OOP in Java Review

CS356 Object-Oriented Design and Programming
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Announcement

- Submit your GitHub username as soon as possible

Important

- The basic Java OOP features will be used through the whole course

- These features are frequently asked in tech interviews

Interface

- An *interface* in the Java programming language is an abstract type that is used to specify an interface (in the generic sense of the term) that classes must implement

Web iClicker

- http://answer.yusun.io
- Test Question:
- What grade do you think you can get from this course?

Interface – Question 1

- Which of the following variable declarations are correct?

```
public interface TestInterface1 {
  A     int var1;
  B     final int var2;
  C     public int var3 = 100;
  D     private int var4 = 100;
  E     public static final int var5 = 100;
}
```

Interface – Question 1

- Which of the following variable declarations are correct?

```
public interface TestInterface1 {
❌      int var1;

        final int var2;

        public int var3 = 100;

        private int var4 = 100;

        public static final int var5 = 100;

}
```

Only constants can be declared in an interface

Interface – Question 1

- Which of the following variable declarations are correct?

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public interface TestInterface1 {

        int var1;

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        public int var3 = 100;

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final requires an initial value to make a variable as constant.

Interface – Question 1

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Interface only contains public declarations, even without public keyword.

Interface – Question 1

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}
```

Interface – Question 2

- What’s wrong with the following interface?

```
public interface TestInterface2 {

        void aMethod(int aValue) {
                System.out.println("Hello World!");
        }

}
```

Interface – Question 2

- What’s wrong with the following interface?

```
public interface TestInterface2 {

        void aMethod(int aValue) {
                System.out.println("Hello World!");
        }

}
```

Interface contains method signatures, not implementations.

Interface – Question 2

- How to fix it?

```
public interface TestInterface2 {

A       void aMethodFix0(int aValue);

B       protected aMethodFix1(int aValue);

C       abstract void aMethodFix2(int aValue);

D       static void aMethodFix3(int aValue) {
                System.out.println("Hello World!");
        }

E       default void aMethodFix4(int aValue) {
                System.out.println("Hello World!");
        }
}
```

Interface – Question 2

- How to fix it?

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}
```

Interface only contains public methods, even without the public keyword.

Interface – Question 2

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public interface TestInterface2 {

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                System.out.println("Hello World!");
        }
}
```

Start from Java 8, interface can contain static and default method bodies.

Interface – Question 3

- Is the following interface valid?

```
public interface TestInterface3 {

}
```

A. **Valid**
B. **Invalid**

Interface – Question 3

- Is the following interface valid?

✓

