Week 05 - SubClasses & Inheritance

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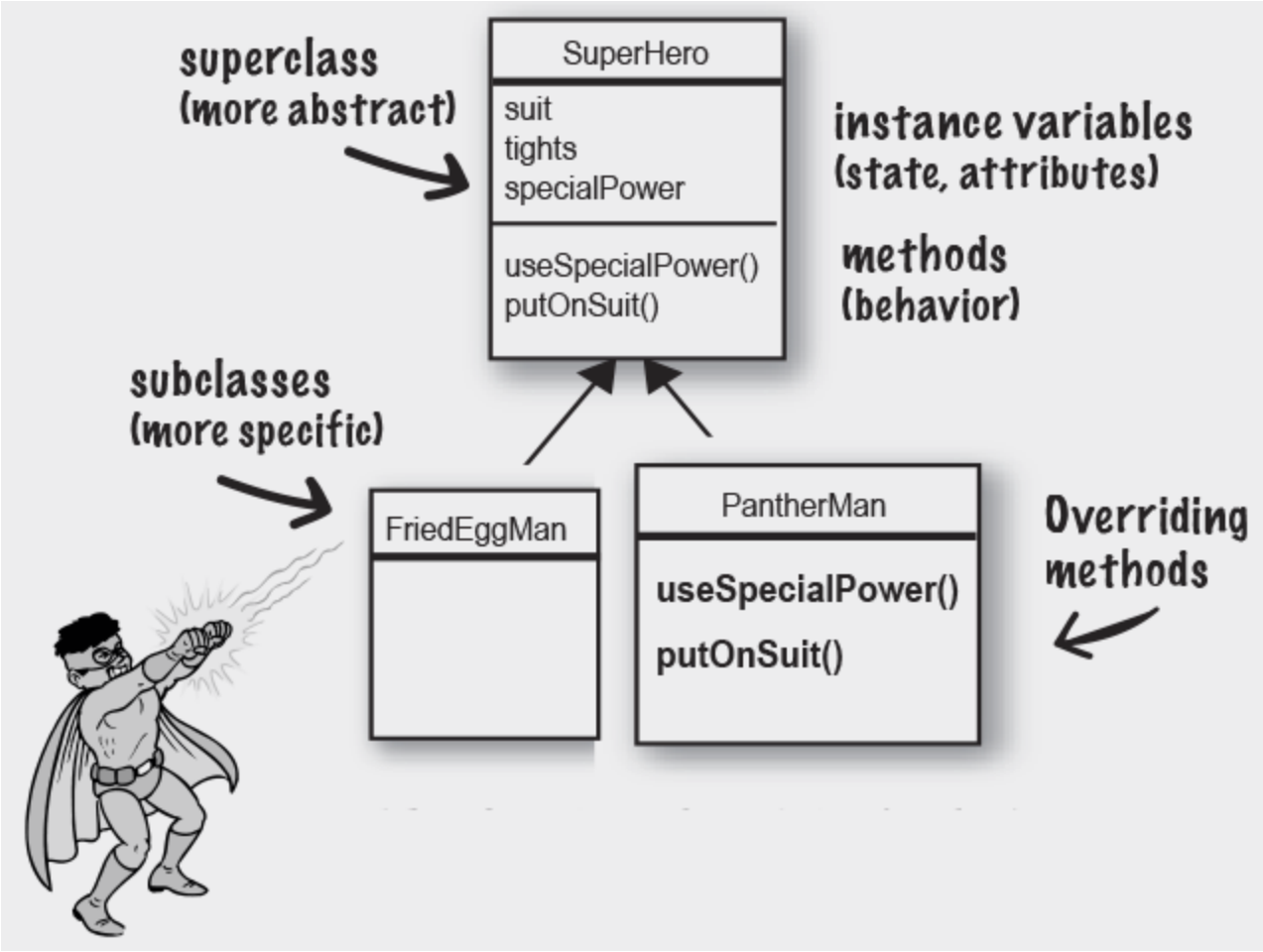


Head First Java

Source: Head First Java, 3rd Edition
Source: Java All in One
Source: Learn Java 17

Read more: Introduction to object-oriented programming
Read more: W3Schools

Inheritance

Inheritance refers to a feature of object-oriented programming that lets you create classes that are derived from other classes.

- A class that's based on another class is said to **inherit** the other class.
- The class that is inherited is called the **parent class**, **the base class**, or the **superclass**.
- The class that does the inheriting is called the **child class**, the **derived class**, or the **subclass**.

The parent-child relationship in Java is expressed using the **extends** keyword:

```
class A { }

class B extends A { }
```

The **B** class inherits from the **A** class.

