COMP 110/L Lecture 7

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Outline

- Introduction to objects

  - Constructors and `new`

  - Instance variables

  - Instance methods

  - `static` **vs. non-**`static`

Object-Oriented Programming

Basic Idea

The world is composed of *objects*

which interact with each other in well-defined ways

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Example: boiling water

-Task: boil water

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Example: boiling water

faucet object

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Example: boiling water

faucet object

pot object

–...as well as a pot object

Basic Idea

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Example: boiling water

Interaction:
fill with water

faucet object   pot object

–The faucet can fill the pot

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Example: boiling water

Interaction:
fill with water

faucet object

pot object

–Now the pot is filled with water

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Example: boiling water

pot object

–Now the pot is filled with water

Basic Idea

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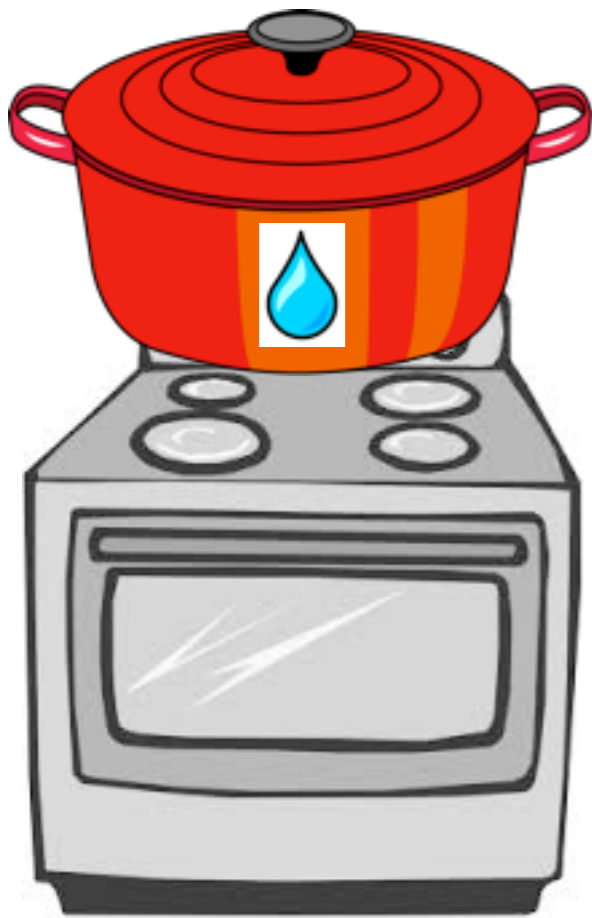Example: boiling water

Interaction:
Place on top of

stove object

pot object

Basic Idea

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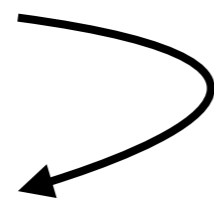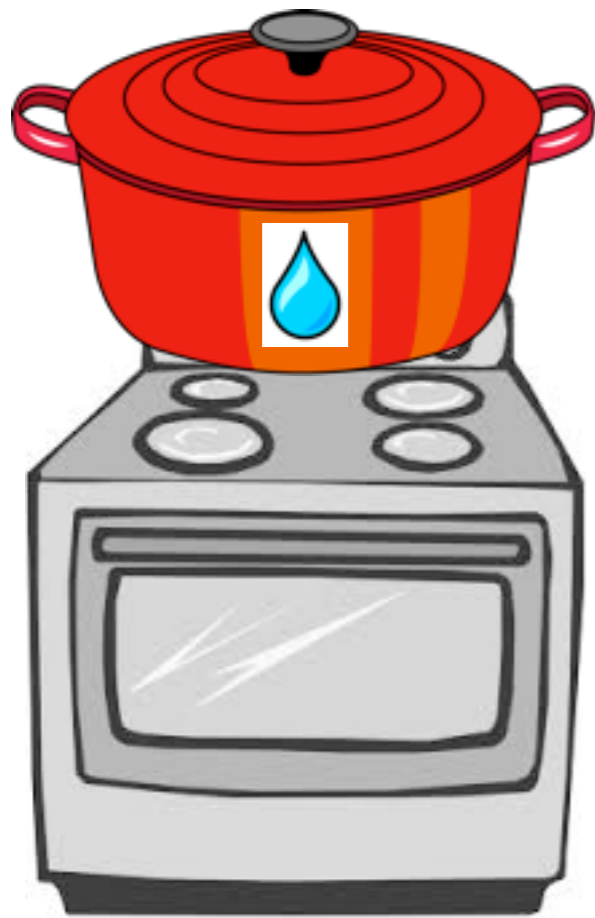
Example: boiling water