```
public interface TestInterface3 {

}
```

Empty interface is often used as a class marker. For instance,

java.io.Serializable

java.lang.Cloneable

Abstract Class

- Abstract classes are similar to interfaces. You cannot instantiate them.
- They may contain a mix of methods declared with or without an implementation.

Mark Rothko – "No. 13 (White, Red on Yellow)" – Oil and Acrylic on canvas -1958. "It was with the utmost reluctance that I found the figure could not serve my purposes. But a time came when none of us could use the figure without mutilating it."

Abstract Class vs Interface

- Use Abstract Class or Interface?
  - *Choose the ones that should use Abstract Class*

A. You want to share code among several closely related classes.
B. You want to take advantage of multiple inheritance of type.
C. You expect that classes that implement/extend your __ have many common methods or fields, or require access modifiers other than public (such as protected and private).
D. You want to declare non-static or non-final fields. This enables you to define methods that can access and modify the state of the object to which they belong.
E. You want to specify the behavior of a particular data type, but not concerned about who implements its behavior.
F. You expect that unrelated classes would implement/extends your __.

Abstract Class vs Interface

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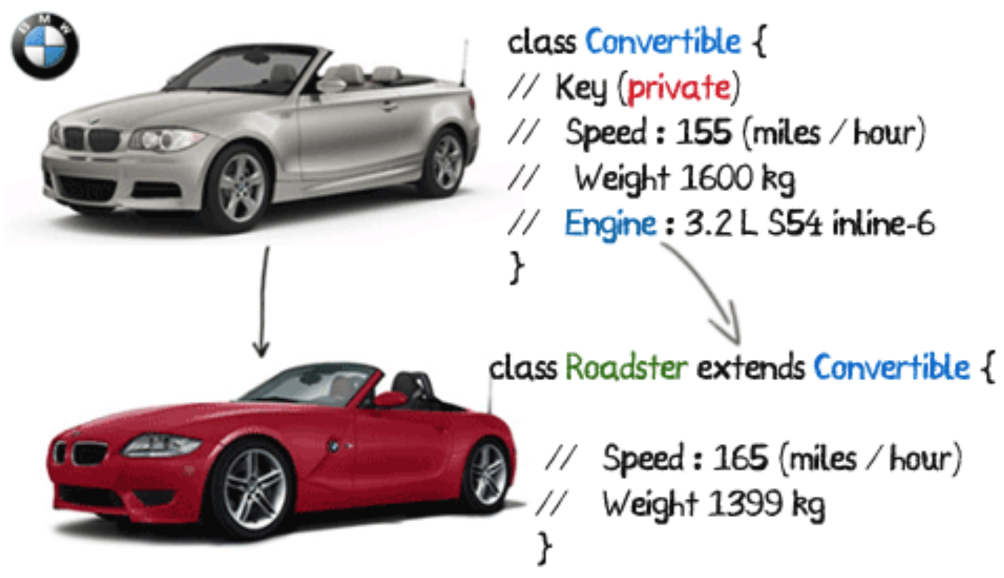
E. You want to specify the behavior of a particular data type, but not concerned about who implements its behavior.
F. You expect that unrelated classes would implement/extends your __.

Inheritance

- A class that is derived from another class is called a subclass (also a derived class, extended class, or child class).
- The class from which the subclass is derived is called a superclass (also a base class or a parent class).



```
class Convertible {
// Key (private)
//  Speed : 155 (miles / hour)
//  Weight 1600 kg
//  Engine : 3.2 L S54 inline-6
}
class Roadster extends Convertible {

  //  Speed : 165 (miles / hour)
  //  Weight 1399 kg
  }
```

Inheritance – Question 1

- Which of the the following are valid class/interface definitions?

```
interface InterfaceA { }
interface InterfaceB { }
interface InterfaceC { }

class ClassA { }
class ClassB { }
class ClassC { }
```

```
A. class TC1 implements InterfaceA, InterfaceB { }
B. class TC2 extends InterfaceA { }
C. class TC3 extends Class B, ClassC { }
D. class TC4 extends ClassB implements InterfaceA, InterfaceB { }
E. class TC5 extends Class B, ClassC implements InterfaceA, InterfaceB {
F. class TC6 implements InterfaceA, InterfaceB extends ClassB { }

G. interface TI1 implements InterfaceA, InterfaceB { }
H. interface TI2 extends InterfaceA, InterfaceB { }
I. interface Ti3 extends ClassB implements InterfaceA, InterfaceB { }
```

Inheritance – Question 1

- Which of the the following are valid class/interface definitions?

```
interface InterfaceA { }
interface InterfaceB { }
interface InterfaceC { }

class ClassA { }
class ClassB { }
class ClassC { }
```

```
A. class TC1 implements InterfaceA, InterfaceB { } ✓
B. class TC2 extends InterfaceA { }
C. class TC3 extends Class B, ClassC { }
D. class TC4 extends ClassB implements InterfaceA, InterfaceB { } ✓
E. class TC5 extends Class B, ClassC implements InterfaceA, InterfaceB {
F. class TC6 implements InterfaceA, InterfaceB extends ClassB { }

G. interface TI1 implements InterfaceA, InterfaceB { }
H. interface TI2 extends InterfaceA, InterfaceB { } ✓
I. interface Ti3 extends ClassB implements InterfaceA, InterfaceB { }
```

Inheritance – Question 2

- Which method overrides a method in the superclass?

