JAC444 / BTP400 Course Object-Oriented Software Development inJava

Classes

Segment 2 – Inheritance

Classes – Segment 2 – Inheritance

In this segment you will be learning about:

- Inheritance
- Overriding
- Final Methods and Classes
- Implementing and Extending Interfaces with Default Methods
- Abstract Classes

Inheritance

Definition:

A subclass is a class that extends another class.

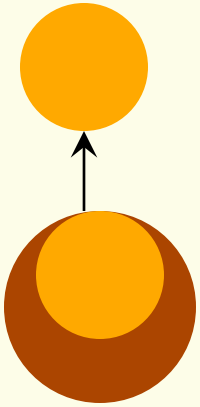
A subclass inherits state and behavior from all its ancestor.

The superclass refers to a direct ancestor.

Subclass inherits all, but private superclasses members

```
public class SuperClass { ... }

public class SubClass extends SuperClass {
    ...
}
```



Overriding

- Definition:
  Replacing the superclass's implementation with a new method in a subclass is called overriding.

  - The signature should be identical.
  - Only accessible non-static method can be overridden.
  - Access modifier could be different in overridden method as long as the subclass modifier is less restrictive then the superclass.
  - A subclass can change whether a parameter in an overridden method is final (final is not part of method signature).
  - Fields cannot be overridden; they can only be hidden.

  super acts as a reference accessing fields and method of superclass.

  - Ex: `super.superclassField;`

Overriding and Hiding - Example

```
class Base {
      public String s = "X";
      public void show() { System.out.println(s); } }

class Extended extends Base {
      public String s = "Y";
      public void show() { System.out.println(s); }
      public static void main(String[ ] args) {
                Extended e = new Extended();
                Base b = e;
                b.show();
                e.show();
                System.out.println(b.s + " " + e.s); } }
```

Results: Y Y X Y

- **When invoke a method on an object, the actual class of the object governs which implementation is used.**
- **When access a field the declared type of the referenced is used.**

Final Methods and Classes

- A method could be declared as ***final***
  - A final method **cannot be overridden**.
- A class could be declared as ***final***
  - A final class **cannot be subclassed**.

  Example: Immutable class like ***String*** class

Implementing / Extending

- Implementing Interface I

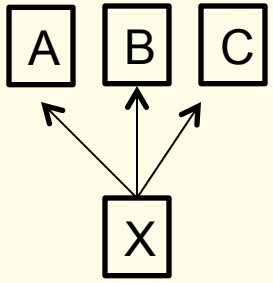
```
interface I { void m(); }
class A implements I { void m() { … } }
```

- Extending Interface I

```
interface J extends I { void n(int); }
class A implements J {
    void m() { … }
    void n(int) {… }
}
```

Interface = Multiple inheritance

```
interface X extends A, B, C { … }
```

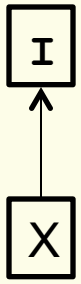


Default and Static Methods

- Interface could contain Static Methods and Default Methods

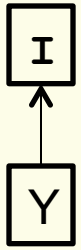
  One can add new methods to an old interface, without breaking old code

```
interface I { void m(); }
class X implements I { … }
```



- Evolving the `I` Interface

```
interface I  {
    void m();
    default String n(int k){
        if (k % 2)
          return "It is OK";
    }
}
class Y implements I { … }
```



Abstract Methods / Classes

- Abstract Method is a method without implementation

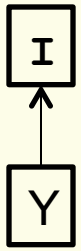
```
absract void movePoint(int deltaX, int deltaY);
```

Abstract Class is a class with at least an abstract method

```
public abstract class X { //fields //other methods
    absract void movePoint(int deltaX, int deltaY);
}
```

- Evolving the `I` Interface

```
interface I  {
    void m();
    default String n(int k){
        if (k % 2)
            return "It is OK";
    }
}
class Y implements I { … }
```



Extending Interfaces - revisited

- Extending an interface with default methods

- Three options:
  1. Ignore the default methods – inherit the default methods
  2. Redeclare the default method (makes the method an abstract method)
  3. Redefine the default method – overrides it.

Interface declaration can contain:

- Method signatures
- Default methods
- Static methods
- Constant defintions

Annotations

- Annotation does not effect the program semantics
- Annotations are used by development tools to generate new artifacts or to check the properties of class / methods, etc.
- Previous annotation were defined in JavaDoc such as:
  - `@author`
  - `@version`

Annotation types are imported in the same fashion as classes and interfaces

Annotation Example and Use

Example of annotation: *@Override*

```
public class Example {
    @Override
    public int hashCode { return toString().hashCode(); }
}
```

Annotation can be used anywhere you use a type (starting with Java SE 8)

```
@NotNull String str;
```

Annotation type definitions

```
public @interface Preliminary {//Marker annotation }

public @interface Copyright { String value(); //Single member annotation }

public @interface Name { String first(); String last(); }
```