Module 1-10

Classes and Objects (Part 2)
Encapsulation
Static Members
Garbage Collection

Encapsulation

Encapsulation: Protecting Data & Behavior

- **Encapsulation** is the process of combining related data members and methods into a single unit. In Java, encapsulation is achieved by putting all related members (properties) and methods in a class. With that class forming a model for the object we intend to work with in code.

- **Protection** is achieved by obscuring the internal workings of the object from the outside world. In Java, this is achieved by setting all members to ***private*** and providing ***public*** getter and setter methods for those members.

Static

Definition of Static in Java

If a method or data member is marked as static, it means that there is **only one** version of the method, or one copy of the data member and that they are shared across all instantiated objects of the class.

One way to think about it is to see the static member as a unique property of the “blueprint”, and that it is shared by all objects created from that blueprint.

The non-static methods and data members we have defined so far are often called Instance members or Instance methods. They belong to an instance of that class represented by each **new** object.

Static Members: Declaration

Static members and methods are declared by adding the keyword static.

```
public class Car {
        public static String carBrand = "Ford";

        public static void honkHorn() {
                System.out.println("beeep?");
        }
...
}
```

Static: Calling

Assuming we have the static member declarations from the previous slide, this is how you call them from a different class. Note that we use the class name (**C**ar*) as opposed to the name of an instance of a car (thisCar). ***Case really matters now!***

```
public class Garage {

        public static void main(String args[]) {

                System.out.println(Car.carBrand); // Correct way to refer to a static member.
                Car.honkHorn(); // Correct call to a static method.

                Car thisCar = new Car("Red", 2);
                System.out.println(thisCar.brand); // Not a valid way to call a static member.
                thisCar.honkHorn() // Not a valid way to call a static method.

        }
}
```

Static: Assignment

Static data members can be reassigned to new values.

```
public class Garage {

        public static void main(String args[]) {
                Car.carBrand = “GM”;
        }
}
```

Static: Constants

Constants are variables that cannot change. The closest thing to a constant in Java is declaring a data member with **static final**.

```
public class FordCar {
        public static final String carBrand = "Ford";
...
}
```

Attempts to change the value of this data member will result in an error. This, for example is invalid:

```
public class CarDealership {

        public static void main(String args[]) {

                FordCar.carBrand = "GM";
}}
```

Static: Rules

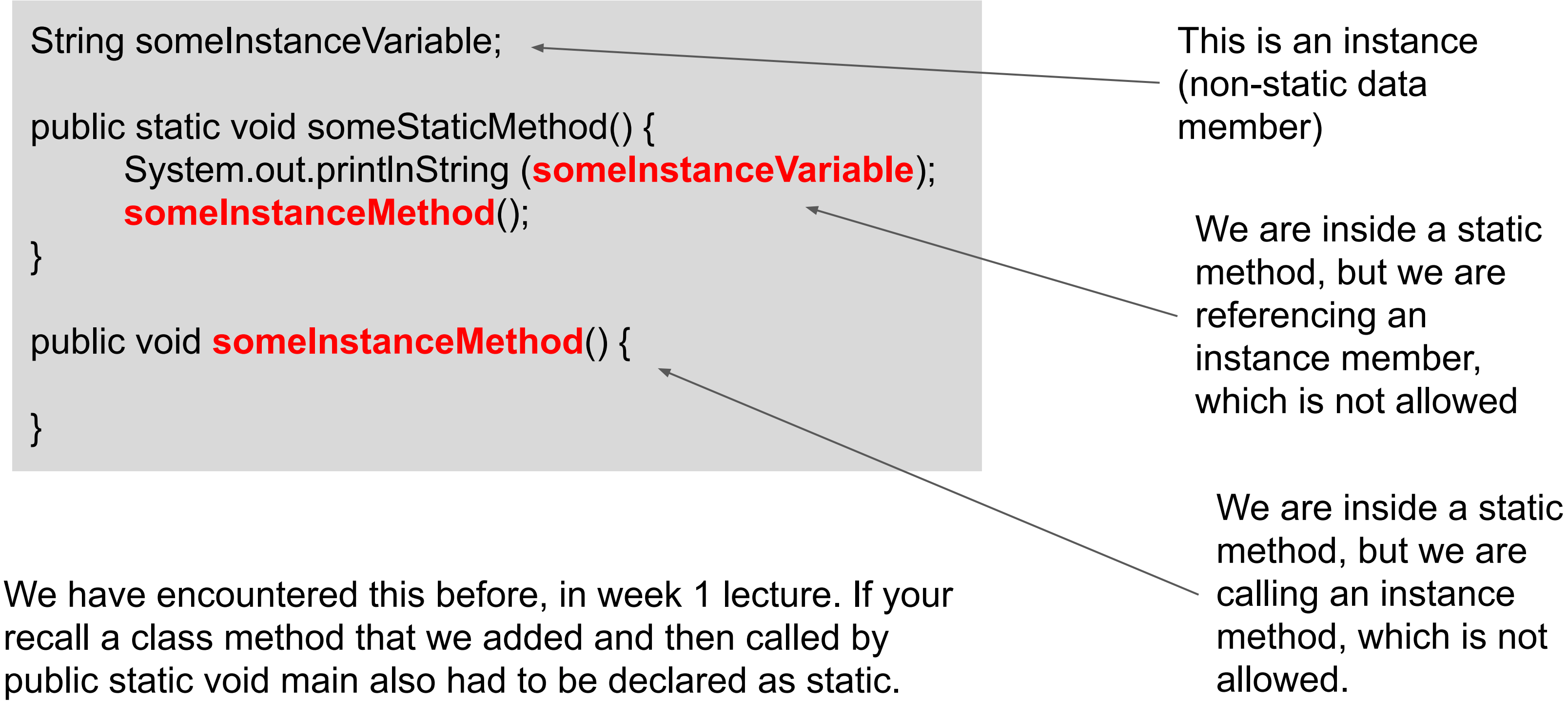
There are some rules to observe when using static methods or data members:

