Northeastern University

Lecture 5: Java Review - 5 (Self-Study)

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Data Structures and Abstractions with Java, 5th edition. By Frank M. Carrano and Timothy M. Henry.
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JAVA: An Introduction to Problem Solving & Programming, 7th Ed. By Walter Savitch
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What have we reviewed?

- Encapsulation & Abstraction
- Methods
- Interfaces
- System & Classes Design (UML)
- Classes, Methods, Objects, Inheritance (Labs)

Outline

- Classes and Methods (Lecture 5)
- Objects and Methods (Lecture 6)
  - » Constructors
  - » Overloading

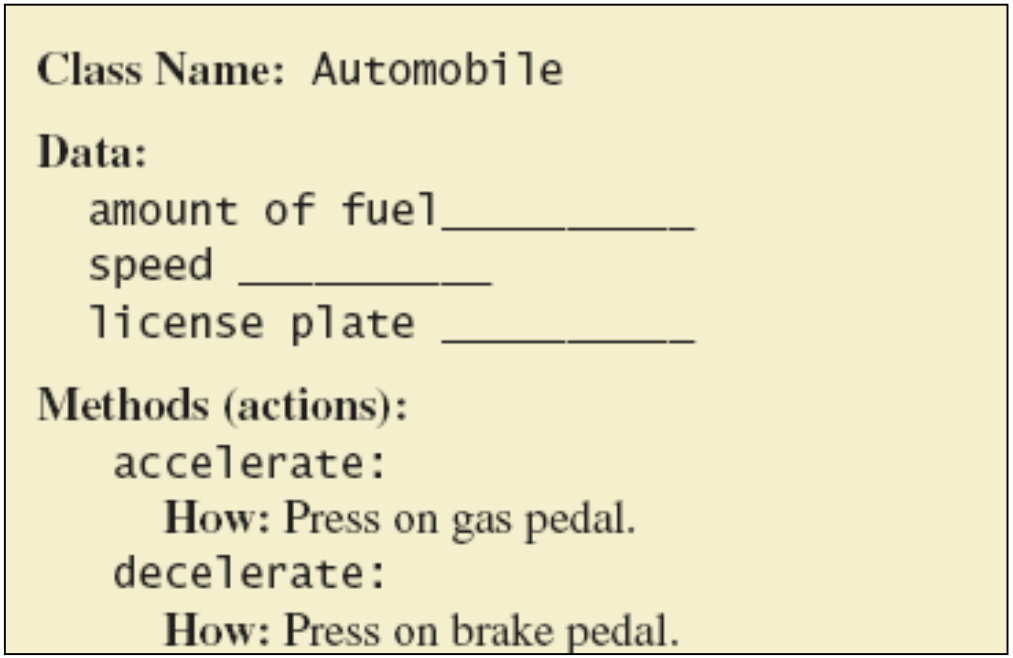
Classes and Methods

Class and Method Definitions

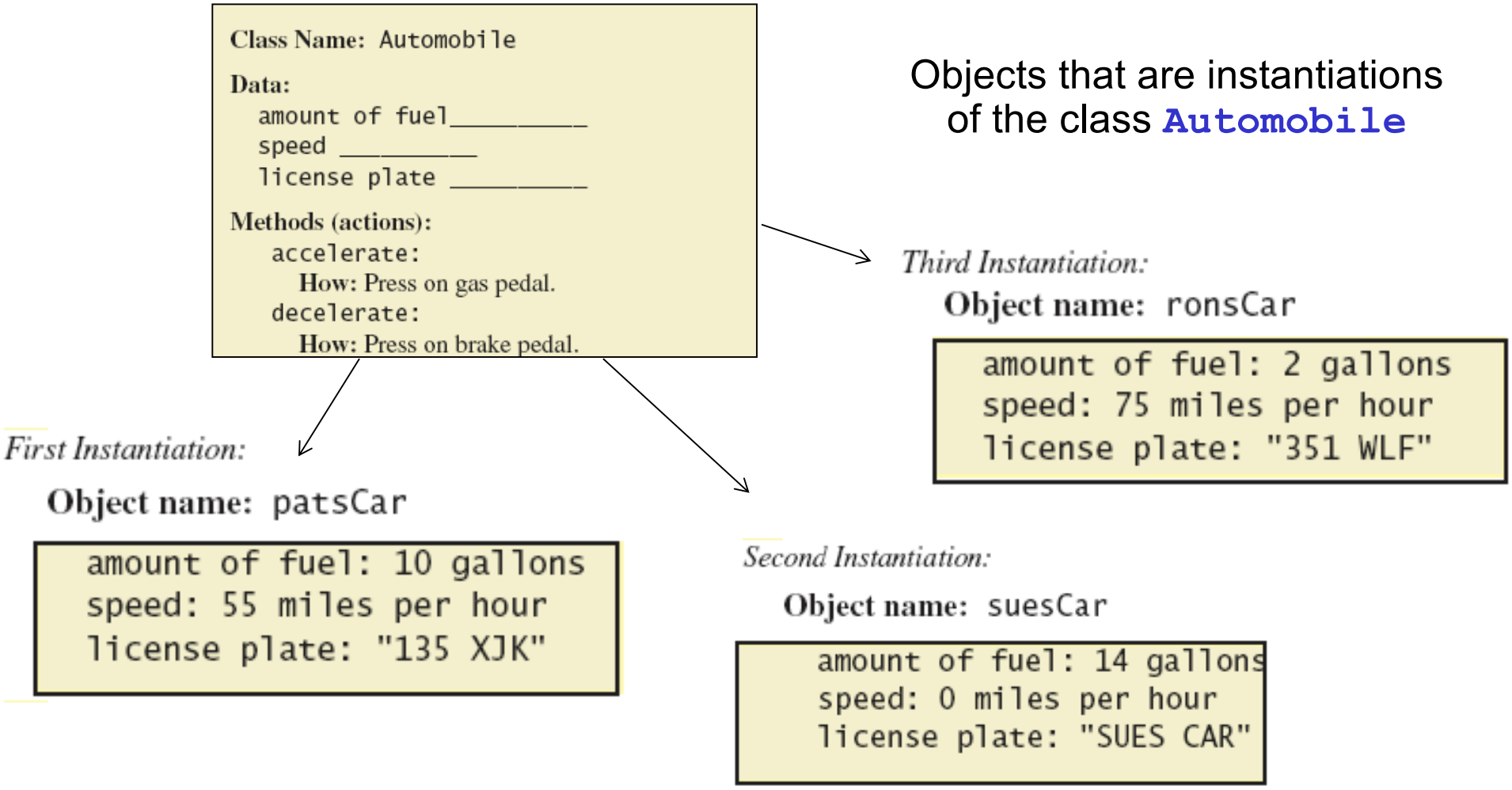
