面向对象设计入门

第一讲(免费试听)

讲师：文泰来

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OOD(面向对象)的三大特性

OOD 面向对象设计

- 三大特性
  - 封装
  - 继承
  - 多态

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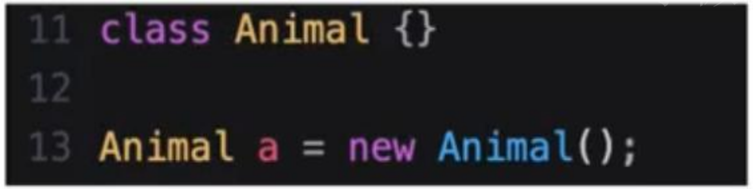
封装

OOD 面向对象设计

- 封装

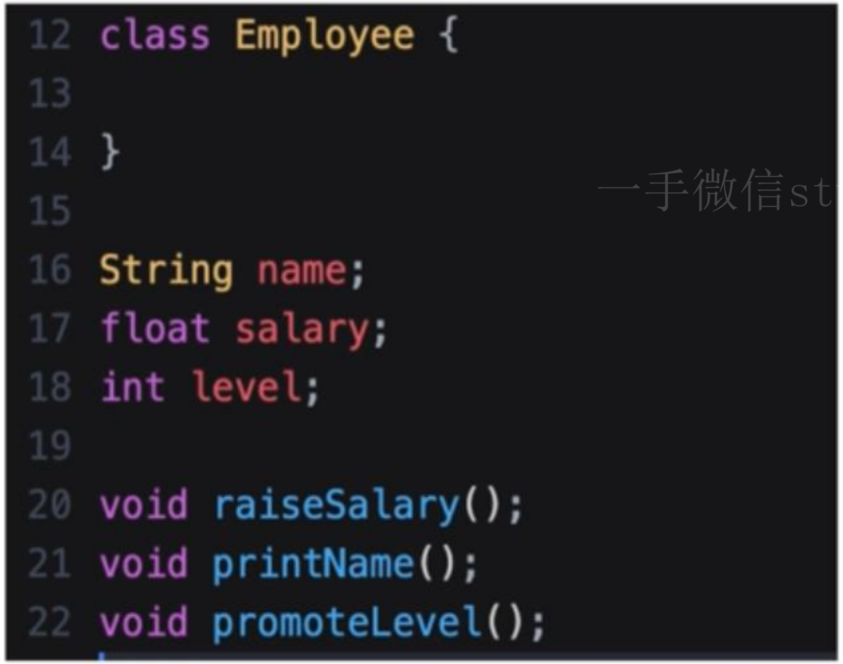
- Class
- Object



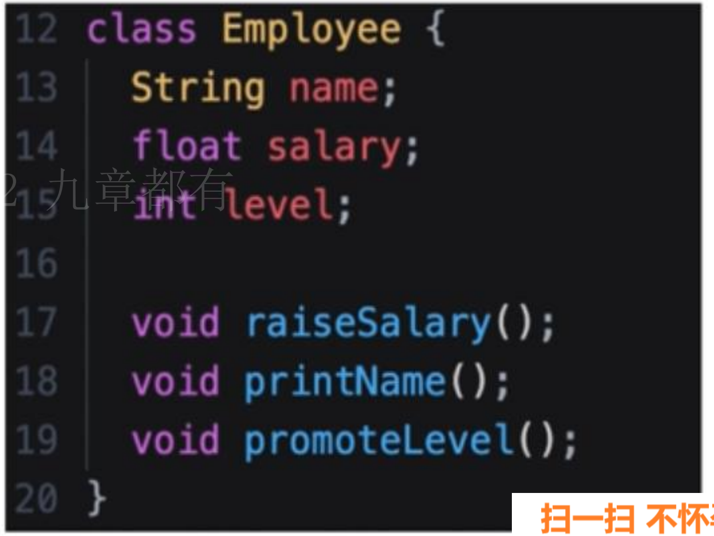
```
class Animal {}

Animal a = new Animal();
```

OOD 面向对象设计

- 封装



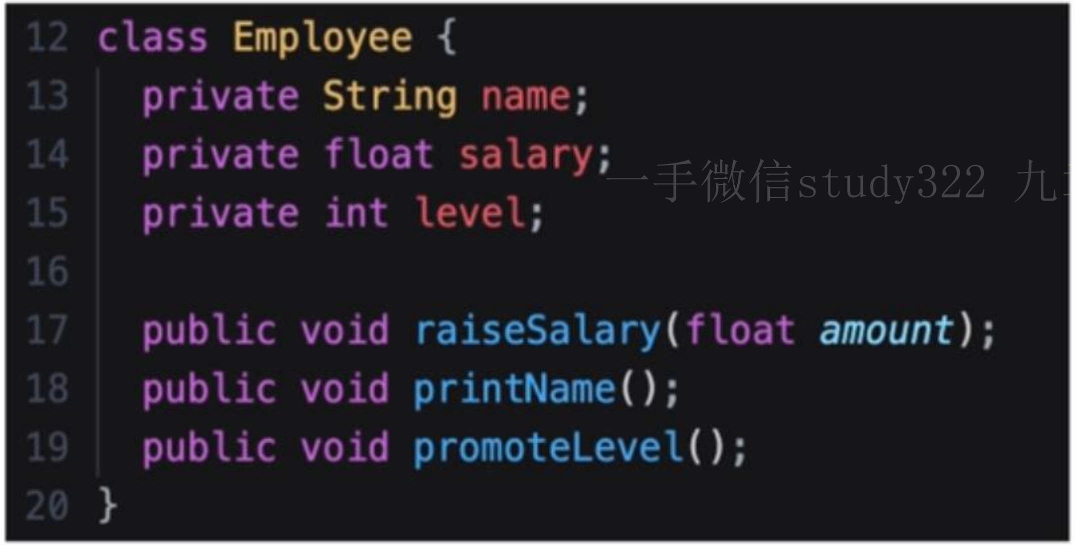
```
class Employee {

}

String name;
float salary;
int level;

void raiseSalary();
void printName();
void promoteLevel();
```



```
class Employee {
  String name;
  float salary;
  int level;

  void raiseSalary();
  void printName();
  void promoteLevel();
}
```

OOD 面向对象设计

- 封装

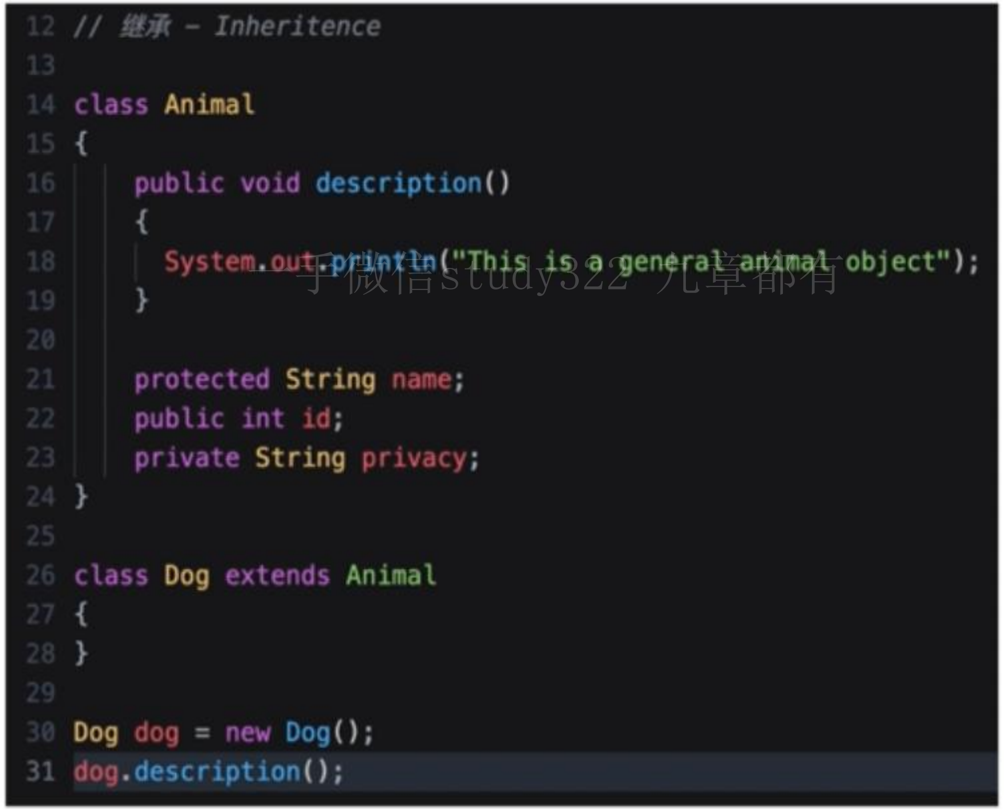


```
class Employee {
  private String name;
  private float salary;
  private int level;

  public void raiseSalary(float amount);
  public void printName();
  public void promoteLevel();
}
```

继承

OOD 面向对象设计

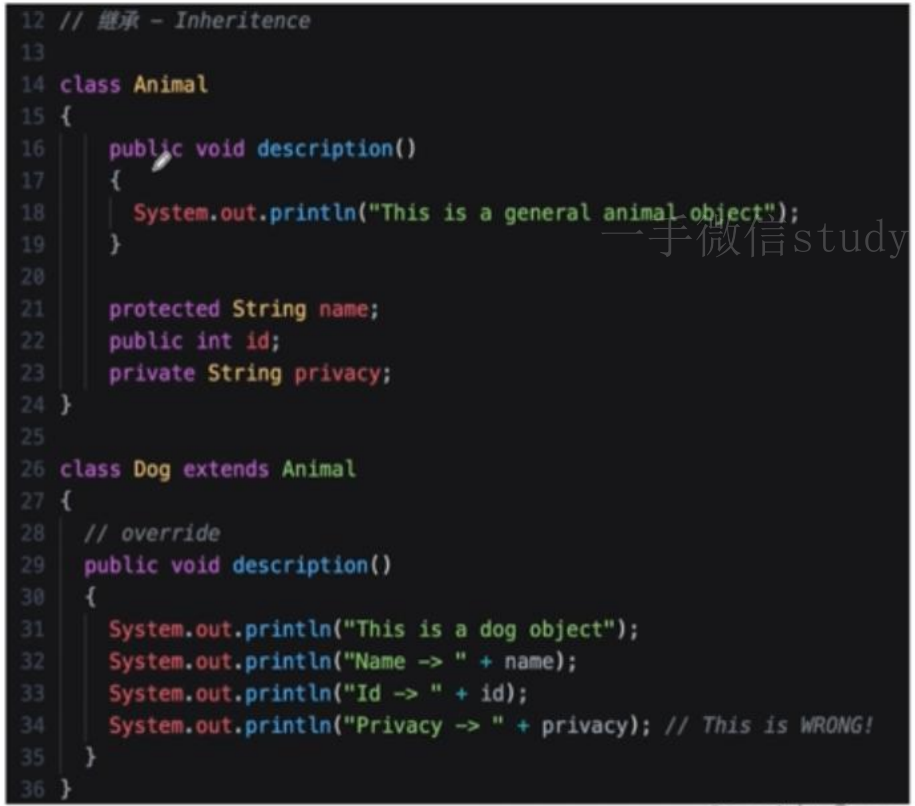
- 继承



```java
// 继承 - Inheritence

class Animal
{
    public void description()
    {
        System.out.println("This is a general animal object");
    }

    protected String name;
    public int id;
    private String privacy;
}

class Dog extends Animal
{
}

Dog dog = new Dog();
dog.description();
```

OOD 面向对象设计

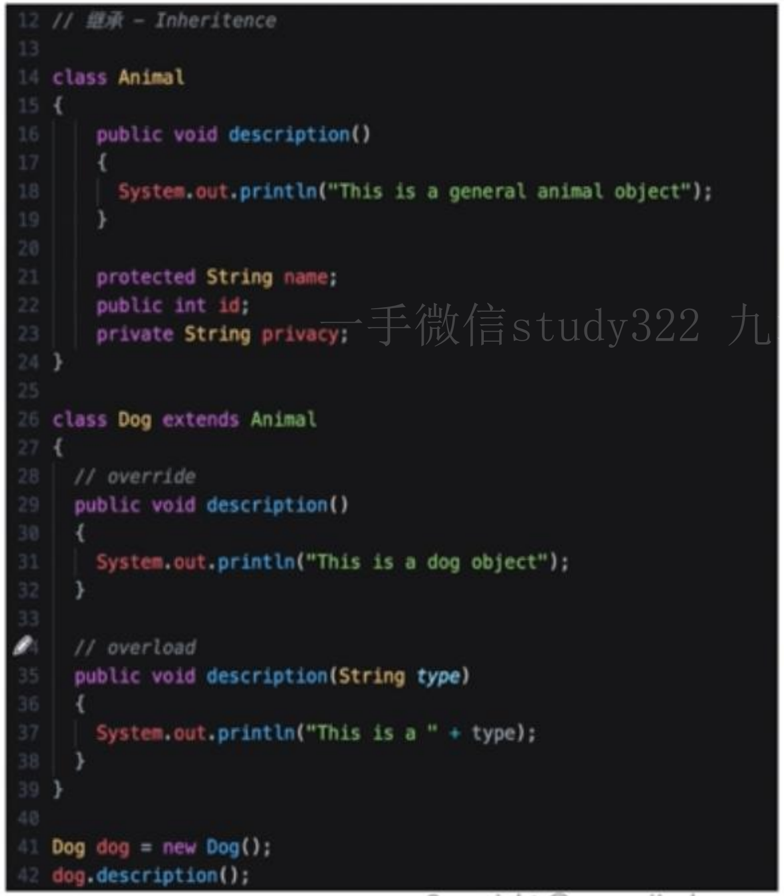
- 继承



```
// 继承 - Inheritence

class Animal
{
    public void description()
    {
      System.out.println("This is a general animal object");
    }

    protected String name;
    public int id;
    private String privacy;
}

class Dog extends Animal
{
  // override
  public void description()
  {
    System.out.println("This is a dog object");
    System.out.println("Name -> " + name);
    System.out.println("Id -> " + id);
    System.out.println("Privacy -> " + privacy); // This is WRONG!
  }
}
```

OOD 面向对象设计

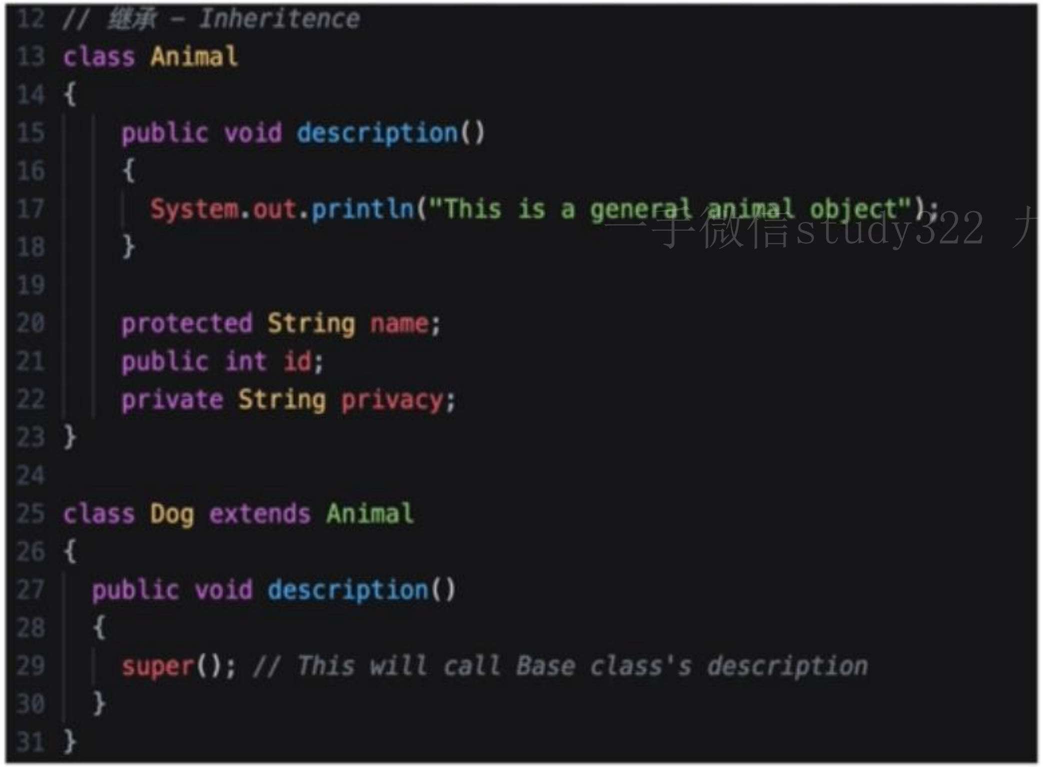
- 继承



```
// 继承 - Inheritence

class Animal
{
    public void description()
    {
        System.out.println("This is a general animal object");
    }

    protected String name;
    public int id;
    private String privacy;
}

class Dog extends Animal
{
  // override
  public void description()
  {
    System.out.println("This is a dog object");
  }

  // overload
  public void description(String type)
  {
    System.out.println("This is a " + type);
  }
}

Dog dog = new Dog();
dog.description();
```