```
class ClassParent {
        public void method1(int i) { }
        public void method2(int i) { }
        public static void method3(int i) { }
        public static void method4(int i) { }
        public void method5(int i) { }
        protected void method6(int i) { }
}
class ClassChild extends ClassParent {
A.      public static void method1(int i) { }
B.      public void method2(int i) { }
C.      public void method3(int i) { }
D.      public static void method4(int i) { }
E.      protected void method5(int i) { }
F.      public void method6(int i) { }
}
```

Inheritance – Question 2

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class ClassParent {
        public void method1(int i) { }
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}
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        public void method2(int i) { }
        public void method3(int i) { }
        public static void method4(int i) { }
        protected void method5(int i) { }
        public void method6(int i) { }
}
```

Non-static method cannot be override with static.

Inheritance – Question 2

- Which method overrides a method in the superclass?

```
class ClassParent {
        public void method1(int i) { }
        public void method2(int i) { }
        public static void method3(int i) { }
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        public void method6(int i) { }
}
```

Inheritance – Question 2

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    public static void method4(int i) { }
    protected void method5(int i) { }
    public void method6(int i) { }
}
```

Static method cannot be override with non-static.

Inheritance – Question 2

- Which method overrides a method in the superclass?

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class ClassParent {
      public void method1(int i) { }
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      public static void method1(int i) { }
      public void method2(int i) { }
      public void method3(int i) { }
      public static void method4(int i) { }
      protected void method5(int i) { }
      public void method6(int i) { }
}
```

Static method can hide the parent static method, not override.

Inheritance – Question 2

- Which method overrides a method in the superclass?

```
class ClassParent {
    public void method1(int i) { }
    public void method2(int i) { }
    public static void method3(int i) { }
    public static void method4(int i) { }
    public void method5(int i) { }
    protected void method6(int i) { }

      ssChild extends ClassParent {
    public static void method1(int i) { }
    public void method2(int i) { }
    public void method3(int i) { }
    public static void method4(int i) { }
    protected void method5(int i) { }
    public void method6(int i) { }
}
```

Override cannot reduce the visibility.

Inheritance – Question 2

- Which method overrides a method in the superclass?

```
class ClassParent {
        public void method1(int i) { }
        public void method2(int i) { }
        public static void method3(int i) { }
        public static void method4(int i) { }
        public void method5(int i) { }
        protected void method6(int i) { }
}
```

Override can increase the visibility.

```
    ssChild extends ClassParent {
        public static void method1(int i) { }
        public void method2(int i) { }
        public void method3(int i) { }
        public static void method4(int i) { }
        protected void method5(int i) { }
        public void method6(int i) { } ✓
}
```

Polymorphism

- Subclasses of a class can define their own unique behaviors and yet share some of the same functionality of the parent class

"Now Speak!"
"Quack"
"Woof"
"Meow"

Polymorphism - Basics

```
class Animal {
    public void makeNoise() {
        System.out.println("Some sound");
    }
}

class Dog extends Animal{
    public void makeNoise() {
        System.out.println("Bark");
    }
}

class Cat extends Animal{
    public void makeNoise() {
        System.out.println("Meawoo");
    }
}
```

- What's the output of the following piece of code?

```
Animal a1 = new Cat();
a1.makeNoise();
Animal a2 = new Dog();
a2.makeNoise();
```

Polymorphism - Basics

```
class Animal {
    public void makeNoise() {
        System.out.println("Some sound");
    }
}

class Dog extends Animal{
    public void makeNoise() {
        System.out.println("Bark");
    }
}

class Cat extends Animal{
    public void makeNoise() {
        System.out.println("Meawoo");
    }
}
```

- What's the output of the following piece of code?

```
Animal a1 = new Cat();
a1.makeNoise();
Animal a2 = new Dog();
a2.makeNoise();
```

```
Meawoo
Bark
```

Polymorphism – Tricky Question

```java
abstract class A {
        void test(A a) {
                System.out.println("You are in A");
        }
}
class B extends A {
        void test(B b) {
                System.out.println("You are in B");
        }
}
public class TrickyPoly {
        public static void main(String[] args) {
                A a1 = new B();
                A a2 = new B();
                B b1 = new B();
                a1.test(a2);
                b1.test(a2);
                a1.test(b1);
                b1.test(b1);
        }
}
```