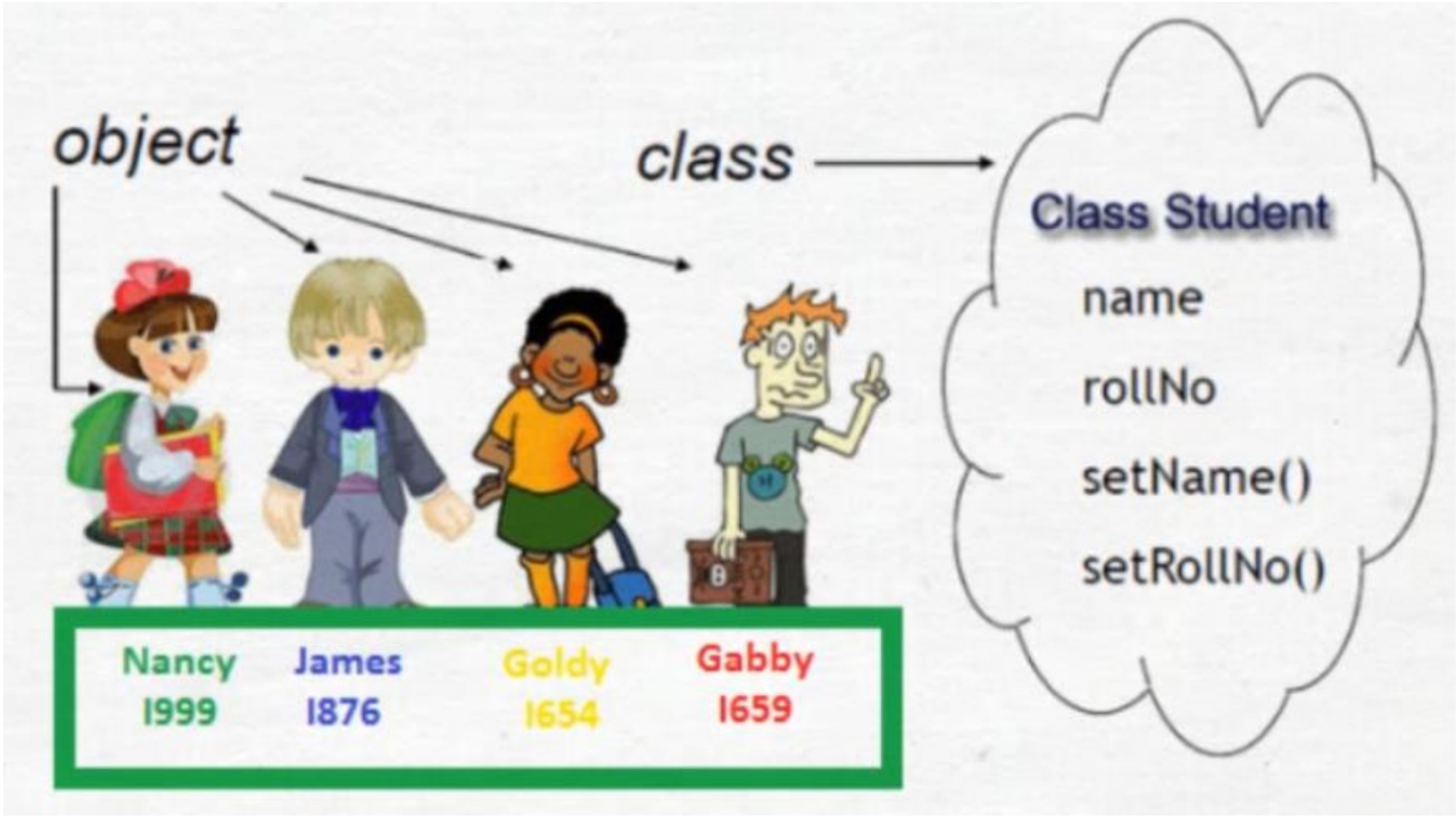
Car carObject1 = new Car();
Car carObject2 = new Car();
Car carObject3 = new Car();

carObject1.setSize(6);
carObject1.setColor("blue");

carObject1.setSize(4);
carObject1.setColor("red");

carObject1.setSize(8);
carObject1.setColor("grey");
}
```

Example


object
class
Class Student
name
rollNo
setName()
setRollNo()
Nancy
1999
James
1876
Goldy
1654
Gabby
1659

Basic Idea

The world is composed of *objects*
which interact with each other in well-defined ways

Example: Student

String firstName
String lastName
double gpa

Class Definition

```
public class Student {

    String firstName;
    String lastName;
    double gpa;