OOD 面向对象设计

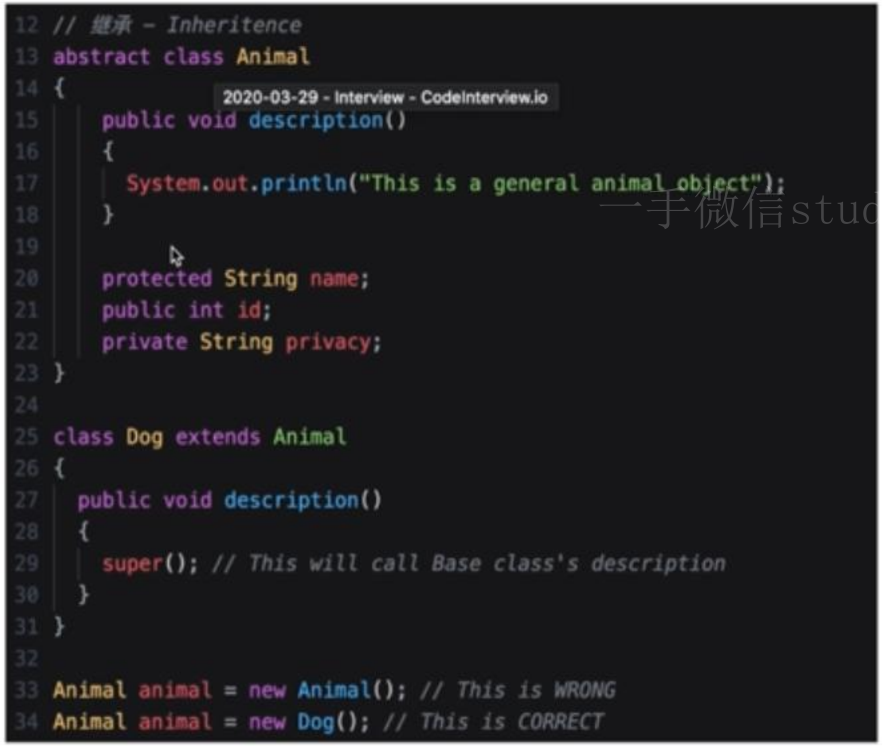
- 继承



```
// 继承 - Inheritence
class Animal
{
    public void description()
    {
        System.out.println("This is a general animal object");
    }

    protected String name;
    public int id;
    private String privacy;
}

class Dog extends Animal
{
  public void description()
  {
    super(); // This will call Base class's description
  }
}
```

OOD 面向对象设计

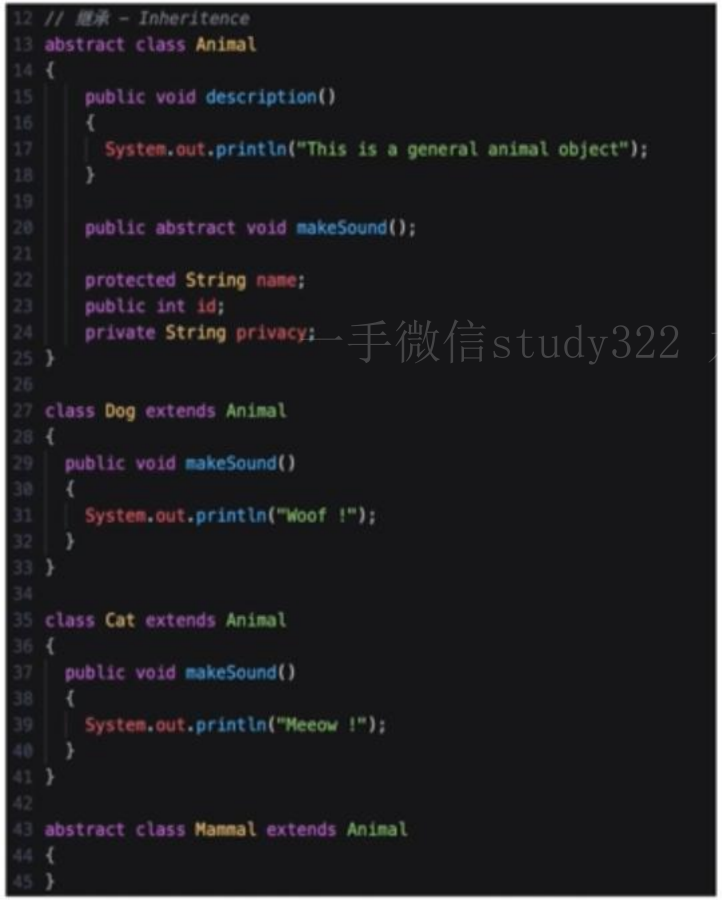
- 继承



```
// 继承 - Inheritence
abstract class Animal
{
    public void description()
    {
      System.out.println("This is a general animal object");
    }

    protected String name;
    public int id;
    private String privacy;
}

class Dog extends Animal
{
  public void description()
  {
    super(); // This will call Base class's description
  }
}

Animal animal = new Animal(); // This is WRONG
Animal animal = new Dog(); // This is CORRECT
```

OOD 面向对象设计

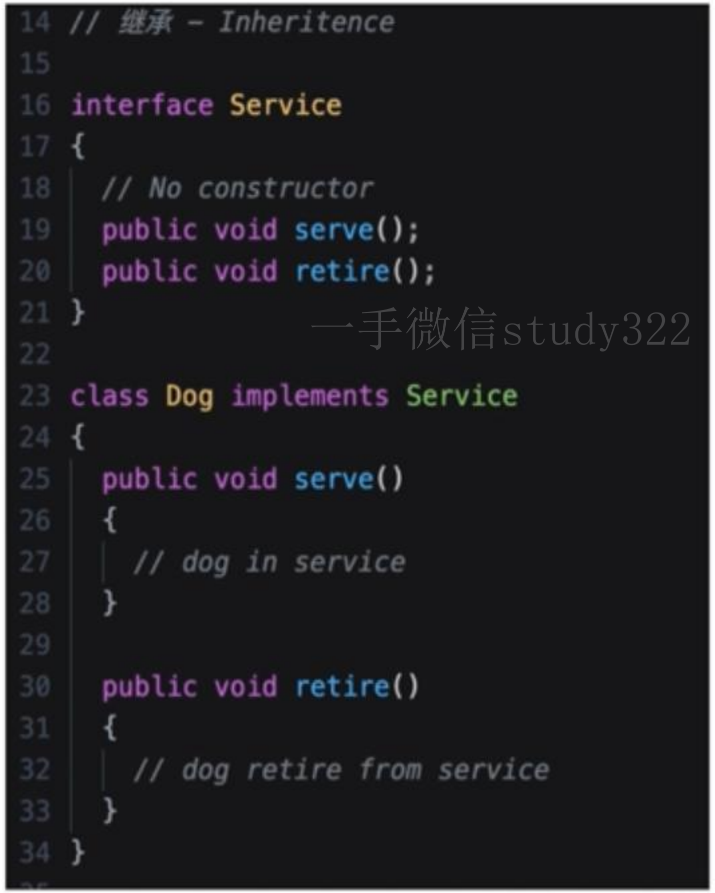
- 继承



```java
// 继承 - Inheritence
abstract class Animal
{
    public void description()
    {
        System.out.println("This is a general animal object");
    }

    public abstract void makeSound();

    protected String name;
    public int id;
    private String privacy;
}

class Dog extends Animal
{
    public void makeSound()
    {
        System.out.println("Woof !");
    }
}

class Cat extends Animal
{
    public void makeSound()
    {
        System.out.println("Meeow !");
    }
}

abstract class Mammal extends Animal
{
}
```

OOD 面向对象设计

- 继承



```
// 继承 - Inheritence

interface Service
{
    // No constructor
    public void serve();
    public void retire();
}

class Dog implements Service
{
    public void serve()
    {
        // dog in service
    }

    public void retire()
    {
        // dog retire from service
    }
}
```

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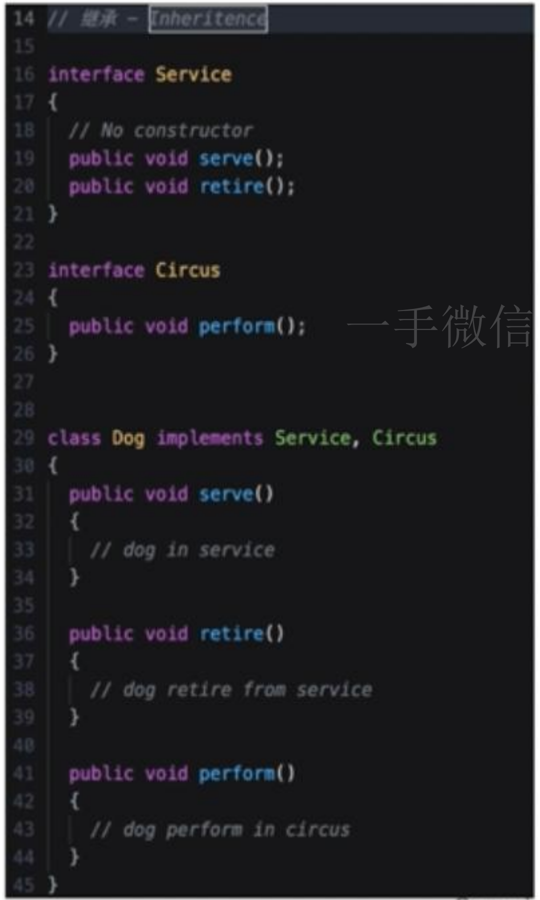
OOD 面向对象设计

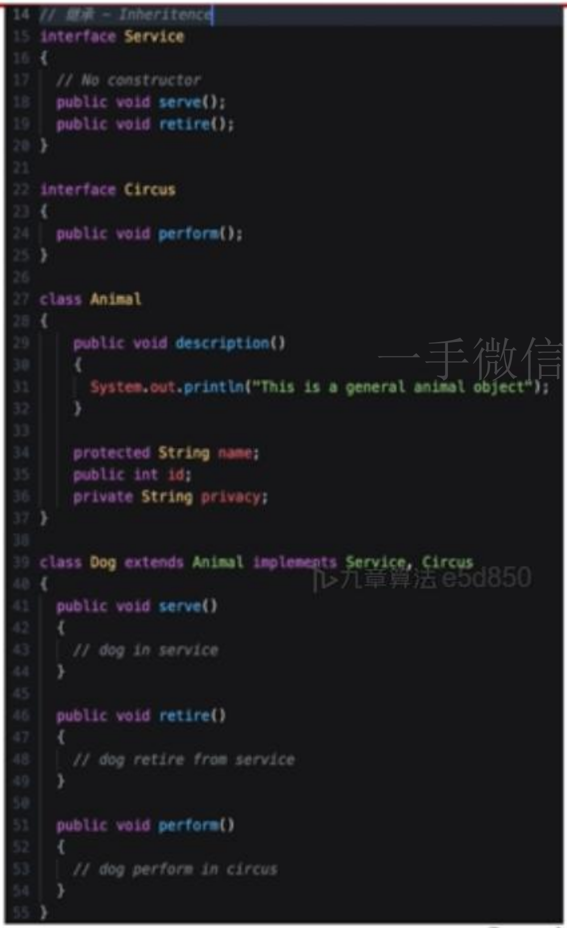
- 继承



```
// 继承 - Inheritence

interface Service
{
  // No constructor
  public void serve();
  public void retire();
}

interface Circus
{
  public void perform();
}


class Dog implements Service, Circus
{
  public void serve()
  {
    // dog in service
  }

  public void retire()
  {
    // dog retire from service
  }

  public void perform()
  {
    // dog perform in circus
  }
}
```

OOD 面向对象设计

- 继承



```java
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interface Service
{
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    public void serve();
    public void retire();
}

interface Circus
{
    public void perform();
}

class Animal
{
    public void description()
    {
        System.out.println("This is a general animal object");
    }

    protected String name;
    public int id;
    private String privacy;
}

class Dog extends Animal implements Service, Circus
{
    public void serve()
    {
        // dog in service
    }

    public void retire()
    {
        // dog retire from service
    }

    public void perform()
    {
        // dog perform in circus
    }
}
```
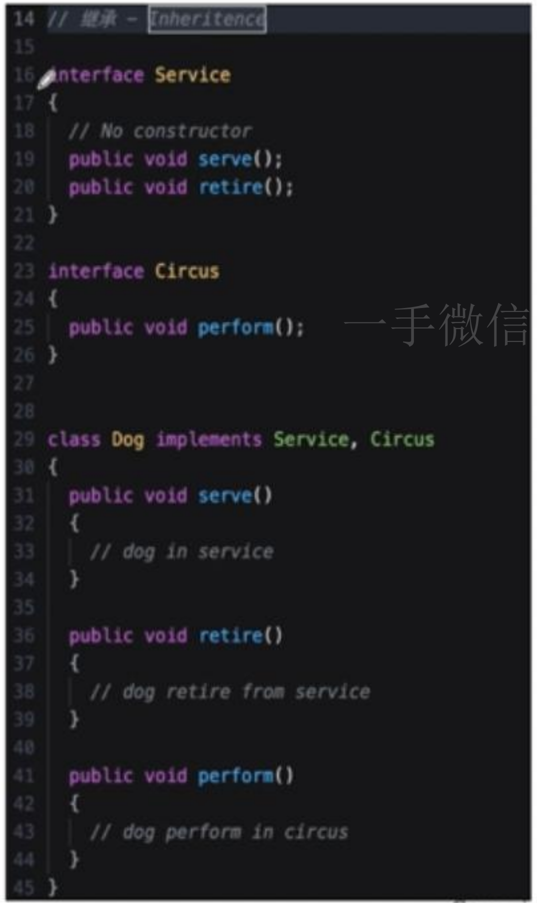

