

CSE201: Monsoon 2020, Section-A
Advanced Programming

Lecture 07: Constructors in Inheritance Tree

Vivek Kumar
Computer Science and Engineering
IIT Delhi
vivekk@iiitd.ac.in

This Lecture

- Constructor invocation in inheritance tree

Slide acknowledgements: CS15, Brown University

Indirectly Accessing private Instance Variables in Superclass by defining Accessors and Mutators

```
public class Car {  
  
    private Radio _myRadio;  
  
    public Car() {  
        _myRadio = new Radio();  
    }  
  
    protected Radio getRadio(){  
        return _myRadio;  
    }  
    protected void setRadio(Radio radio){  
        _myRadio = radio;  
    }  
}
```

- Remember from earlier that private variables are not directly inherited by subclasses
- If `Car` does want its subclasses to be able to access and change the value of `_myRadio`, it can **define protected accessor and mutator methods**
 - Will non-subclasses be able to access `getRadio()` and `setRadio()` ?
- Very carefully consider these design decisions in your own programs – which properties will need to be accessible to other classes?

Calling Accessors/Mutators From Subclass

- **Convertible** can get a reference to `_radio` by calling `this.getRadio()`
 - Subclasses automatically inherit these public accessor and mutator methods
- Note that using “double dot” we’ve chained two methods together
 - First, `getRadio` is called, and returns the radio
 - Next, `setFavorite` is called on that radio

```
public class Convertible extends Car {  
    public Convertible() {  
  
        public void setRadioPresets(){  
            this.getRadio().setFavorite(1, 95.5);  
            this.getRadio().setFavorite(2, 92.3);  
        }  
    }  
}
```

Let's step through some code

- Somewhere in our code, a `Convertible` is instantiated

```
//somewhere in the program  
Convertible convertible = new Convertible();  
convertible.setRadioPresets();
```

- The next line of code calls `setRadioPresets()`
- Let's step into `setRadioPresets()`

Let's step through some code

- When someone calls `setRadioPresets()`; first line is `this.getRadio()`
- `getRadio()` returns `_myRadio`
- What is the value of `_myRadio` at this point in the code?
 - Has it been initialized?
 - Nope, assuming that the structure of class `Car` is exactly as shown on right side (i.e. without any constructor), we'll run into a `NullPointerException` here :(

```
public class Convertible extends Car {  
    public Convertible() { //code elided  
    }  
  
    public void setRadioPresets() {  
        this.getRadio().setFavorite(1, 95.5);  
        this.getRadio().setFavorite(2, 92.3);  
    }  
}
```

```
public class Car {  
  
    private Radio _myRadio;  
  
    public Radio getRadio() {  
        return _myRadio;  
    }  
}
```

Making Sure Superclass's Instance Variables are Initialized

- **Convertible** may declare its own instance variables, which it initializes in its constructor
- **Car**'s instance variables are initialized in the **Car** constructor
- When we instantiate **Convertible**, how can we make sure **Car**'s instance variables are initialized too?
 - Case-1: Car has a default constructor that instantiate all its fields
 - Case-2: Car has a parameterized constructor for initializing all its fields

super(): Invoking Superclass's Default Constructor (Case 1)

- Let's assume that **Car**'s instance variables (like `_radio`) are initialized in **Car**'s default constructor
- Whenever we instantiate **Convertible**, default constructor of **Car** is called automatically
- To **explicitly** invoke **Car**'s default constructor, we can call **super()** inside the constructor of **Convertible**
 - **Can only make this call once**, and it must be the very first line in the **subclass's** constructor

```
public class Convertible extends Car {  
  
    private ConvertibleTop _top;  
  
    public Convertible() {  
        super();  
        _top = new ConvertibleTop();  
        this.setRadioPresets();  
    }  
  
    public void setRadioPresets(){  
        this.getRadio().setFavorite(1, 95.5);  
        this.getRadio().setFavorite(2, 92.3);  
    }  
}
```


super(): Invoking Superclass's Parameterized Constructor (Case 2)

```
public class Car {  
    private Racer _driver;  
    public Car(Racer driver) {  
        _driver = driver;  
    }  
    .....  
}
```

```
public class Convertible extends Car {  
    private ConvertibleTop _top;  
    public Convertible(Racer driver) {  
        super(driver);  
        _top = new ConvertibleTop();  
    }  
    .....  
}
```

- What if the superclass's constructor takes in a parameter?
 - We've modified **Car**'s constructor to take in a **Racer** as a parameter
 - How do we invoke this constructor correctly from the subclass?
- In this case, need the **Convertible**'s constructor to also take in a Racer
- The Racer is then passed as an argument to **super()** – now Racer's constructor will initialize **_driver** to the instance of Racer that was passed to the **Convertible**

What if we don't call `super()`?

- What if we forget to call `super()`?
- If you don't explicitly call `super()` first thing in your constructor, Java automatically calls it for you, passing in no arguments
- But if superclass's constructor requires a parameter, you'll get an error!
- In this case, we get a **compiler error** saying that there is no constructor "`public Car()`", since it was declared with a parameter

```
public class Convertible extends Car {  
    private ConvertibleTop _top;  
  
    public Convertible(Racer driver) {  
        //oops forgot to call super()  
        _top = new ConvertibleTop();  
    }  
  
    .....  
}
```

Next Lecture

- Abstract class
- Immutable class