Inheritance is best used to implement is-a-type-of relationships. For example:

- Class **B** is a type of Class **A**
- Solitaire is a type of game
- a truck is a type of vehicle
- an invoice is a type of transaction

In each case, a particular kind of object is a specific type of a more general category of objects.

You need to know a few important things about inheritance:

- A derived class automatically takes on all the behavior and attributes of its base class.
- A derived class can add features to the base class it inherits by defining its own methods and fields.
- A derived class can also change the behavior provided by the base class.
- Public members of a class **are** inherited
- Private members of a class **are** not inherited

> *:attention: A class can extend only one other class in Java*

Types of inheritance in Java

- Single inheritance
  Subclass inherit characteristics from a single superclass

```
class A { }
```

```
class B extends A { }
```

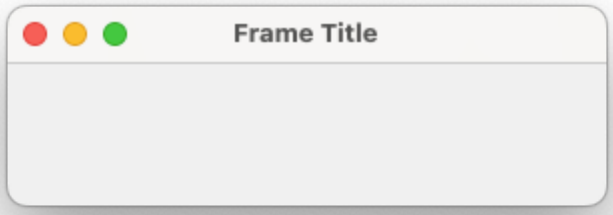
- Multilevel inheritance
  A subclass can have its own subclasses.

```
class A { }
class B extends A { }
class C extends B { }
```

- Hierarchal inheritance
  Superclass can be the parent to multiple levels of subclasses

```
class A { }
class B extends A { }
class C extends A { }
class D extends A { }
```

Inheritance is used a lot with Graphical User Interface programming.



When inheriting from the a graphics library class, the class will have all the same properties as the default class.

```
import javax.swing.*;


class SimpleFrame extends JFrame {
```

```
    public SimpleFrame() {
        super("Frame Title");
        setSize(300, 100);
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        setVisible(true);
    }

    public static void main(String[] arguments) {
        SimpleFrame sf = new SimpleFrame();
    }
}
```

By inheriting JFrame, the SimpleFrame has for example all the properties of a UI window.

Inheritance and Constructors

When you create an instance of a subclass, Java automatically calls the default constructor of the base class before it executes the subclass constructor.

```
class Animal {
    public Animal() {
        System.out.println(
            "Hello from the ANIMAL constructor");
    }
}

class Dog extends Animal {
    public Dog() {
        System.out.println(
            "Hello from the DOG constructor");
    }
```

```
}

class Main {
    public static void main(String[] args) {
        Dog myDog = new Dog();
    }
}
```

```
// Output
❯ java Main
Hello from the ANIMAL constructor
Hello from the DOG constructor
```

```
class Animal {
    private String name;

    public Animal(String name) {
        this.name = name;
    }

    public String getName() {
        return this.name;
    }
}

class Dog extends Animal {
    public Dog(String name) {
        super(name);
    }
```

```
}

class Main {
    public static void main(String[] args) {
        Dog myDog = new Dog("Lassie");
        System.out.println("Hello " + myDog.getName());
    }
}
```

```
//Output
❯ java Main
Hello Lassie
```

Method overriding

Method Overriding is the process when the subclass or a child class has the same method as declared in the parent class.

Example of Method Overriding in Java.

```
class Animal {
    public void run() {
        System.out.println("The ANIMAL run");
    }
}

class Dog extends Animal {
    public void run() {
        System.out.println("The DOG run");
    }
}
```

```
class Main {
    public static void main(String[] args) {
        Dog myDog = new Dog();
        myDog.run();
    }
}
```

```
// Output
❯ java Main
The DOG run
```

Only the *The DOG run* printed as the class overwrites the run method of the parent class.

Using Super

The `super` keyword works similarly to `this` but refers to the instance of the base class rather than the instance of the current class.

```
class Animal {
    public void run() {
        System.out.println("The ANIMAL run");
    }
}
class Dog extends Animal {
    public void run() {
        System.out.println("The DOG run");
        super.run();
    }
}
class Main {
    public static void main(String[] args) {
```

```
        Dog myDog = new Dog();
        myDog.run();
    }
}
```

```
// Output
❯ java Main
The DOG run
The ANIMAL run
```

Using Final

final variable
Java has a `final` keyword that serves three purposes.
When you use `final` with a variable, also called a constant, is a variable whose value you can't change after it's been initialised.

To declare a final variable, you add the final keyword to the variable declaration, like this:

```
final int WEEKDAYS = 5;
```

final method
A *final method* is a method that can't be overridden by a subclass.

```
class Animal {
    private String name;
    final public String getName() {
        return this.name;
    }
}
```

As the method `getName` is declared as `final`, any class that uses the `Animal` class as a base class can't override the `getName` method. If it tries, the compiler issues the error message `("Overridden method final")`.

final class

A *final class* is a class that can’t be used as a base class.

```
final class Animal {

}
```

No one can use the Animal class as the base class for another class.