OOD 面向对象设计

- 继承



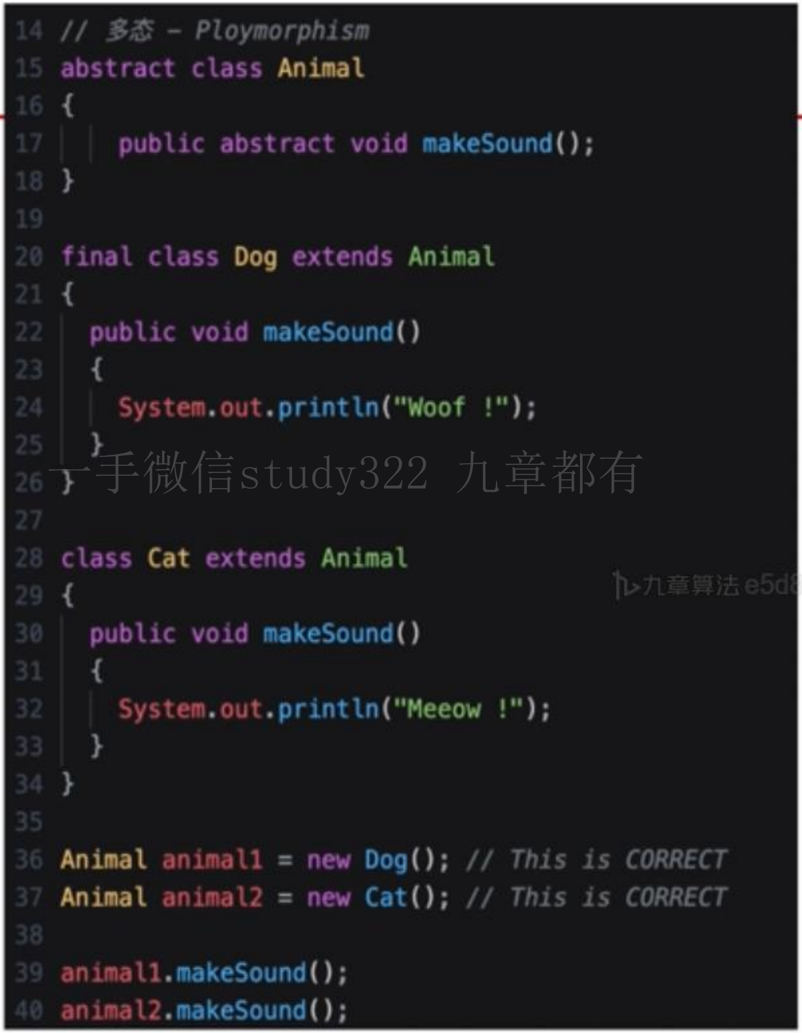
```
// 继承 - Inheritence

interface Service
{
  // No constructor
  public void serve();
  public void retire();
}

interface Circus
{
  public void perform();
}


class Dog implements Service, Circus
{
  public void serve()
  {
    // dog in service
  }

  public void retire()
  {
    // dog retire from service
  }

  public void perform()
  {
    // dog perform in circus
  }
}
```

九章算法

多态

OOD 面向对象设计

- 多态



```
// 多态 - Ploymorphism
abstract class Animal
{
    public abstract void makeSound();
}

final class Dog extends Animal
{
  public void makeSound()
  {
    System.out.println("Woof !");
  }
}

class Cat extends Animal
{
  public void makeSound()
  {
    System.out.println("Meeow !");
  }
}

Animal animal1 = new Dog(); // This is CORRECT
Animal animal2 = new Cat(); // This is CORRECT

animal1.makeSound();
animal2.makeSound();
```

Exception

OOD 面向对象设计

- 异常

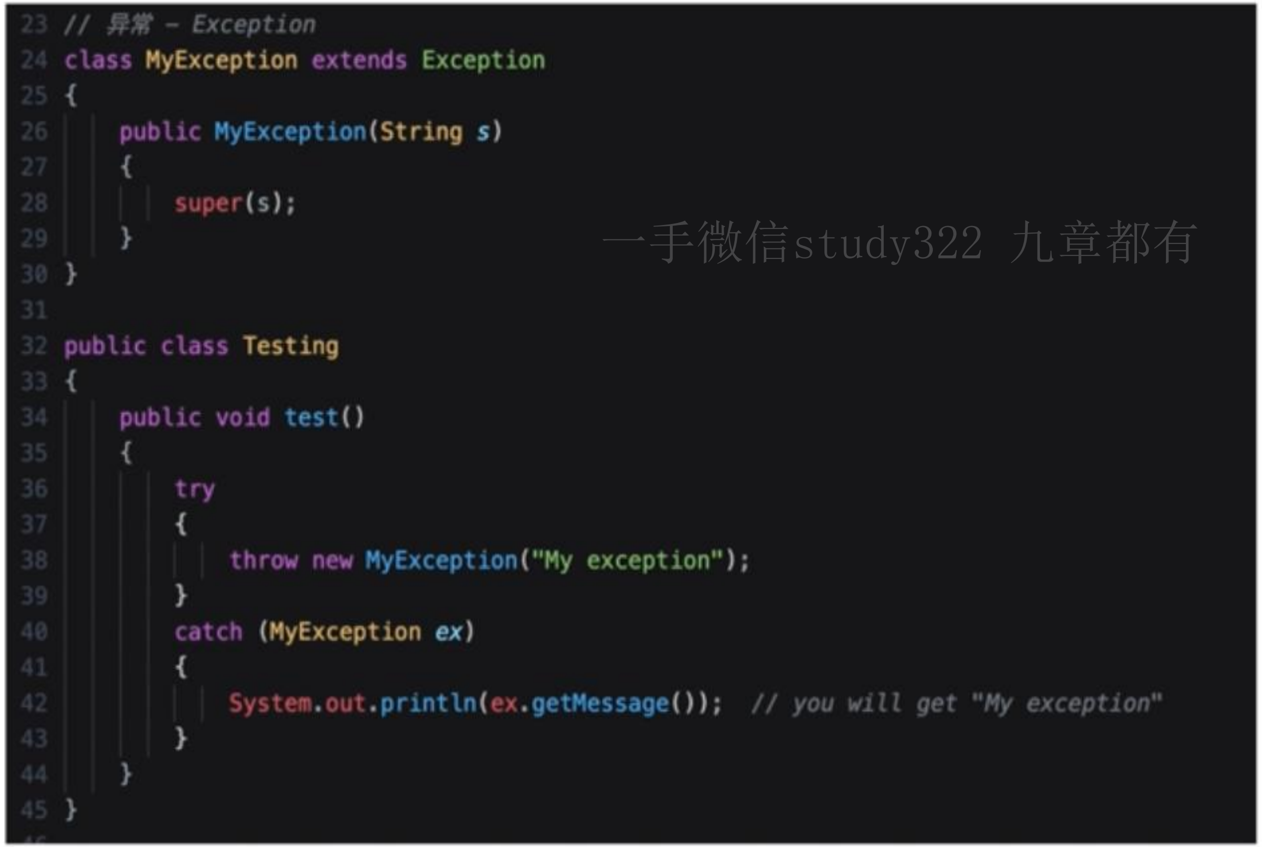
  Exception in JAVA:

  - Checked Exception (IO Exception, Compile time exception)
  - Unchecked Exception (Runtime Exception, NPE)

OOD 面向对象设计

九章算法

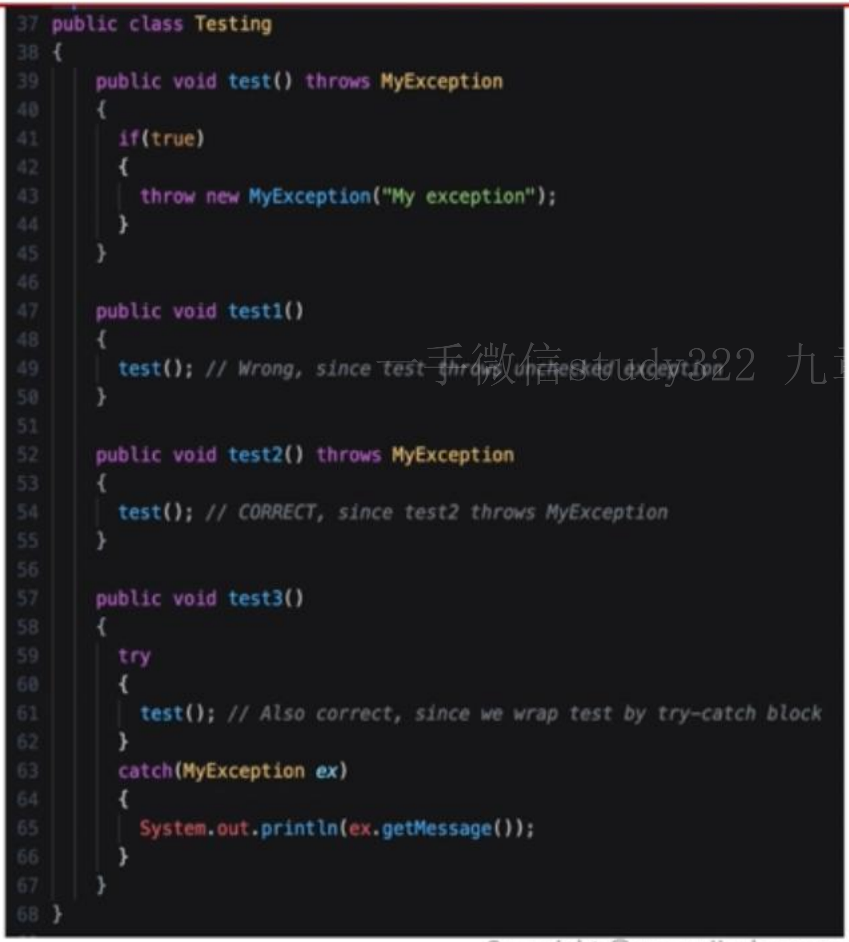
- 异常



```
// 异常 - Exception
class MyException extends Exception
{
    public MyException(String s)
    {
        super(s);
    }
}

public class Testing
{
    public void test()
    {
        try
        {
            throw new MyException("My exception");
        }
        catch (MyException ex)
        {
            System.out.println(ex.getMessage());  // you will get "My exception"
        }
    }
}
```

OOD 面向对象设计

- 异常

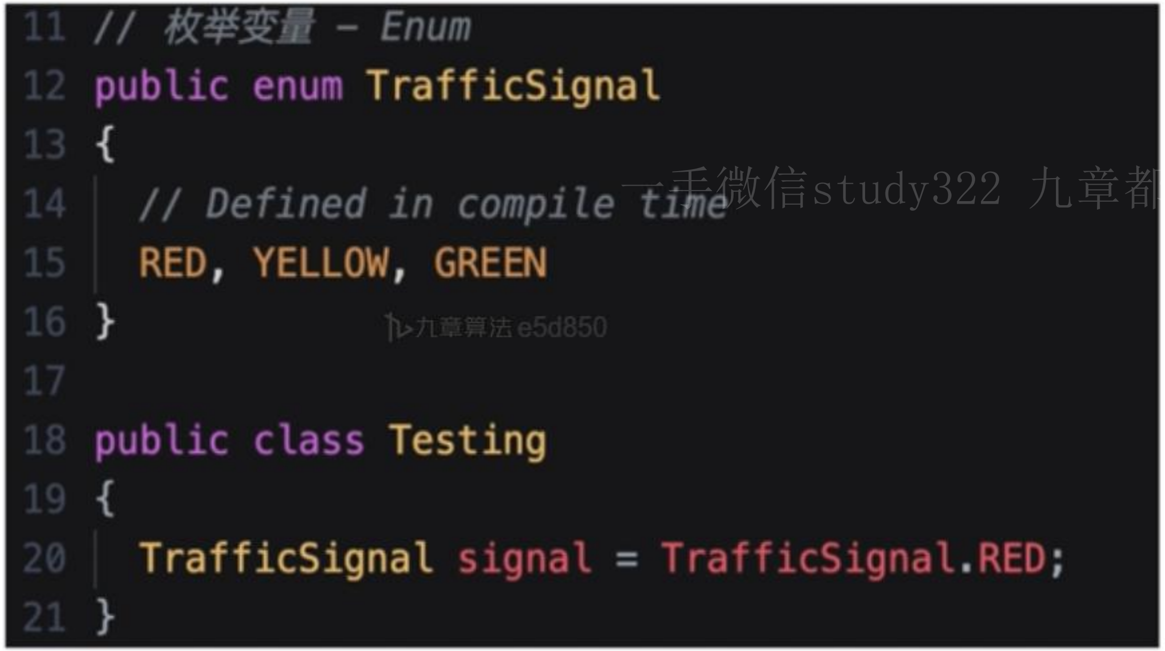


```java
public class Testing
{
    public void test() throws MyException
    {
        if(true)
        {
            throw new MyException("My exception");
        }
    }

    public void test1()
    {
        test(); // Wrong, since test throws unchecked exception
    }

    public void test2() throws MyException
    {
        test(); // CORRECT, since test2 throws MyException
    }

    public void test3()
    {
        try
        {
            test(); // Also correct, since we wrap test by try-catch block
        }
        catch(MyException ex)
        {
            System.out.println(ex.getMessage());
        }
    }
}
```

Enum

OOD 面向对象设计

- 枚举变量



```
// 枚举变量 - Enum
public enum TrafficSignal
{
  // Defined in compile time
  RED, YELLOW, GREEN
}

public class Testing
{
  TrafficSignal signal = TrafficSignal.RED;
}
```

Speak to the audience

- 我不太能够区分OOD和系统设计；想要能够系统的学习OOD的知识点

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Speak to the audience

- 我不太能够区分OOD和系统设计；想要能够系统的学习OOD的知识点
- 我是在读的学生，还没有面试经验；想要学习如何准备OOD的面试

Speak to the audience

- 我不太能够区分OOD和系统设计；想要能够系统的学习OOD的知识点
- 我是在读的学生，还没有面试经验；想要学习如何准备OOD的面试
- 我经常被OOD题型的面试题难住，不知道应该从何下手；想要学习解题方法和技巧

What will you be learning from lesson 1

- 什么是OOD，他和系统设计有什么区别？
- OOD经常在面试中出现吗？它重要吗？
- 怎么样的设计才算是好的设计？
- 如何解答OOD的题目 – 5C解题法
- 这门课有什么要求吗？

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What will you be learning after lesson 1

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- 如何解答OOD的题目 – 5C解题法
- 这门课有什么要求吗？

- OOD的题目类型划分：
  - 管理类 / 预定类 / 实物类 / 游戏类

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OOD介绍

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OOD vs. System Design

	Object Oriented Design	System Design
面试者		
出题目的		
常见公司		
关键字		
例题		

OOD vs. System Design

	Object Oriented Design	System Design
面试者	应届毕业生，SDE I -	有经验的面试者， SDE I +
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例题		

OOD vs. System Design

	Object Oriented Design	System Design
面试者	应届毕业生，SDE I -	有经验的面试者， SDE I +
出题目的	OOD常被当做考察面试者综合素质的标准	需要处理大量数据，提供Service的部门
常见公司		
关键字		
例题		

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OOD vs. System Design

	Object Oriented Design	System Design
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出题目的	OOD常被当做考察面试者综合素质的标准	需要处理大量数据，提供Service的部门
常见公司	Amazon, Uber,…	Facebook, Twitter,…
关键字		
例题		

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关键字	Viability	Scalability
例题		

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常见公司	Amazon, Uber,…	Facebook, Twitter,…
关键字	Viability	Scalability
例题	Design Elevator System	Design Twitter

OOD和面试

- 面试频率：
  - Phone interview 低
  - Onsite interview 中高频

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OOD和面试

- 面试频率：
  - Phone interview 低
  - Onsite interview 中高频

- 面试重要性：
  - 考察作为程序员的基础和大局观
  - 在一些公司拥有一票否决权

OOD和面试

- 面试频率：
  - Phone interview 低
  - Onsite interview 中高频
- 面试重要性：
  - 考察作为程序员的基础和大局观
  - 在一些公司拥有一票否决权
- 高频公司：
  - Amazon, Bloomberg, TripAdvisor, EMC, Uber…

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课程要求

- Coding skill
  - Java entry level，有基本的Java知识，了解基本的data structure如Array, List, HashMap等

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- Coding skill
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- Design pattern
  - 不需要design pattern的基础，我们将会在课程中讲解如何运用常见的design pattern来为面试加分

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课程要求

- Coding skill
  – Java entry level，有基本的Java知识，了解基本的data structure如Array, List, HashMap等
- Design pattern
  – 不需要design pattern的基础，我们将会在课程中讲解如何运用常见的design pattern来为面试加分
- Time commitment
  – 每节课时2小时，一周两节课，一共五节课10小时
  – Lintcode 做题，每周一小时

