

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.

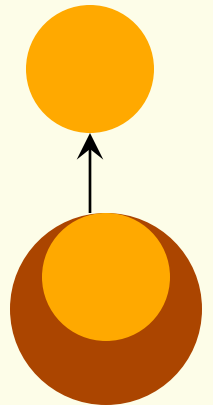
A subclass inherits state and behavior from all its ancestor.

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 than 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

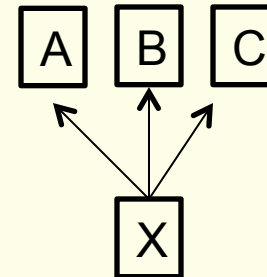
```
interface I { void m(); }  
class A implements I { void m() { ... } }
```

- 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

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

Abstract Class is a class with at least an abstract method

```
public abstract class X { //fields //other methods
    abstract 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. Redecclare 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 definitions



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(); }
```