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

  }

}
```

Class Definition

```
public class Student {
```

fields

methods

```
}
```

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Example: boiling water

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faucet object

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pot object

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Interaction:
fill with water

pot object

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Interaction:

Place on top of

stove object

pot object

Basic Idea

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Example: boiling water

stove object

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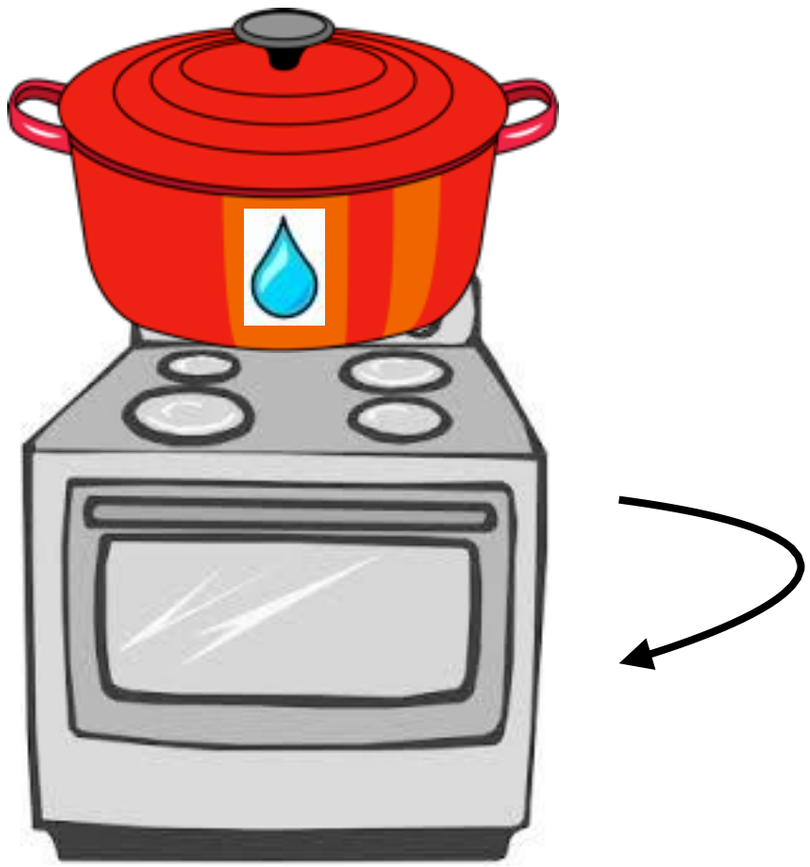

stove object

Interaction:
Turn on burner

Creating Objects

In Java, we first need a *class* to make an *object*.
A class serves as a blueprint/template for an object.

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Stove Class

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Stove Class

Stove object

Stove object

Stove object

-The same class can be used to make different stoves
-These stoves can be different from each other, perhaps even radically different. It all depends on exactly how the class is defined.

`public class`

Declares a `class`, and gives it `public` visibility (more on that later in the course)

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```
public class Table {
    . . .
}
```

Constructors

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- A way to initialize the object's member variables.
- Code executed upon object creation
- Effectively create the object
- Looks like a method, but no return type (not even `void`) and has the same name as the class

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   public Table() {
      System.out.println(
        “Creating table...”);
   }
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Constructors

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Constructor

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Executing Constructors

`new` executes a given constructor,
creating a new object in the process.

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```
Table t = new Table();
```

Example:

`Table.java`

Constructor Parameters

Just like methods, constructors can take parameters

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```
public class ConsParam {
   public ConsParam(String str) {
      System.out.println(str);
   }
}
```

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```
public class ConsParam {
   public ConsParam(String str) {
      System.out.println(str);
   }
}
```

```
ConsParam p = new ConsParam(“hi”);
```

Example:

`ConsParam.java`

Instance Variables

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Declared in the class.

Each object created from a class (hereafter referred to as an *instance*) has its own instance variables.

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   int myInt; // instance variable
   ...
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public class HasInstance {
   int myInt; // instance variable
   public HasInstance(int setInt) {
      myInt = setInt;
   }
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```
HasInstance a = new HasInstance(7);
```

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HasInstance a = new HasInstance(7);
HasInstance b = new HasInstance(8);
```

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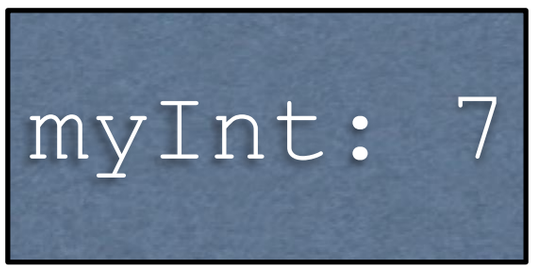
HasInstance a:



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   int myInt; // instance variable
   public HasInstance(int setInt) {
      myInt = setInt;
   }
}
```

```
HasInstance a = new HasInstance(7);
HasInstance b = new HasInstance(8);
```

HasInstance a:

HasInstance b:

Example:

`HasInstance.java`

Instance Methods

Instance Methods

- Define which interactions can occur between objects
- Declared in the `class`
- Specific to objects created from the class (instances), and operate over instance variables.

```
public class HasInstance {
   int myInt; // instance variable
   public HasInstance(int setInt) {
      myInt = setInt;
   }
}
```

-To show an example, let's take the HasInstance definition from before...

```
public class HasInstance2 {
   int myInt; // instance variable
   public HasInstance2(int setInt) {
     myInt = setInt;
   }

   public void printInt() {
     System.out.println(myInt);
   }
}
```

-...and now we add the printInt instance method
-The name of the class has also been changed, just so we can have both examples in two separate files (namely HasInstance.java and HasInstance2.java)

Example:

`HasInstance2.java`

`static`

Associates something with **the class itself**,
as opposed to individual objects created from the class.

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as opposed to individual objects created from the class.

```
public class MyClass {
   public static void
      main(String[] args) {
         ...
      }
}
```

-You've been defining main and all your methods this way the entire time
-Java forces all source code to be in classes, so this is unavoidable. However, we haven't really gotten into proper objects yet.

`static` vs. non-`static`

With static: associated with the class.

Without static: associated with objects *created from* the class.

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}
```

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With class `MyClass`

```
public class MyClass {
   public static void
   main(String[] args) {
      ...
   }
}
```

```
public class MyClassTest {
   @Test
   public void someTest() {...}
}
```

`static` vs. non-`static`

With static: associated with the class.

Without static: associated with objects *created from* the class.

With class `MyClass`

```
public class MyClass {
   public static void
   main(String[] args) {
      ...
   }
}
```

With objects created from `MyClassTest`

```
public class MyClassTest {
   @Test
   public void someTest() {...}
}
```

Stove Example in Java

- `Water.java`
- `Faucet.java`
- `Pot.java`
- `Stove.java`
- `BoilingWater.java`