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如何评判一轮OOD面试

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S.O.L.I.D原则

- S – Single responsibility principle
- O – Open close principle
- L – Liskov substitution principle
- I – Interface segregation principle
- D – Dependency inversion principle

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S.O.L.I.D原则

- Single responsibility principle 单一责任原则

一个类应该有且只有一个去改变他的理由，这意味着一个类应该只有一项工作。

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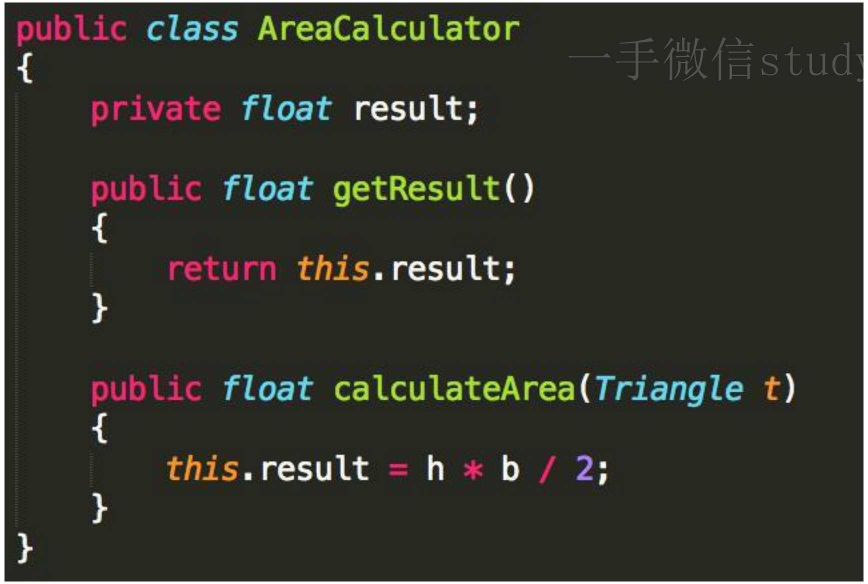
S.O.L.I.D原则

- Single responsibility principle 单一责任原则

一个类应该有且只有一个去改变他的理由，这意味着一个类应该只有一项工作。



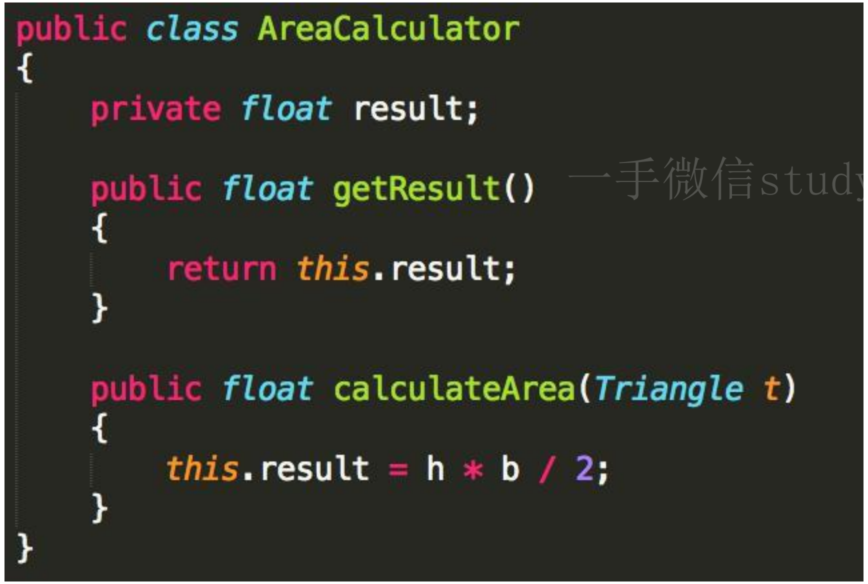
```
public class AreaCalculator
{
    private float result;

    public float getResult()
    {
        return this.result;
    }

    public float calculateArea(Triangle t)
    {
        this.result = h * b / 2;
    }
}
```

S.O.L.I.D原则

- Single responsibility principle 单一责任原则



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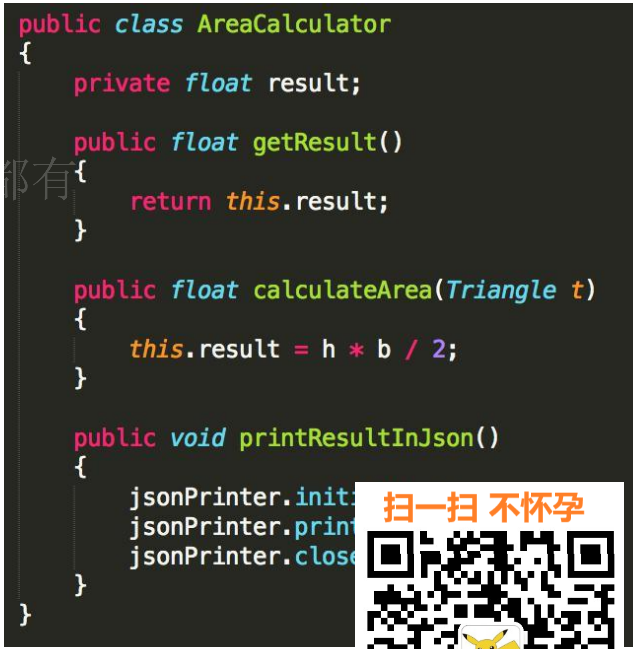
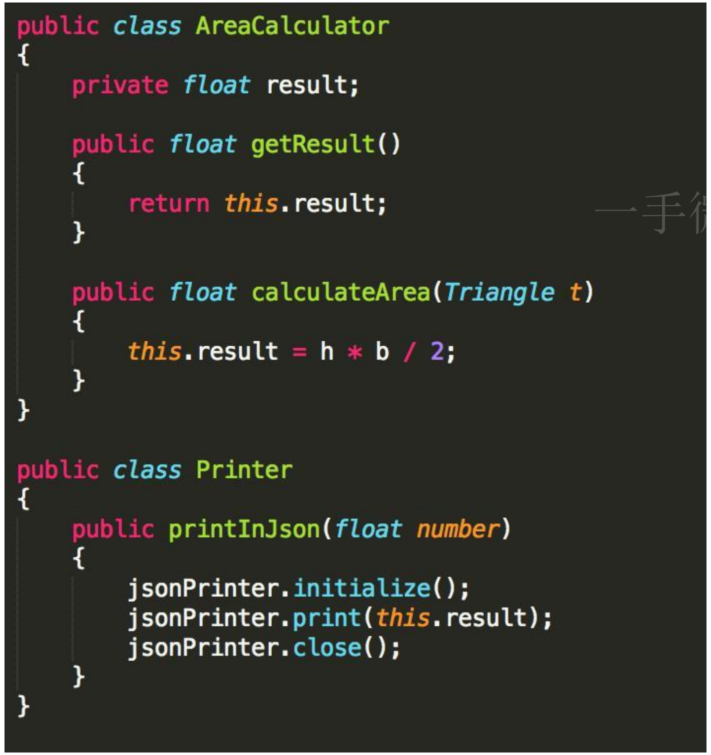


```java
public class AreaCalculator
{
    private float result;

    public float getResult()
    {
        return this.result;
    }

    public float calculateArea(Triangle t)
    {
        this.result = h * b / 2;
    }

    public void printResultInJson()
    {
        jsonPrinter.init
        jsonPrinter.print
        jsonPrinter.close
    }
}
```

S.O.L.I.D原则

- Single responsibility principle 单一责任原则



```
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{
    private float result;

    public float getResult()
    {
        return this.result;
    }

    public float calculateArea(Triangle t)
    {
        this.result = h * b / 2;
    }
}

public class Printer
{
    public printInJson(float number)
    {
        jsonPrinter.initialize();
        jsonPrinter.print(this.result);
        jsonPrinter.close();
    }
}
```

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S.O.L.I.D原则

- Open close principle 开放封闭原则

对象或实体应该对扩展开放，对修改封闭 (Open to extension, close to modification)。

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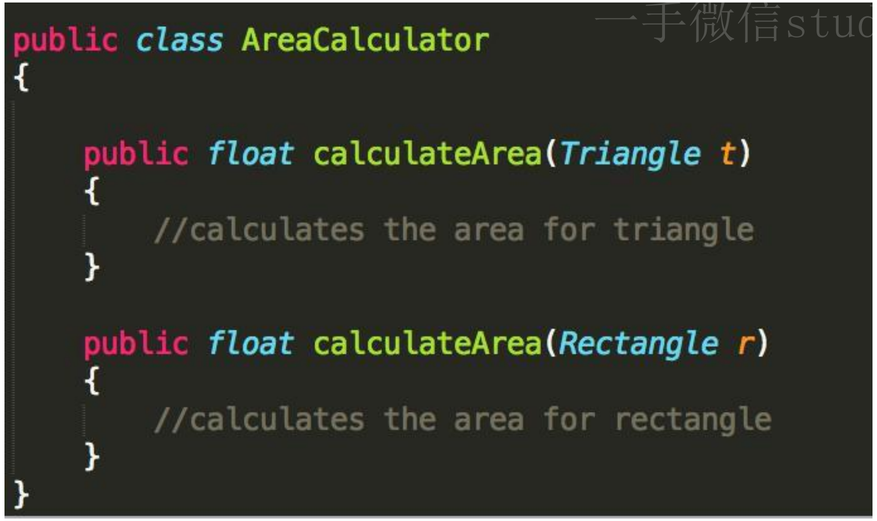
S.O.L.I.D原则

- Open close principle 开放封闭原则

对象或实体应该对扩展开放，对修改封闭 (Open to extension, close to modification)。



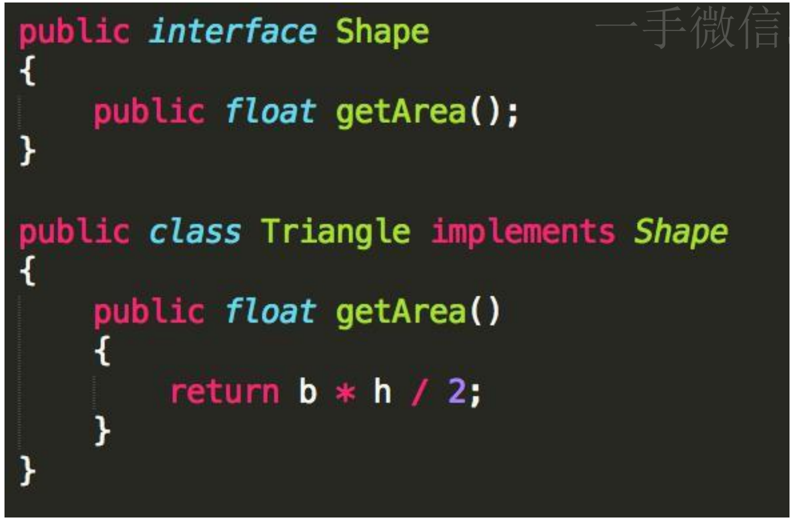
```
public class AreaCalculator
{

    public float calculateArea(Triangle t)
    {
        //calculates the area for triangle
    }

    public float calculateArea(Rectangle r)
    {
        //calculates the area for rectangle
    }
}
```

扫一扫 不怀孕

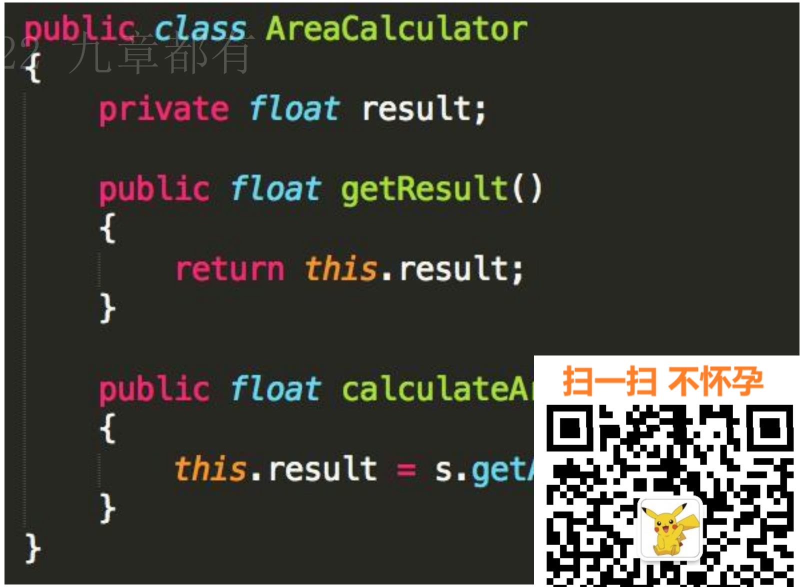
S.O.L.I.D原则

- Open close principle 开放封闭原则

对象或实体应该对扩展开放，对修改封闭 (Open to extension, close to modification)。



```
public interface Shape
{
    public float getArea();
}

public class Triangle implements Shape
{
    public float getArea()
    {
        return b * h / 2;
    }
}
```



```
public class AreaCalculator
{
    private float result;

    public float getResult()
    {
        return this.result;
    }

    public float calculateA
    {
        this.result = s.get
    }
}
```

S.O.L.I.D原则

- Liskov substitution principle 里氏替换原则

任何一个子类或派生类应该可以替换它们的基类或父类

扫一扫 不怀孕

S.O.L.I.D原则

- Interface segregation principle 接口分离原则

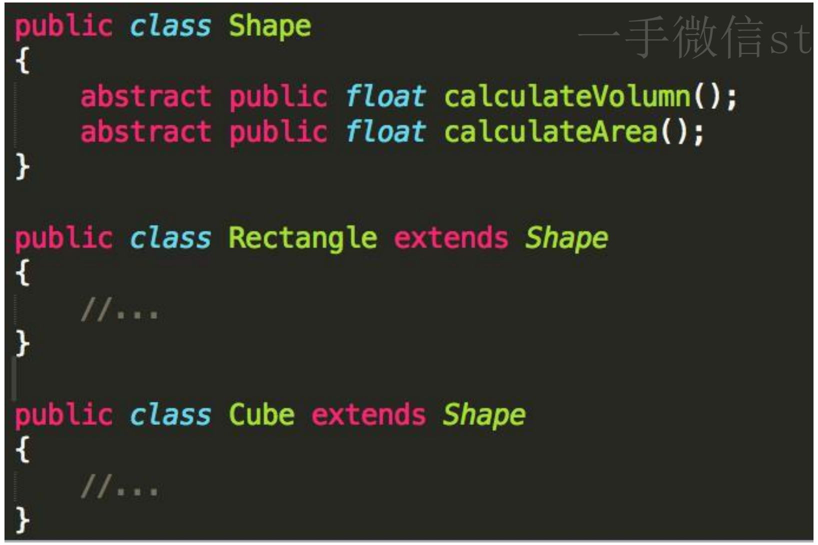
不应该强迫一个类实现它用不上的接口

S.O.L.I.D原则

九章算法

- Liskov substitution principle 里氏替换原则

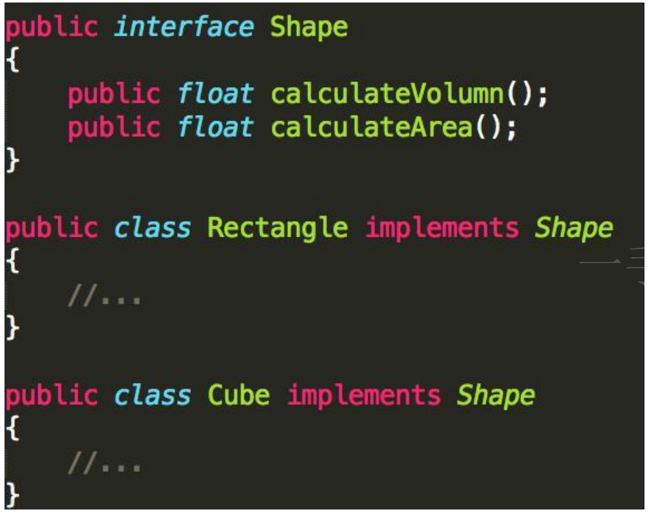
任何一个子类或派生类应该可以替换它们的基类或父类



```
public class Shape
{
    abstract public float calculateVolumn();
    abstract public float calculateArea();
}

public class Rectangle extends Shape
{
    //...
}

public class Cube extends Shape
{
    //...
}
```