- Java program consists of objects
  - » Objects of Class types
  - » Objects that interact with one another
- Program objects can represent
  - » Objects in real world
  - » Abstractions

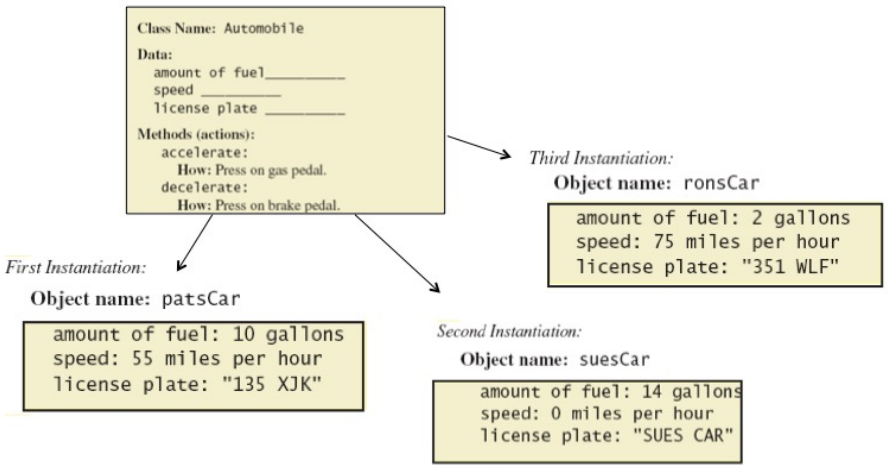
Class and Method Definitions

- A class as a blueprint



Class and Method Definitions





Java Project

Automobile.java

CarSystem.java

Objects

- patsCar
- suesCar
- ronsCar

```
Automobile patsCar = new Automobile();
```

or

```
Automobile patsCar =
     new Automobile(10, 55, "135 XJK");
```

Class Files and Separate Compilation

- Each `Java` class definition usually in a file by itself
  - » File begins with name of the class
  - » Ends with `.java`
- Class can be compiled separately
- Helpful to keep all class files used by a program in the same directory