stove object

–The pot is now on top of the stove

Basic Idea

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

Example: boiling water

Interaction:
Turn on burner

stove object

–Self–interactions are permitted, and even common

Creating Objects

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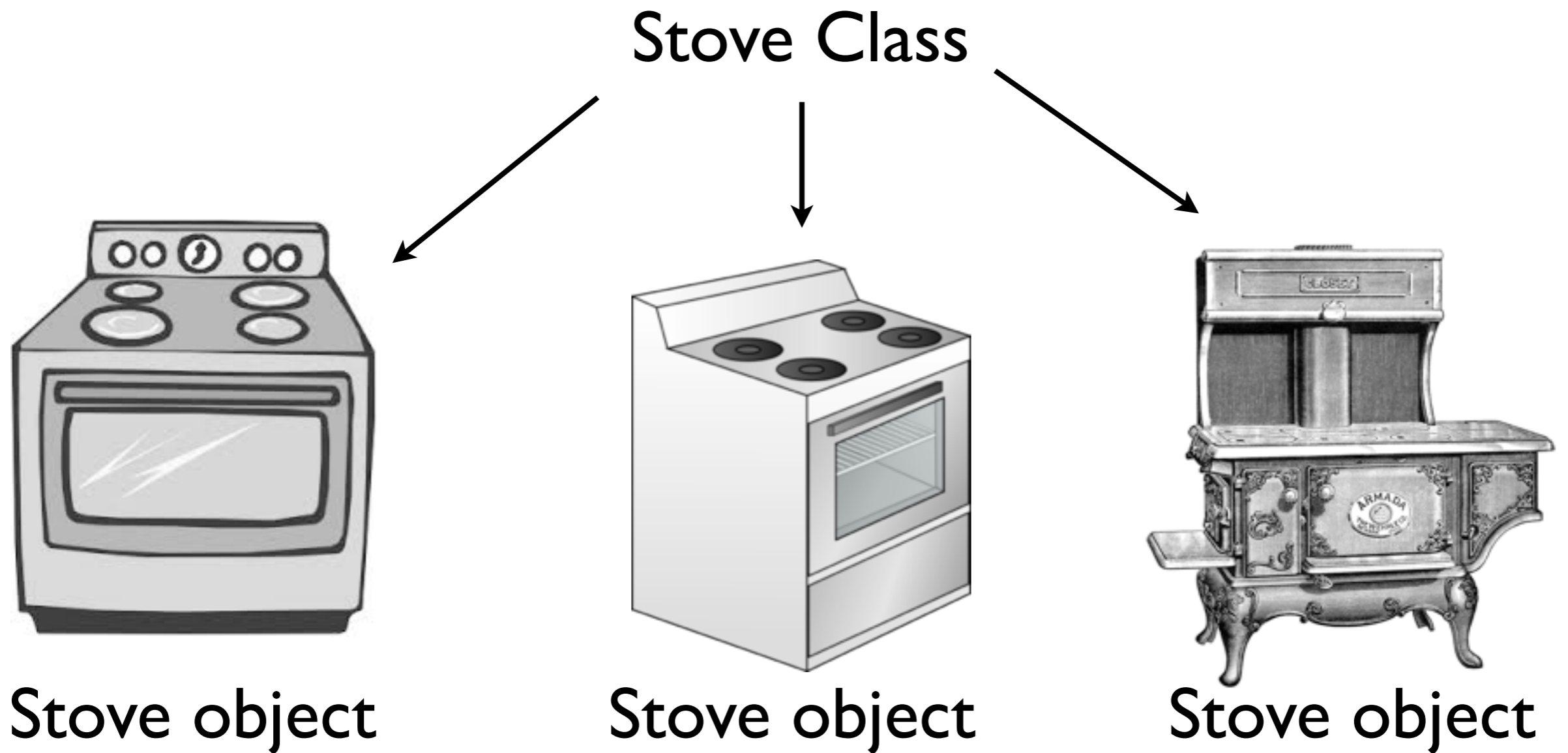A class serves as a blueprint/template for an object.

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Stove Class

Creating Objects

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

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)

-This should sound familiar – you've been using it this whole time!

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

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

Constructors

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- 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 class Table {
  public Table() {
    System.out.println(
      "Creating table...");
  }
}
```

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<div align="center">Constructor</div>

```
public class Table {
   public Table() {
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         "Creating table...");
   }
}
```

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

Constructor Parameters

Just like methods, constructors can take parameters

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

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

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

-Shift up the code to make some room

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

```java
HasInstance a = new HasInstance(7);
```

-Later on you execute this statement...

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

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

–Followed by this statement...

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

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

HasInstance a:

myInt: 7

-In memory, you'd see that a has its own value of myInt, and that is 7

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

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

HasInstance a:

| myInt: 7 |

HasInstance b:

| myInt: 8 |

-Similarly, b has its own value of myInt, and that is 8
-Key point: while there is one class, there have been two objects made from this class, and each object has its own values for the instance variable. The instance variables belong to the objects, not the class.

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.

```java
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...

```java
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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```
public class MyClass {
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    }
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```

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) {
        ...
    }
}
```

static **vs. non-**static

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

With class MyClass

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

```java
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`