扫一扫 不怀孕

S.O.L.I.D原则



```
public interface Shape
{
    public float calculateVolumn();
    public float calculateArea();
}

public class Rectangle implements Shape
{
    //...
}

public class Cube implements Shape
{
    //...
}
```

扫一扫 不怀孕

S.O.L.I.D原则

- Dependency inversion principle 依赖反转原则

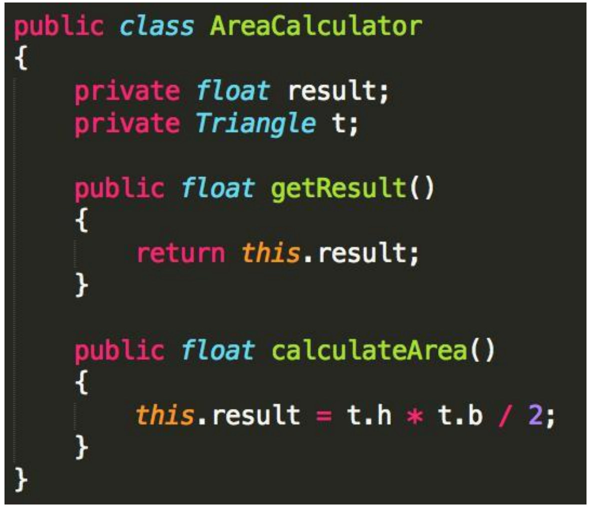
抽象不应该依赖于具体实现，具体实现应该依赖于抽象
High-level的实体不应该依赖于low-level的实体

扫一扫 不怀孕

S.O.L.I.D原则

- Dependency inversion principle 依赖反转原则

抽象不应该依赖于具体实现，具体实现应该依赖于抽象
High-level的实体不应该依赖于low-level的实体



```java
public class AreaCalculator
{
    private float result;
    private Triangle t;

    public float getResult()
    {
        return this.result;
    }

    public float calculateArea()
    {
        this.result = t.h * t.b / 2;
    }
}
```

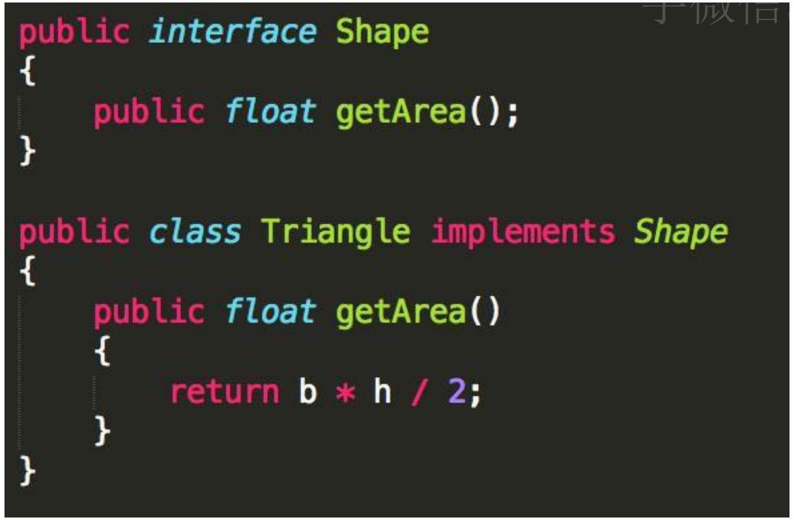
扫一扫 不怀孕

S.O.L.I.D原则

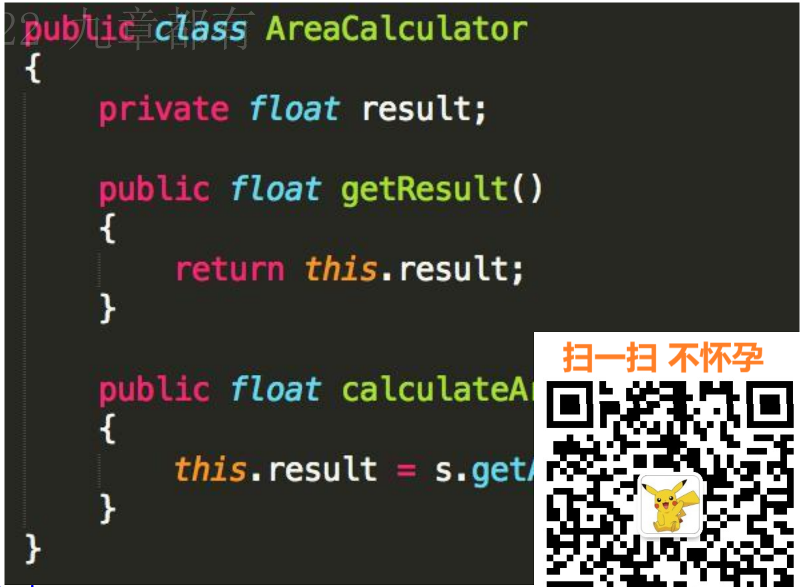
- Dependency inversion principle 依赖反转原则

抽象不应该依赖于具体实现，具体实现应该依赖于抽象

High-level的实体不应该依赖于low-level的实体



```
public interface Shape
{
    public float getArea();
}

public class Triangle implements Shape
{
    public float getArea()
    {
        return b * h / 2;
    }
}
```



```
public class AreaCalculator
{
    private float result;

    public float getResult()
    {
        return this.result;
    }

    public float calculateA
    {
        this.result = s.get
    }
}
```

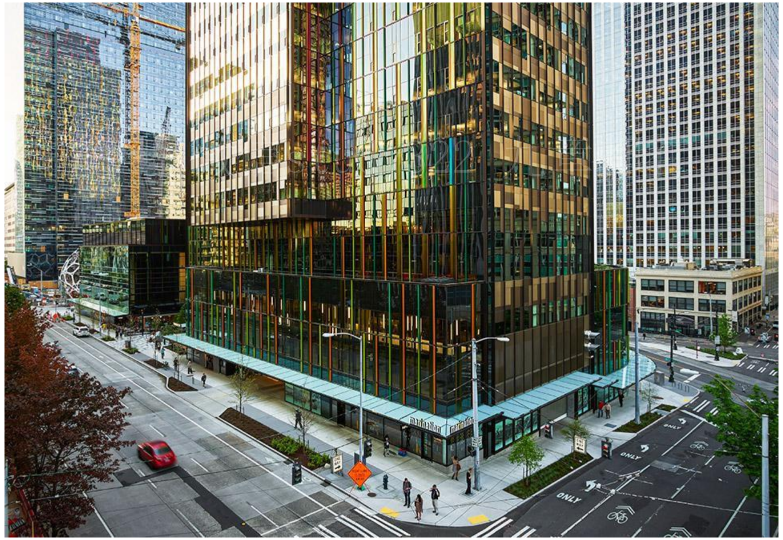
面试中应该怎么做?

- 实战演练

扫一扫 不怀孕

Elevator

- Can you design an elevator system for this building?



扫一扫 不怀孕

奔雷手 - 5C解题法

- Clarify
- Core objects
- Cases
- Classes
- Correctness

扫一扫 不怀孕

奔雷手 - 5C解题法

Clarify
说人话：通过和面试官交流，去除题目中的歧义，确定答题范围

Core objects
说人话：确定题目所涉及的类，以及类之间的映射关系

Cases
说人话：确定题目中所需要实现的场景和功能

Classes
说人话：通过类图的方式，具体填充题目中涉及的类

Correctness
说人话：检查自己的设计，是否满足关键点

扫一扫 不怀孕

Clarify

Example: Glass of water ?

扫一扫 不怀孕

Clarify

Example: Glass of water ?

Clarify

Example: Glass of water ?

Clarify

Example: Glass of water ?

扫一扫 不怀孕

Clarify

Example: Glass of water ?

Clarify

- What
- How

Clarify

- What

针对题目中的关键字来提问，帮助自己更好的确定答题范围。

*大多数的关键字为名词，通过名词的属性来考虑

扫一扫 不怀孕

Clarify

关键字1：Elevator

属性？

扫一扫 不怀孕

Clarify

关键字1：Elevator

- 可能需要考虑获取每辆电梯的目前重量

扫一扫 不怀孕

Clarify

关键字1：Elevator

- 可能需要考虑获取每辆电梯的目前重量

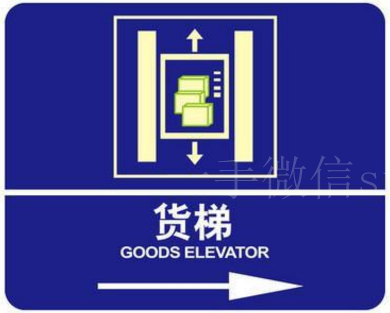
- What’s the weight limit of the elevator ?

- Do we need to consider overweight for our elevator system ?

Clarify

关键字1：Elevator

客梯
AIRSTAIRS



- 是否需要设计两种类，如果需要它们之间是什么关系？
- 客梯和货梯有什么区别？

Clarify

关键字1：Elevator

针对本题：所有电梯厢均为相同规格

扫一扫 不怀孕

Clarify

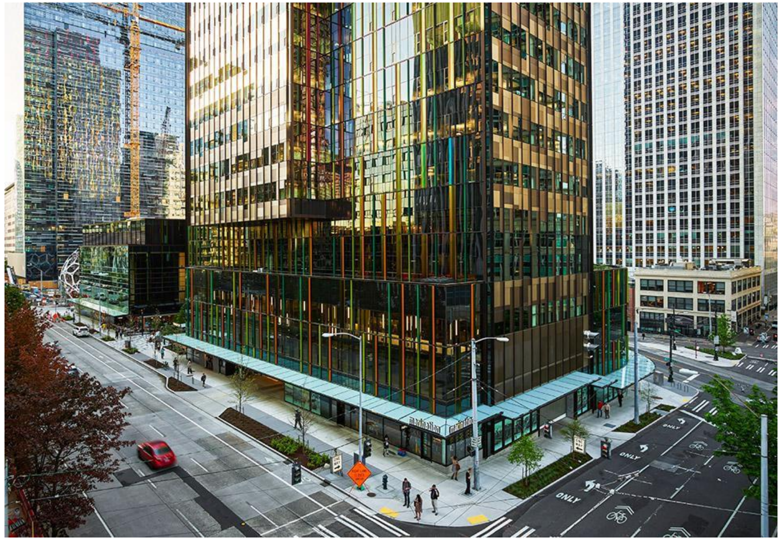
关键字2：Building

属性？

扫一扫 不怀孕

Clarify

关键字2：Building



楼有多大/楼有多高/楼内能容纳多少人？

- 通用属性，对于题目帮助不大

扫一扫 不怀孕

Clarify

关键字2：Building

是否有多处能搭乘的电梯口？

- 当收到一个搭乘电梯的请求时，有多少电梯能够响应？

Clarify

关键字2：Building

针对本题：每层仅一处能搭乘，所有电梯均可响应

扫一扫 不怀孕

Clarify

- How

针对问题主题的规则来提问，帮助自己明确解题方向。

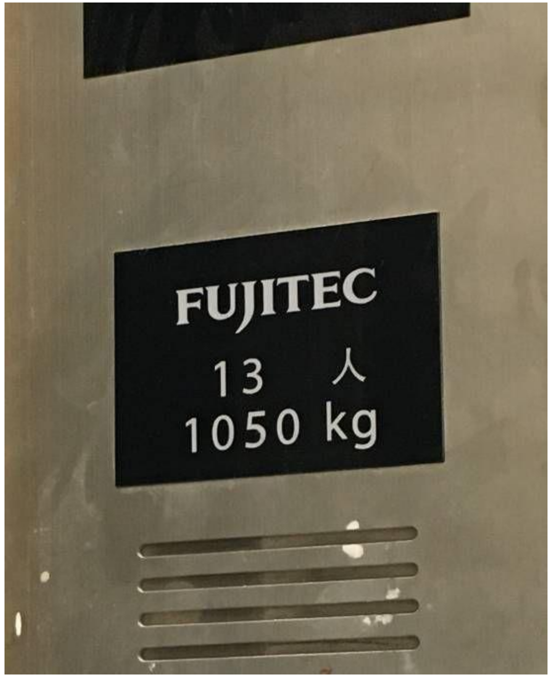
*此类问题没有标准答案，你可以提出一些解决方法，通过面试官的反应，选择一个你比较有信心（简单）的方案