- **Static** variables (members) can be accessed by **Instance** methods.
- **Static** methods can be accessed by **Instance** methods.

Conversely:

- **Static** methods cannot access **Instance** data members.
- **Static** methods cannot call **Instance** methods.

Static: The Rules Shown in Code



```
String someInstanceVariable;

public static void someStaticMethod() {
        System.out.printlnString (someInstanceVariable);
        someInstanceMethod();
}

public void someInstanceMethod() {

}
```

This is an instance (non-static data member)

We are inside a static method, but we are referencing an instance member, which is not allowed

We are inside a static method, but we are calling an instance method, which is not allowed.

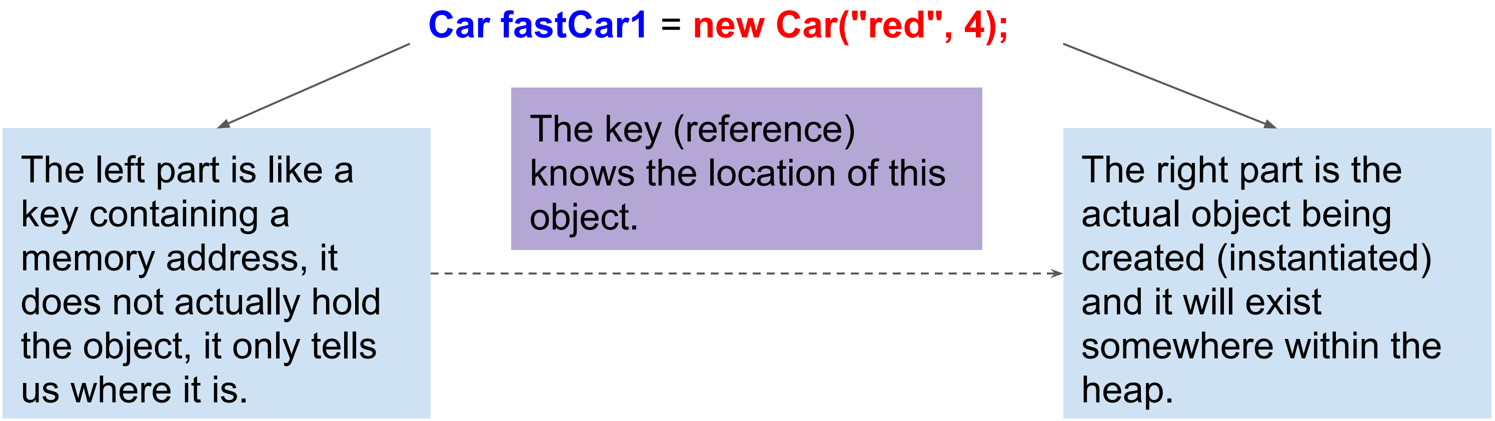
We have encountered this before, in week 1 lecture. If your recall a class method that we added and then called by public static void main also had to be declared as static.

Garbage Collection

Java Memory Management

Memory management in Java is for the most part an automated process. A hidden process known as “**Garbage Collection**” in the JVM automatically scoops up and destroys objects no longer in use.

To understand this process better, revisit the key and locker analogy:



```
Car fastCar1 = new Car("red", 4);
```

The left part is like a key containing a memory address, it does not actually hold the object, it only tells us where it is.