`Dog` class and Instance Variables

- View sample program - `class Dog`
- `Dog` class has
  - » Three pieces of data (instance variables)
  - » Two behaviors
- Each instance of this type has its own copies of the data items
- Use of `public`
  - » No restrictions on how variables used

```
public class Dog
{
    public String name;
    public String breed;
    public int age;
    public void writeOutput()
    {
        System.out.println("Name: " + name);
        System.out.println("Breed: " + breed);
        System.out.println("Age in calendar years: " +
                           age);
        System.out.println("Age in human years: " +
                           getAgeInHumanYears());
        System.out.println();
    }
    public int getAgeInHumanYears()
    {
        int humanAge = 0;
        if (age <= 2)
        {
            humanAge = age * 11;
        }
        else
        {
            humanAge = 22 + ((age-2) * 5);
        }
            return humanAge;
    }
}
```

Using a Class and Its Methods

- View sample program

  `class DogDemo`

Sample screen output

```
Name: Balto
Breed: Siberian Husky
Age in calendar years: 8
Age in human years: 52

Scooby is a Great Dane.
He is 42 years old, or 222 in human years.
```

```
public class DogDemo
{
    public static void main(String[] args)
    {
        Dog balto = new Dog();
        balto.name = "Balto";
        balto.age = 8;
        balto.breed = "Siberian Husky";
        balto.writeOutput();

        Dog scooby = new Dog();
        scooby.name = "Scooby";
        scooby.age = 42;
        scooby.breed = "Great Dane";
        System.out.println(scooby.name + " is a " +
                           scooby.breed + ".");
        System.out.print("He is " + scooby.age +
                         " years old, or ");
        int humanYears = scooby.getAgeInHumanYears();
        System.out.println(humanYears + " in human years.");
    }
}
```

Sample Screen Output

```
Name: Balto
Breed: Siberian Husky
Age in calendar years: 8
Age in human years: 52

Scooby is a Great Dane.
He is 42 years old, or 222 in human years.
```

Exercise

- Give the complete definition of a class called Person that has two instance variables, one for the person's name and the other for the person's age.
- Include accessor methods (getters) and mutator methods (setters) for each instance variable.
- Also, include a method that sets both the name and age of a person.

Answer

```
public class Person {
     private String name;
     private int age;

     public void setName(String newName){
          name = newName;
     }

     public void setAge(int newAge){
          if(newAge > 0){
               age = newAge;
          }else{
               System.out.println("Error: Age is negative");
               System.exit(0);
          }
     }

     public void setPerson(String newName, int newAge){
          setName(newName);
          setAge(newAge);
     }

     public String getName(){
          return name;
     }

     public int getAge(){
          return age;
     }
}
```

The Keyword `this`

- Referring to instance variables outside the class – must use
  - » Name of an object of the class
  - » Followed by a dot
  - » Name of instance variable
- Inside the class,
  - » Use name of variable alone
  - » The object (unnamed) is understood to be there

The Keyword `this`

- Inside the class the unnamed object can be referred to with the name `this`
- Example

```
this.name = keyboard.nextLine();
```

- The keyword `this` stands for the receiving object

Exercise

- Create an `Automobile` Class to represent cars. It contains attributes: amount of fuels, speed and license plate.
- Write a test program to verify the implementation of the `Automobile` Class.
  - » Specifically, create 3 objects:
    - patsCar: 10 gallons, 55 miles per hour, “135 XJK”
    - sueCar: 14 gallons, 30 miles per hour, “SUES CAR”
    - ronsCar: 2 gallons, 35 miles per hour, “351 WLF”
  - » Print out the information of all cars (using toString())

Answer

```
public class Automobile {
    private int amountFuel;
    private int speed;
    private String licensePlate;

    public Automobile(int a, int s, String l){
        this.amountFuel = a;
        this.speed = s;
        this.licensePlate = l;
    }

    public String toString(){
        return "Amount of fuel = " + amountFuel + "\nSpeed = "
                + speed + "\nlicensePlate = " + licensePlate;
    }
}
```

Automobile.java

Answer

```
public class AutomobileDemo {

  public static void main(String[] args){
    Automobile patsCar = new Automobile(10, 55, "135 XJK");
    Automobile suesCar = new Automobile(14, 0, "SUES CAR");
    Automobile ronsCar = new Automobile(2, 75, "351 WLF");

    System.out.println(patsCar);
    System.out.println("");
    System.out.println(suesCar);
    System.out.println("");
    System.out.println(ronsCar);
  }

}
```

AutomobileDemo.java

Answer

```
Amount of fuel = 10
Speed = 55
licensePlate = 135 XJK

Amount of fuel = 14
Speed = 0
licensePlate = SUES CAR

Amount of fuel = 2
Speed = 75
licensePlate = 351 WLF
```

Output Results