扫一扫 不怀孕

Clarify

电梯有哪些规则？

Clarify



如何判断电梯是否超重？

Clarify

如何判断电梯是否超重？

- Passenger class包含重量
- 电梯能够自动感应当前重量

Clarify

当按下按钮时，哪一台电梯会相应？

- 同方向 > 静止 > 反向
- 一半负责奇数楼层，一半负责偶数楼层
- …

Clarify

当电梯在运行时，哪些按键可以响应？

- 是否能按下反向的楼层

扫一扫 不怀孕

Clarify

规则：

对于本题：同向 > 静止 > 反向，当运行时不能按下反向的楼层

信息：电梯至少需要三种状态，并且要知道当前在哪一层

Core Object

- 什么是Core Object
- 为什么要定义Core Object？
- 如何定义Core Object？

Core Object

- 什么是Core Object

为了完成设计，需要哪些类？

Core Object

- 为什么要定义Core Object？

- 这是和面试官初步的纸面contract
- 承上启下，来自于Clarify的结果，成为Use case的依据
- 为画类图打下基础

扫一扫 不怀孕

Core Object

- 如何定义Core Object？

- 以一个Object作为基础，线性思考
- 确定Objects之间的映射关系

Core Object

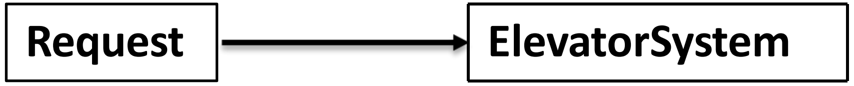
- 如何定义Core Object？

ElevatorSystem

扫一扫 不怀孕

Core Object

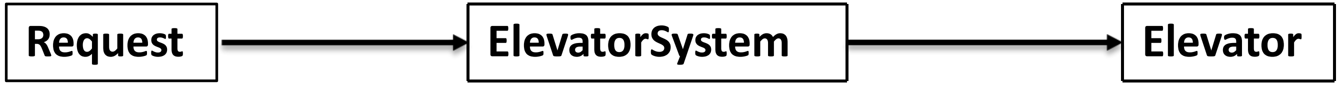
- 如何定义Core Object？



扫一扫 不怀孕

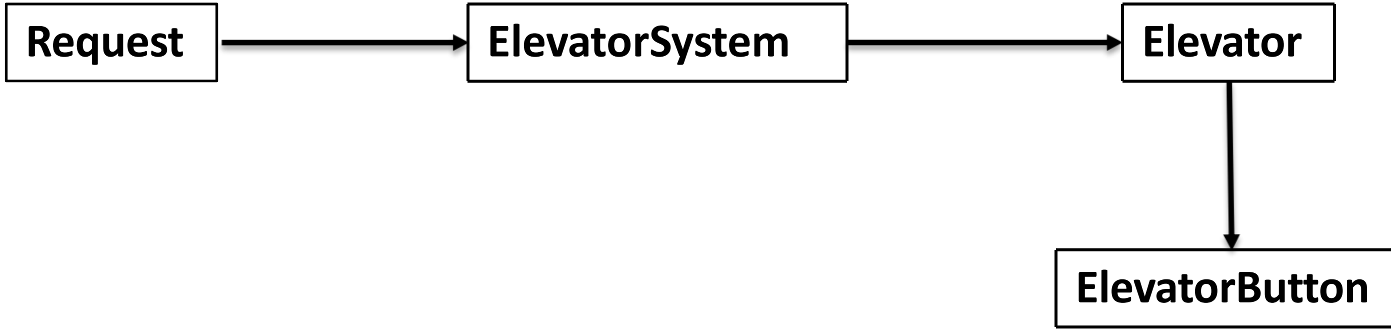
Core Object

- 如何定义Core Object？



Core Object

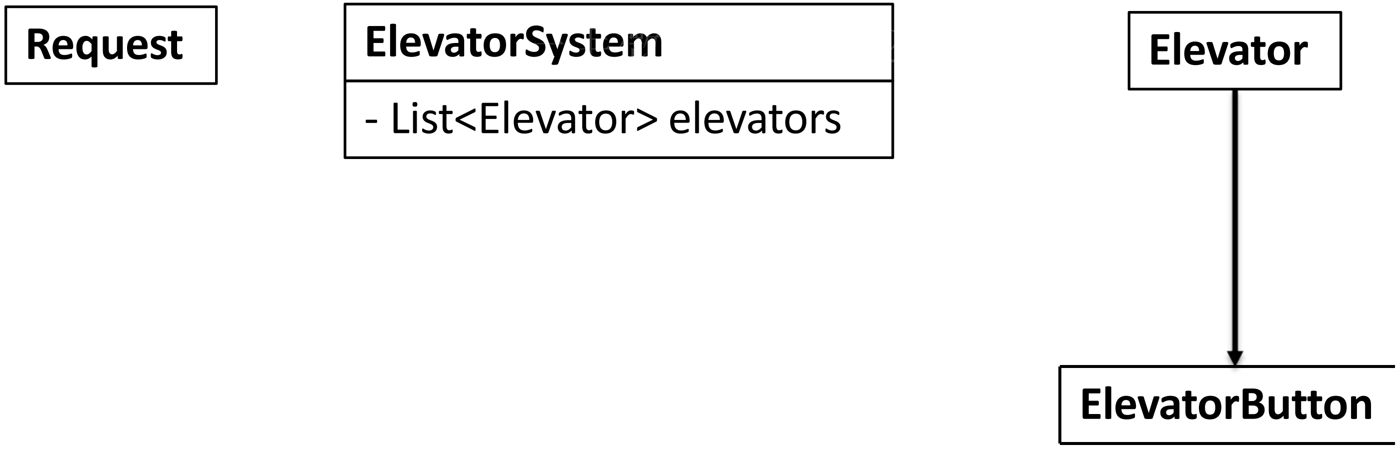
- 如何定义Core Object？



扫一扫 不怀孕

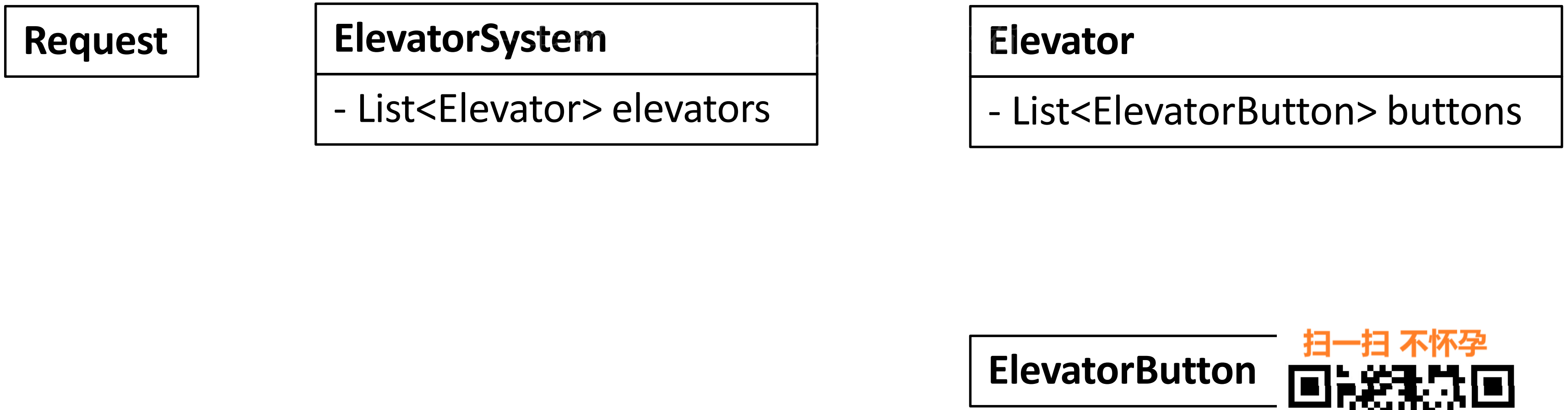
Core Object

- 如何定义Core Object？



Core Object

- 如何定义Core Object？



Good Practice

- Access modifier

- package
- public
- private
- protected

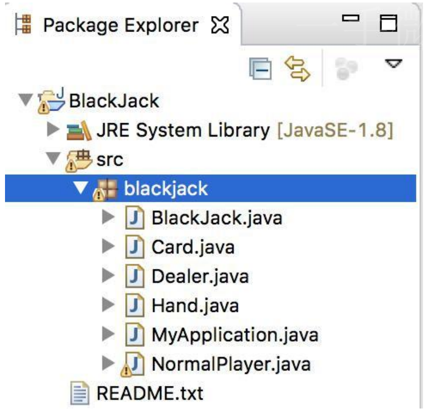
扫一扫 不怀孕

Good Practice

- package

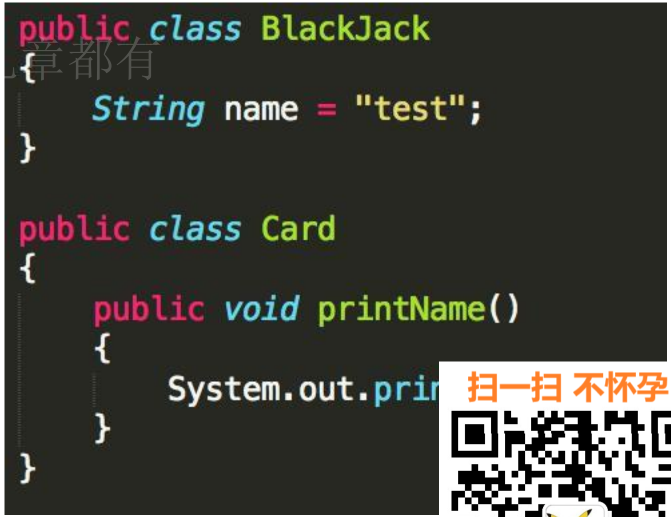
如果什么都不声明，变量和函数都是package level visible的，在同一个package内的其他类都可以访问

Example:



Package Explorer

```
▼ BlackJack
  ▶ JRE System Library [JavaSE-1.8]
  ▼ src
    ▼ blackjack
      ▶ BlackJack.java
      ▶ Card.java
      ▶ Dealer.java
      ▶ Hand.java
      ▶ MyApplication.java
      ▶ NormalPlayer.java
  README.txt
```



```
public class BlackJack
{
    String name = "test";
}

public class Card
{
    public void printName()
    {
        System.out.prin
    }
}
```

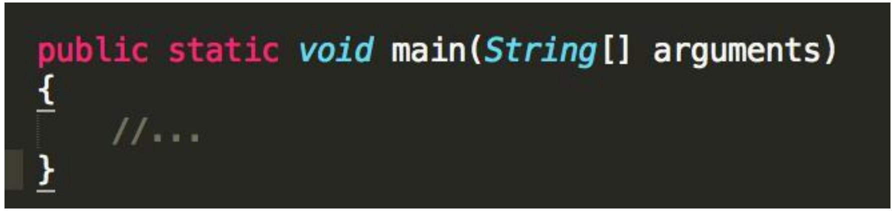
在类图中，避免使用default的package level access

Good Practice

- public

如果声明为public，变量和函数都是public level visible的，任何其他的类都可以访问

Example:



```
public static void main(String[] arguments)
{
    //...
}
```

在类图中，用”+”表示一个变量或者函数为public

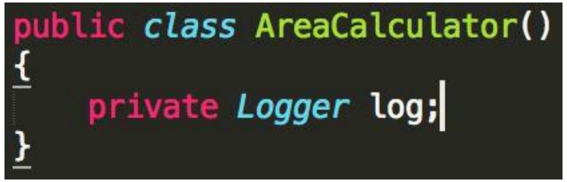
扫一扫 不怀孕

Good Practice

- private

如果声明为private，变量和函数都是class level visible的，这是所有access modifier中限制最多的一个。仅有定义这些变量和函数的类自己可以访问。

private也是OOD当中实现封装的重要手段。 Example:


```
public class AreaCalculator()
{
    private Logger log;
}
```

在类图中，用”-”表示一个变量或者函数为private

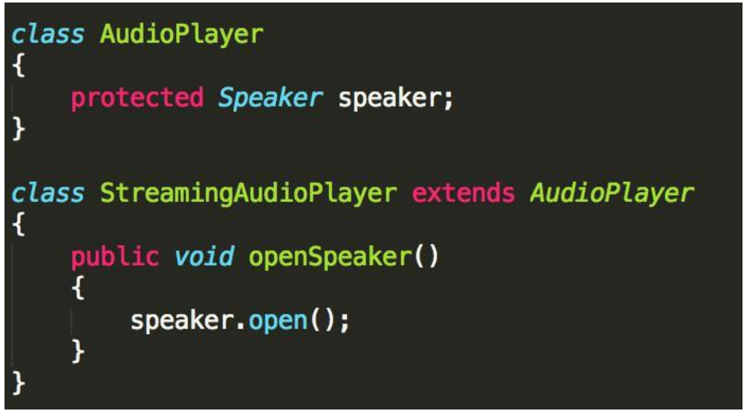
Good Practice

- protected

如果声明为protected，变量和函数在能被定义他们的类访问的基础上，还能够被该类的子类所访问。

protected也是OOD当中实现继承的重要手段。

Example:



```
class AudioPlayer
{
    protected Speaker speaker;
}

class StreamingAudioPlayer extends AudioPlayer
{
    public void openSpeaker()
    {
        speaker.open();
    }
}
```

在类图中，用”#”表示一个变量或者函数为protected

扫一扫 不怀孕

Cases

- 什么是Use case？
- 为什么要写Use cases？
- 如何写Use cases？

扫一扫 不怀孕

Cases

- 什么是Use case？

在你设计的系统中，需要支持哪些功能？

扫一扫 不怀孕

Cases

- 为什么要写Use cases？

- 这是你和面试官白纸黑字达成的第二份共识，把你将要实现的功能列在白板上
- 帮助你在解题过程中，理清条例，一个一个Case实现
- 作为检查的标准

扫一扫 不怀孕

Cases

- 怎么写Use cases？

- 利用定义的Core Object, 列举出每个Object对应产生的use case.
- 每个use case只需要先用一句简单的话来描述即可

Cases

- ElevatorSystem

扫一扫 不怀孕

Cases

- ElevatorSystem

- Handle request

扫一扫 不怀孕

Cases

- Request

N/A

扫一扫 不怀孕

Cases

- Elevator

扫一扫 不怀孕

Cases

- Elevator

- Take external request

扫一扫 不怀孕

Cases

- Elevator

- Take external request
- Take internal request

Cases

- Elevator

- Take external request
- Take internal request
- Open gate

扫一扫 不怀孕

Cases

- Elevator

- Take external request
- Take internal request
- Open gate
- Close gate

Cases

- Elevator

- Take external request
- Take internal request
- Open gate
- Close gate
- Check weight

Cases

- Elevator

- Take external request
- Take internal request
- Open gate
- Close gate
- Check weight

What about single responsibility principle?

扫一扫 不怀孕

Cases

- ElevatorButton

Cases

- ElevatorButton

- Press button

扫一扫 不怀孕

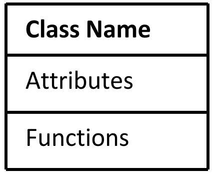
Class

- 什么是类图？
- 为什么要画类图？
- 怎么画类图？

扫一扫 不怀孕

Class

- Class diagram (类图)



扫一扫 不怀孕

Class

- 为什么要画类图？

- 可交付，Minimal Viable Product
- 节省时间，不容易在Coding上挣扎
- 建立在Use case上，和之前的步骤层层递进，条例清晰，便于交流和修改
- 如果时间允许/面试官要求，便于转化成Code

扫一扫 不怀孕

Class

九章算法

- 怎么画类图?

- 遍历你所列出的use cases
- 对于每一个use case，更加详细的描述这个use case在做什么事情（例如：take external request -> ElevatorSystem takes an external request, and decide to push this request to an appropriate elevator）
- 针对这个描述，在已有的Core objects里填充进所需要的信息

扫一扫 不怀孕

Class

Request

ElevatorSystem
- List<Elevator> elevators

Elevator
- List<ElevatorButton> buttons

ElevatorButton

Use cases

uest

al request

al request

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n

扫一扫 不怀孕

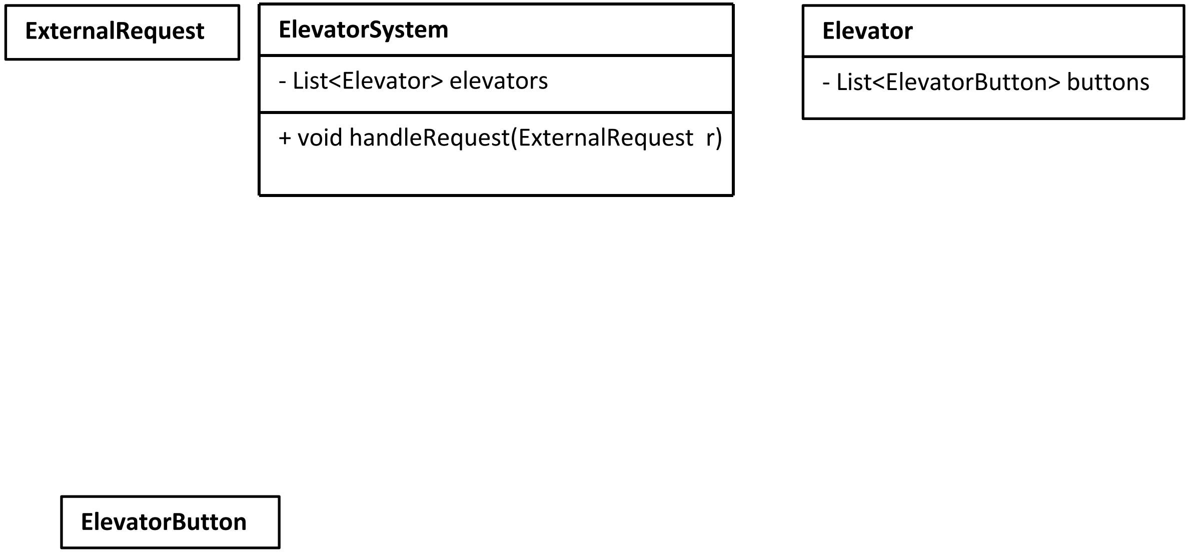
Class

- Use case: Handle request

ElevatorSystem takes an **external request**, and decide to push this request to an appropriate **elevator**

扫一扫 不怀孕

Class


ExternalRequest
ElevatorSystem
- List<Elevator> elevators
+ void handleRequest(ExternalRequest r)
Elevator
- List<ElevatorButton> buttons
ElevatorButton

扫一扫 不怀孕

cases

uest

al request

al request

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Good Practice

- 如何知道一个函数，是否成功完成任务？

地下一层电梯关闭，这时有人在地下一层按了向上的按钮，会发生什么？

扫一扫 不怀孕

Good Practice

- 如何知道一个函数，是否成功完成任务？

- Use boolean instead of void
成功的话返回true, 否则返回false

Good Practice

- 如何知道一个函数，是否成功完成任务？

- Use boolean instead of void

成功的话返回true, 否则返回false

- 如何知道是什么地方出错？

扫一扫 不怀孕

Good Practice

- 如何知道一个函数，是否成功完成任务？

- Use exceptions

Class

ExternalRequest

ElevatorSystem
- List<Elevator> elevators
+ void handleRequest(ExternalRequest r)

Elevator
- List<ElevatorButton> buttons

InvalidExternalRequestException

ElevatorButton

Use cases

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al request

al request

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n

扫一扫 不怀孕

Class

- Use case: Take external request

An **elevator** takes an external **request**, inserts in its stop list.