The key (reference) knows the location of this object.

The right part is the actual object being created (instantiated) and it will exist somewhere within the heap.

Java Memory Management

Consider the following example:

```
Car fastCar1 = new Car("red", 4);
Car fastCar2 = new Car("red", 4);

if (fastCar1 == fastCar2) {
        System.out.println("They are the same car");
}
else {
        System.out.println("Not the same car.");
}

Car fastCar3 = fastCar1;
if (fastCar1 == fastCar3) {
        System.out.println("They are the same car");
}
else {
        System.out.println("Not the same car.");
}
```

1. These are separate instantiations, each taking up a different part of memory.

2. Because fastCar1 and fastCar2 point at different things in the heap, the else will execute.

3. We have now set fastCar3 and fastCar1 to point at the same location in memory, they are now therefore referring to the same thing! The program will print “They are the same car.

Java Memory Management

```
Car fastCar1 = new Car("red", 4);
Car fastCar2 = new Car("blue", 4);
Car fastCar3 = fastCar1;
fastCar1 = null;
```

At this point in time, there are two references pointing to fastCar1.

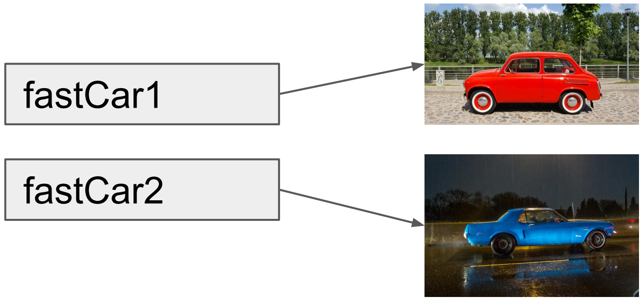
Here, the first reference has been set to null, meaning it’s not pointing at anything anymore.

The red car we instantiated on the first line can still be accessed via fastCar3! But what if fastCar3 also became null?

Java Memory Management

Here is a more visual representation of the previous sequence of events:

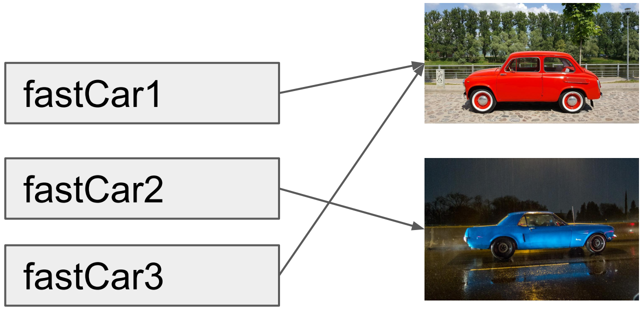
1)



fastCar1

fastCar2

2)

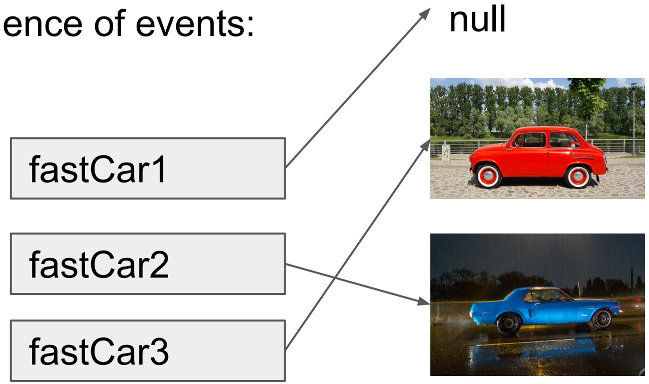


fastCar1

fastCar2

fastCar3

3)



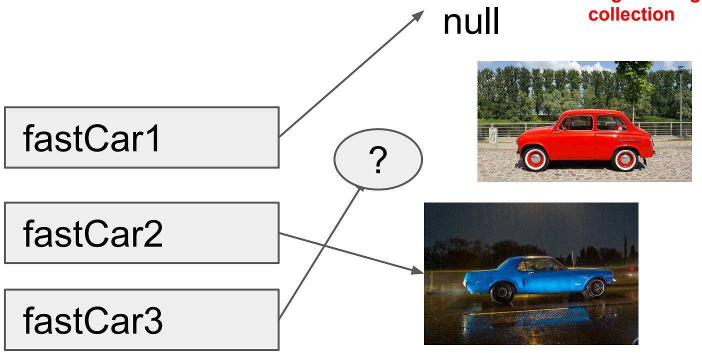
null

fastCar1

fastCar2

fastCar3

4)



null

?

fastCar1

fastCar2

fastCar3

Eligible for garbage collection