扫一扫 不怀孕

Class

ExternalRequest

- Direction d
- int level

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons

InvalidExternalRequestException

ElevatorButton

cases

uest

al request

al request

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n

扫一扫 不怀孕

Class

ExternalRequest
- Direction d
- int level

ElevatorSystem
- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator
- List<ElevatorButton> buttons

InvalidExternalRequestException

<<enumeration>>
Direction

Up Down

ElevatorButton

Use cases

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Class

ExternalRequest

- Direction d
- int level

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons

+ void handleExternalRequest(ExternalRequest r)

InvalidExternalRequestException

<<enumeration>>
Direction

Up Down

ElevatorButton

Use cases

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Class

九章算法 九章算法

ExternalRequest

- Direction d
- int level

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> stops

+ void handleExternalRequest(ExternalRequest r)

InvalidExternalRequestException

<<enumeration>>
Direction

Up Down

ElevatorButton

扫一扫 不怀孕

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Challenge

- 如果电梯目前在1L，有人按下了5L向上，之后又有人按下了3L向上，电梯会怎样行动？

stops will be {5,3} Expected is: {3,5}

Challenge

- 如果电梯目前在1L，有人按下了5L向上，之后又有人按下了3L向上，电梯会怎样行动？

stops will be {5,3} Expected is: {3,5}

Solution1: sort stops every time we add to it.

扫一扫 不怀孕

Challenge

- 如果电梯目前在1L，有人按下了5L向上，之后又有人按下了3L向上，电梯会怎样行动？

stops will be {5,3} Expected is: {3,5}

Solution2: use priority queue instead of list

Challenge

- 如果电梯目前在1L，有人按下了5L向上，之后又有人按下了3L向上，紧接着这台电梯又被分配了一个2L向下的request。这台电梯会如何行动？

stops will be {2，3，5} Expected is: {3，5，2}

Challenge

- 如果电梯目前在1L，有人按下了5L向上，之后又有人按下了3L向上，紧接着这台电梯又被分配了一个2L向下的request。这台电梯会如何行动？

stops will be {2，3，5} Expected is: {3，5，2}

Solution: keep 2 lists for different direction

Class

ExternalRequest
- Direction d
- int level

ElevatorSystem
- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator
- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops

+ void handleExternalRequest(ExternalRequest r)

InvalidExternalRequestException

<<enumeration>>
Direction

Up Down

ElevatorButton

cases

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扫一扫 不怀孕

Challenge

- How do you handle an external request?
- What if I want to apply different ways to handle external requests during different time of a day?
- Can you implement it in code?

Challenge

- How do you handle an external request?

如我们最早和面试官讨论的结果：　同方向

> 静止 > 反向

Challenge

九章算法

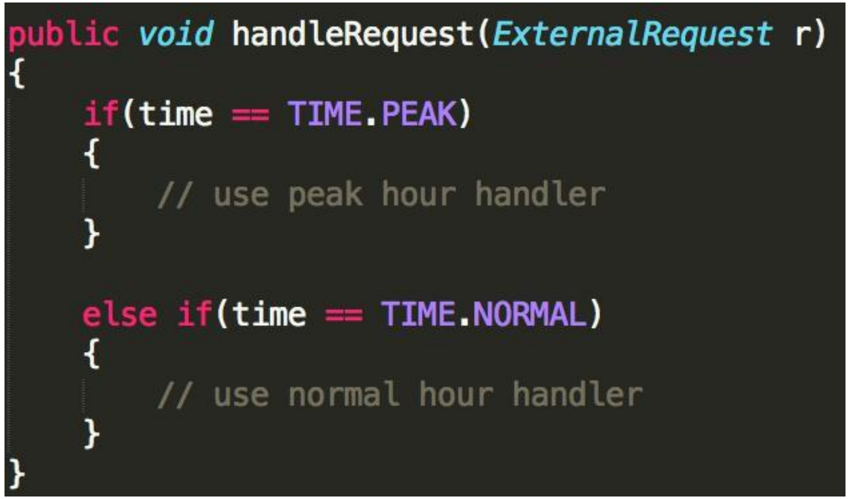
- What if I want to apply different ways to handle external requests during different time of a day?

扫一扫 不怀孕

Challenge

- What if I want to apply different ways to handle external requests during different time of a day?

- Solution 1: if - else



```
public void handleRequest(ExternalRequest r)
{
    if(time == TIME.PEAK)
    {
        // use peak hour handler
    }

    else if(time == TIME.NORMAL)
    {
        // use normal hour handler
    }
}
```

扫一扫 不怀孕

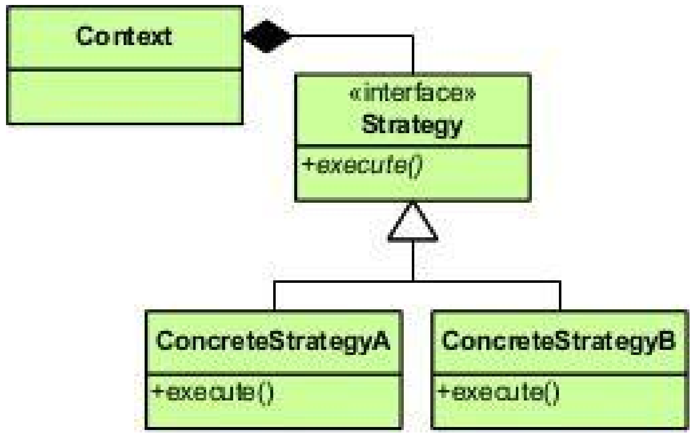
Challenge

- What if I want to apply different ways to handle external requests during different time of a day?

Solution 2: Strategy design pattern

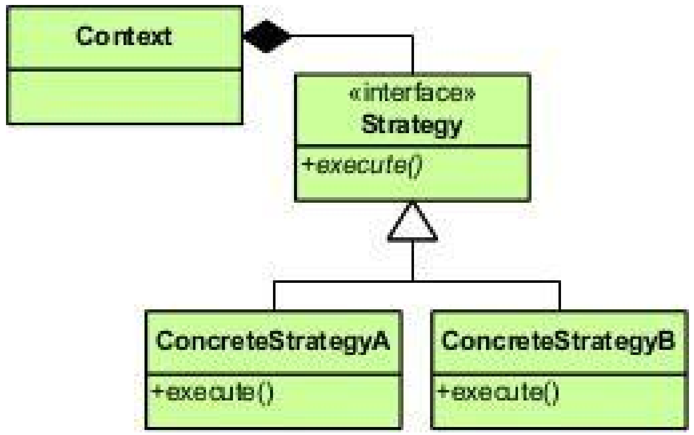
Challenge

- Strategy Pattern



Challenge

- Strategy Pattern

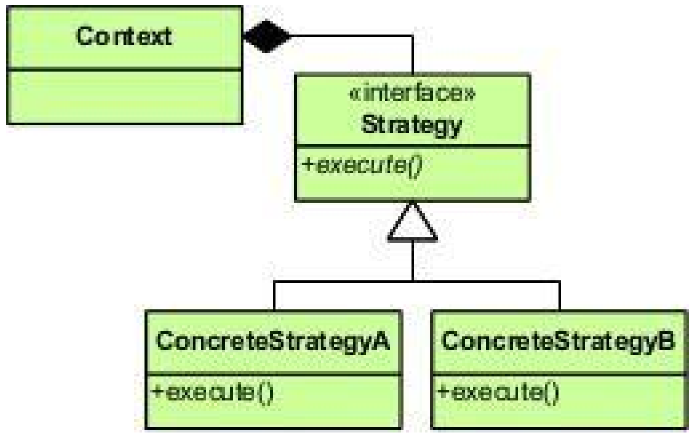


- 封装了多种 算法/策略

扫一扫 不怀孕

Challenge

- Strategy Pattern

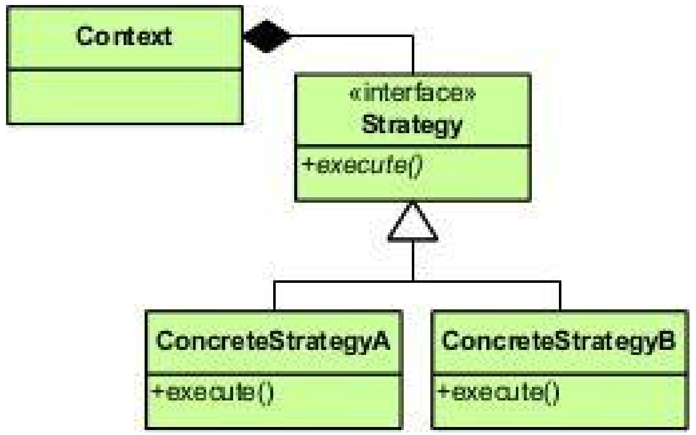


- **封装**了多种 算法/策略
- 使得算法/策略之间能够**互相替换**

扫一扫 不怀孕

Challenge

- Strategy Pattern



ElevatorSystem

- List<Elevator> elevators
- HandleRequestStrategy strategy

+ void handleRequest(ExternalRequest r)
+ void setStrategy(HandleRequestStrategy s)

《interface》
HandleRequestStaregy

+ void handleRequest(Request r, List<Elevator> elevators)

PeakHourHandleRequestStaregy

+ void handleRequest(Request r, List<Elevator> elevators)

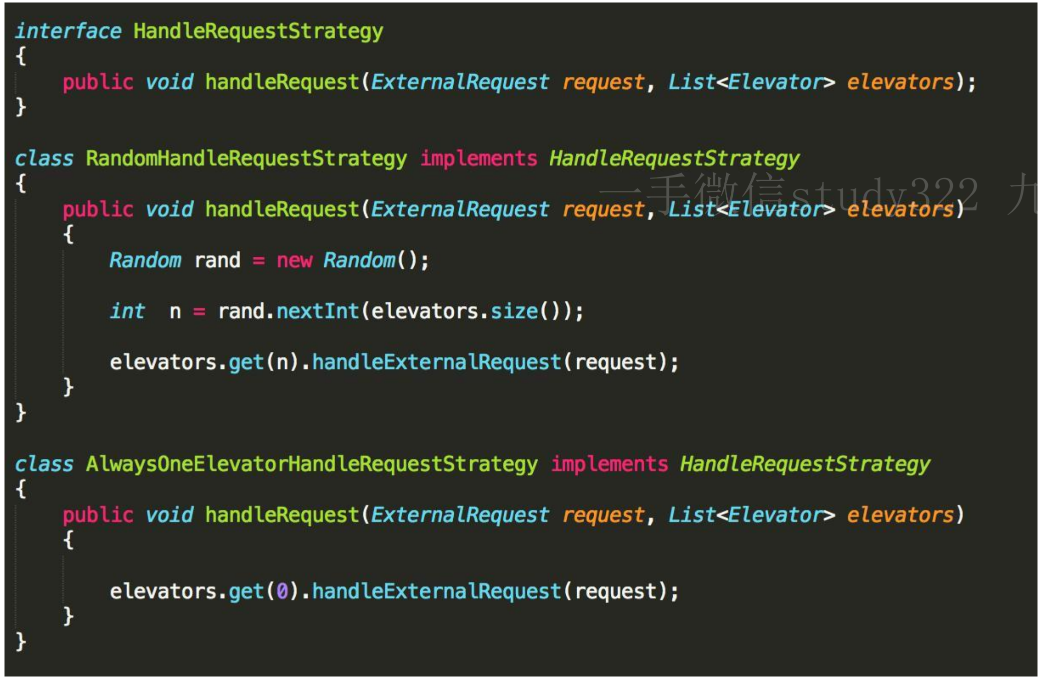
NormalHourHandleRequestStaregy

+ void handleRequest(Request r, List<Elevator> elevators)

扫一扫 不怀孕

Challenge

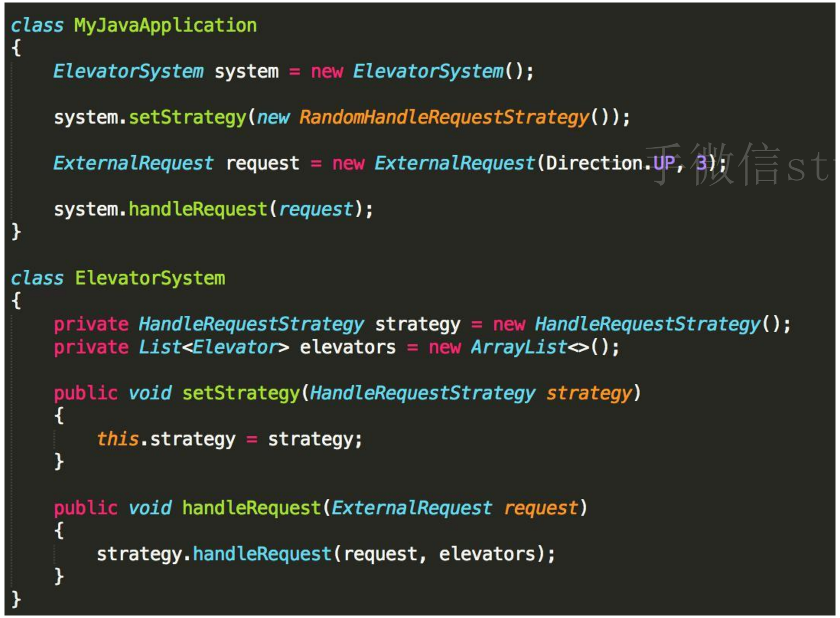
- Strategy design pattern



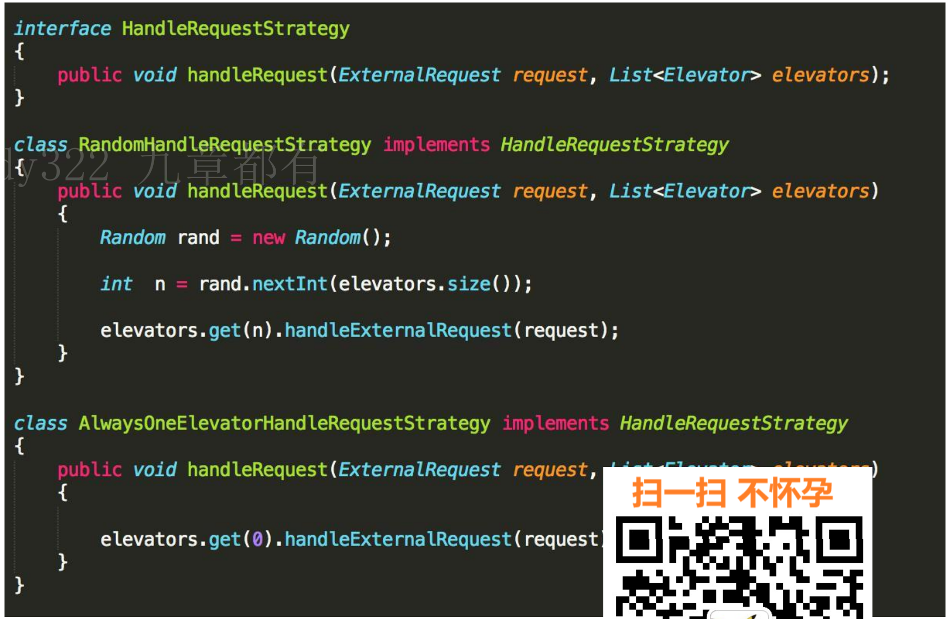
```
interface HandleRequestStrategy
{
    public void handleRequest(ExternalRequest request, List<Elevator> elevators);
}

class RandomHandleRequestStrategy implements HandleRequestStrategy
{
    public void handleRequest(ExternalRequest request, List<Elevator> elevators)
    {
        Random rand = new Random();

        int  n = rand.nextInt(elevators.size());

        elevators.get(n).handleExternalRequest(request);
    }
}

class AlwaysOneElevatorHandleRequestStrategy implements HandleRequestStrategy
{
    public void handleRequest(ExternalRequest request, List<Elevator> elevators)
    {

        elevators.get(0).handleExternalRequest(request);
    }
}
```

Challenge

- Strategy design pattern



```
class MyJavaApplication
{
    ElevatorSystem system = new ElevatorSystem();

    system.setStrategy(new RandomHandleRequestStrategy());

    ExternalRequest request = new ExternalRequest(Direction.UP, 3);

    system.handleRequest(request);
}

class ElevatorSystem
{
    private HandleRequestStrategy strategy = new HandleRequestStrategy();
    private List<Elevator> elevators = new ArrayList<>();

    public void setStrategy(HandleRequestStrategy strategy)
    {
        this.strategy = strategy;
    }

    public void handleRequest(ExternalRequest request)
    {
        strategy.handleRequest(request, elevators);
    }
}
```



```
interface HandleRequestStrategy
{
    public void handleRequest(ExternalRequest request, List<Elevator> elevators);
}

class RandomHandleRequestStrategy implements HandleRequestStrategy
{
    public void handleRequest(ExternalRequest request, List<Elevator> elevators)
    {
        Random rand = new Random();

        int  n = rand.nextInt(elevators.size());

        elevators.get(n).handleExternalRequest(request);
    }
}

class AlwaysOneElevatorHandleRequestStrategy implements HandleRequestStrategy
{
    public void handleRequest(ExternalRequest request, List<Elevator> elevators)
    {

        elevators.get(0).handleExternalRequest(request)
    }
}
```

Class

- Use case: Take internal request

An **elevator** takes an internal **request**, determine if it’s valid, inserts in its stop list.

Class

九章算法 九章算法

ExternalRequest
- Direction d
- int level

InternalRequest
- int level

ElevatorButton

ElevatorSystem
- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator
- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops

+ void handleExternalRequest(ExternalRequest r)

InvalidExternalRequestException

<<enumeration>>
Direction

Up Down

扫一扫 不怀孕

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Class

九章算法 九章算法

ExternalRequest

- Direction d
- int level

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)

InvalidExternalRequestException

InternalRequest

- int level

<<enumeration>>
Direction

Up Down

ElevatorButton

扫一扫 不怀孕

Use cases
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Class

ExternalRequest

- Direction d
- int level

InternalRequest

- int level

ElevatorButton

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

<<enumeration>>
Direction

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扫一扫 不怀孕

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Challenge

- 如何判断一个Internal request 是否为Valid?

扫一扫 不怀孕

Challenge

- 如何判断一个Internal request 是否为Valid?

Solution:

If elevator going up
    requested level lower than current level
        invalid

If elevator going down
    requested level higher than current level
        invalid

扫一扫 不怀孕

Challenge

- 如何判断一个Internal request 是否为Valid?

Solution:

If elevator **going up**

  requested level lower than **current level**

    invalid

If elevator **going down**

  requested level higher than **current level**

    invalid

扫一扫 不怀孕

Class

ExternalRequest

- Direction d
- int level

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

InternalRequest

- int level

<<enumeration>>
Direction

Up Down

ElevatorButton

Use cases

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Class

ExternalRequest
- Direction d
- int level

InternalRequest
- int level

ElevatorButton

ElevatorSystem
- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator
- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

<<enumeration>>
Direction

Up Down

<<enumeration>>
Status

Up Down Idle

Use cases

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Class

- Use case: Open gate

扫一扫 不怀孕

Class

- Use case: Open gate

并行 VS 串行

单线程 VS 多线程

Class

- Use case: Open gate

单线程：

{3，5，2} -> {5, 2} -> {2} -> {}

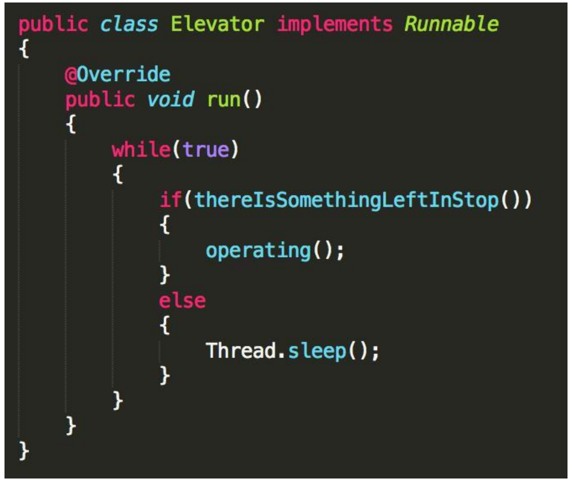
(1, Up) -> Open gate -> (3, Up) -> Close gate -> (3, Up) -> Open Gate -> (5, Up) -> Close gate -> (5, Down) -> Open gate -> (2, Down) -> Close Gate -> (2, Idle)

Class

- Use case: Open gate

多线程:

{3， 5， 2} -> {5, 2} -> {2} -> {} Critical Data


```
public class Elevator implements Runnable
{
    @Override
    public void run()
    {
        while(true)
        {
            if(thereIsSomethingLeftInStop())
            {
                operating();
            }
            else
            {
                Thread.sleep();
            }
        }
    }
}
```

扫一扫 不怀孕

Class

九章算法 九章算法

ExternalRequest

- Direction d
- int level

InternalRequest

- int level

ElevatorButton

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status
- boolean gateOpen

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

**<<enumeration>>
Direction**

Up Down

**<<enumeration>>
Status**

Up Down Idle

Use cases

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扫一扫 不怀孕

Class

- Use case: Close gate

An **elevator**
checks if overweight; close the door;
then check stops corresponds to current status;
if no stops left, check the reserve direction stops;
change status to reserve direction or idle.

Class

- Use case: check weight

An **elevator** checks its **current weight** and compare with **limit** to see if overweight

扫一扫 不怀孕

Class

九章算法 九章算法

ExternalRequest

- Direction d
- int level

InternalRequest

- int level

ElevatorButton

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status
- boolean gateOpen

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

<<enumeration>>
Direction

Up Down

<<enumeration>>
Status

Up Down Idle

Use cases

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Class

九章算法 九章算法

ExternalRequest

- Direction d
- int level

InternalRequest

- int level

ElevatorButton

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status
- boolean gateOpen
- float weightLimit

```
+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)
```

InvalidExternalRequestException

<<enumeration>>
Direction

Up Down

<<enumeration>>
Status

Up Down Idle

扫一扫 不怀孕

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Class

ExternalRequest

- Direction d
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+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status
- boolean gateOpen
- float weightLimit

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

OverWeightException

<<enumeration>>
Direction

Up Down

<<enumeration>>
Status

Up Down Idle

Use cases

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Class

ExternalRequest
- Direction d
- int level

ElevatorSystem
- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

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- List<Integer> upStops
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- int currentLevel
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- boolean gateOpen
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+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
+ void closeGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

OverWeightException

<<enumeration>>
Direction

Up Down

InternalRequest
- int level

<<enumeration>>
Status

Up Down Idle

ElevatorButton

扫一扫 不怀孕

Use cases
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Class

- Use case: press button

A **button** inside elevator is pressed, will generate an **internal request** and send to the **elevator**.

Class

ExternalRequest

- Direction d
- int level

InternalRequest

- int level

ElevatorButton

- int level

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status
- boolean gateOpen
- float weightLimit

```
+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
+ void closeGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)
```

InvalidExternalRequestException

OverWeightException

**<<enumeration>>
Direction**

Up Down

**<<enumeration>>
Status**

Up Down Idle

Use cases

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Class

ExternalRequest

- Direction d
- int level

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status
- boolean gateOpen
- float weightLimit

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
+ void closeGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

OverWeightException

InternalRequest

- int level

<<enumeration>>
Direction

Up Down

<<enumeration>>
Status

Up Down Idle

ElevatorButton

- int level

+ boolean pressButton()

Use cases

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扫一扫 不怀孕

Class

九章算法

```
ExternalRequest
---------------
- Direction d
- int level
```

```
InternalRequest
---------------
- int level
```

```
ElevatorSystem
---------------
- List<Elevator> elevators
---------------
+ void handleRequest(ExternalRequest r)
```

```
Elevator
---------------
-    List<ElevatorButton> buttons
-    List<Integer> upStops
-    List<Integer> downStops
-    int currentLevel
-    Status status
-    boolean gateOpen
-    float weightLimit
---------------
+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
+ void closeGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)
```

```
ElevatorButton
---------------
-    int level
-    Elevator elevator
---------------
+ InternalRequest pressButton()
```

```
InvalidExternalRequestException
```

```
OverWeightException
```

```
<<enumeration>>
Direction
---------------
Up  Down
```

```
<<enumeration>>
Status
---------------
Up  Down  Idle
```

Use cases

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扫一扫 不怀孕

Class – Final view

九章算法 九章算法

ExternalRequest

- Direction d
- int level

ElevatorSystem

- List<Elevator> elevators

+ void handleRequest(ExternalRequest r)

Elevator

- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status
- boolean gateOpen
- float weightLimit

+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
+ void closeGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)

InvalidExternalRequestException

OverWeightException

InternalRequest

- int level

<<enumeration>>
Direction

Up Down

<<enumeration>>
Status

Up Down Idle

ElevatorButton

- int level
- Elevator elevator

+ InternalRequest pressButton()

Use cases

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Correctness

- 从以下几方面检查：

- Validate use cases (检查是否支持所有的use case)
- Follow good practice (面试当中的加分项，展现一个程序员的经验)
- S.O.L.I.D
- Design pattern

扫一扫 不怀孕

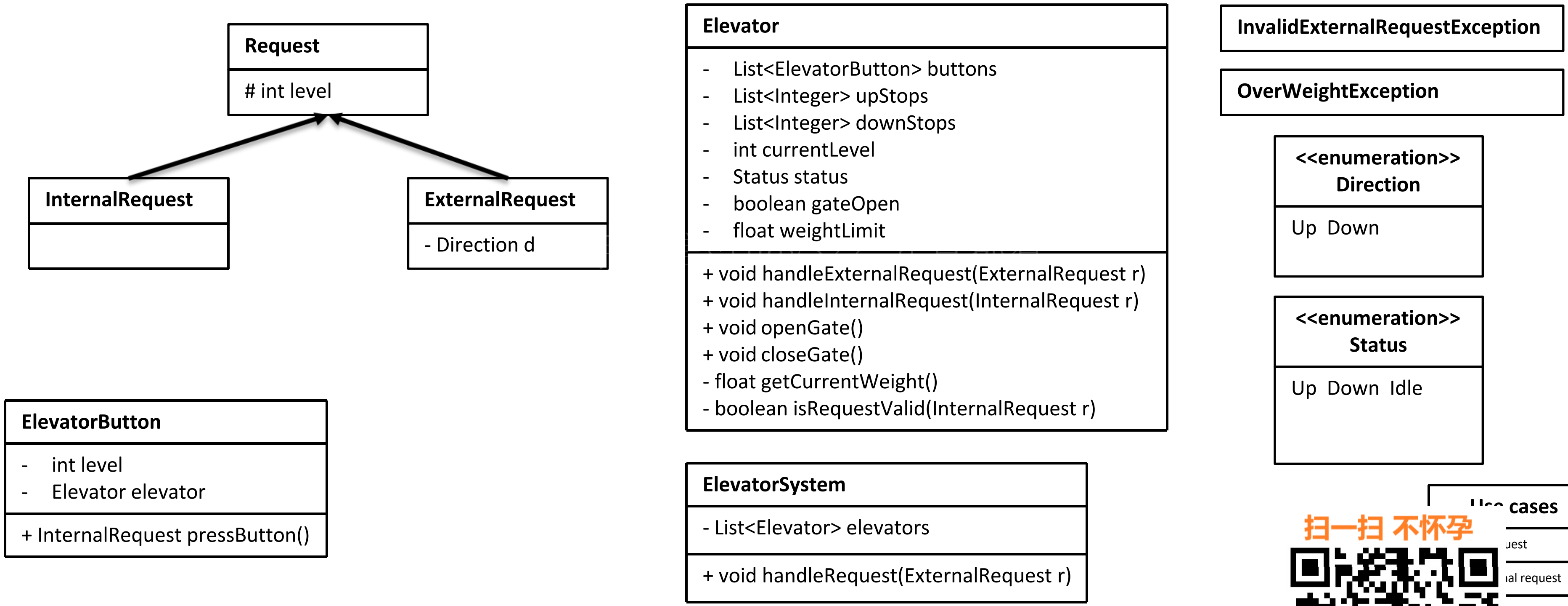
Good Practice

- 继承

检查你的设计中，是否有重复的类，可以采用继承的方式来表现

Good Practice

九章算法 九章算法


Request
# int level
InternalRequest
ExternalRequest
- Direction d
ElevatorButton
- int level
- Elevator elevator
+ InternalRequest pressButton()
Elevator
- List<ElevatorButton> buttons
- List<Integer> upStops
- List<Integer> downStops
- int currentLevel
- Status status
- boolean gateOpen
- float weightLimit
+ void handleExternalRequest(ExternalRequest r)
+ void handleInternalRequest(InternalRequest r)
+ void openGate()
+ void closeGate()
- float getCurrentWeight()
- boolean isRequestValid(InternalRequest r)
ElevatorSystem
- List<Elevator> elevators
+ void handleRequest(ExternalRequest r)
InvalidExternalRequestException
OverWeightException
<<enumeration>>
Direction
Up Down
<<enumeration>>
Status
Up Down Idle

扫一扫 不怀孕

Use cases
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Recap

- 什么是OOD

扫一扫 不怀孕

Recap

- 什么是OOD
- SOLID原则

Recap

- 什么是OOD
- SOLID原则
- 5C 解题法

扫一扫 不怀孕

Recap

- 什么是OOD
- SOLID原则
- 5C 解题法
- Good practice: Access modifier

Recap

- 什么是OOD
- SOLID原则
- 5C 解题法
- Good practice: Access modifier
- Good practice: Exception

扫一扫 不怀孕

Recap

- 什么是OOD
- SOLID原则
- 5C 解题法
- Good practice: Access modifier
- Good practice: Exception
- Design pattern: Strategy

扫一扫 不怀孕

Next…

第2章 管理类面向对象设计 OOD for Management System

本节大纲

- 管理类 OOD 面试题型特点分析
- 实战OOD面试真题：
  - 停车场问题 Parking lot
  - 餐厅管理问题 Restaurant
- 设计模式讲解 Design Pattern: Singleton

Next…

第3章　　预定类面向对象设计 OOD for Reservation System

本节大纲

- 预定类面试题型特点分析
- 实战面试真题：
  - 酒店预订系统设计 Hotel Reservation
  - 航空机票预订系统设计 Airline Ticket Reservation

Next…

第4章 实物类面向对象设计 OOD for Real Life Object

本节大纲

- 实物类面试题型特点分析
- 实战面试真题：
  - Vending machine
  - Juke box
- 设计模式讲解 Design Pattern: Factory
- 设计模式讲解 Design Pattern: Adaptor

Next…

第5章 游戏棋牌类面向对象设计 OOD for Games

本节大纲

- 棋牌游戏类面试题型特点分析
- 棋牌游戏类面试题特殊技巧讲解
- 实战面试真题：
    - Black Jack
    - Chinese chess
- 课程总结及面试技巧点拨

Q & A

九章算法

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- 督学
- 第二节课开课前2天开班仪式

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