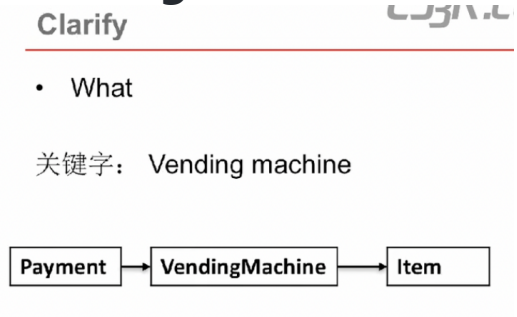
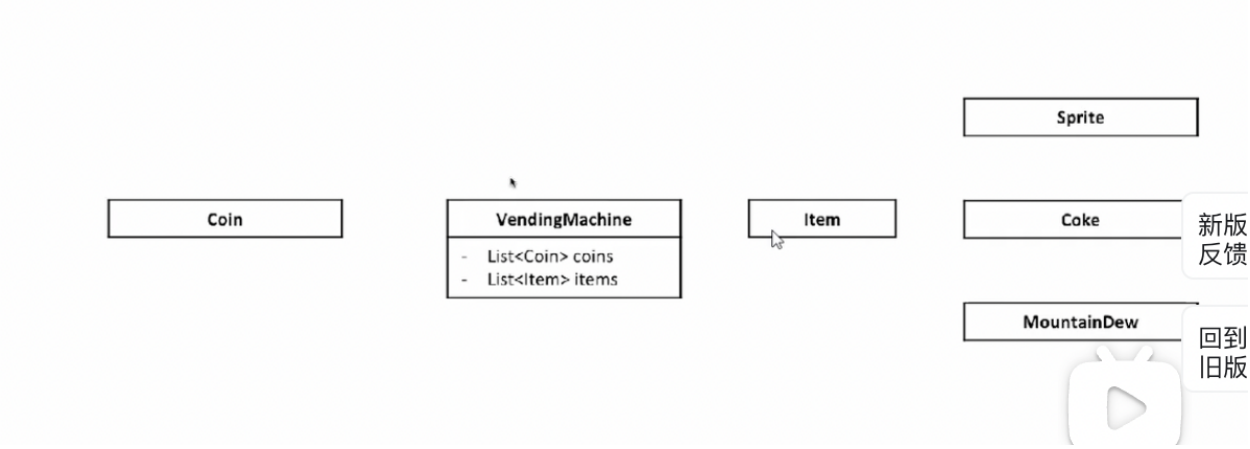
Lecture 4 - 实物类: Vending Machine & Juke Box - Factory & Adaptor Pattern

- 实物类 OOD 题型
  - Vending machine
  - Jukebox
  - CD Player
  - Coffee maker
  - ATM
- 实物类
  - 考虑对于实物的输入输出

- 技巧
  - State pattern
  - Decorate pattern
  - Factory pattern

Vending Machine & ATM Machine





Use cases

Vending machine:

- Select item
- Insert coin
- Execute transaction
- Cancel transaction

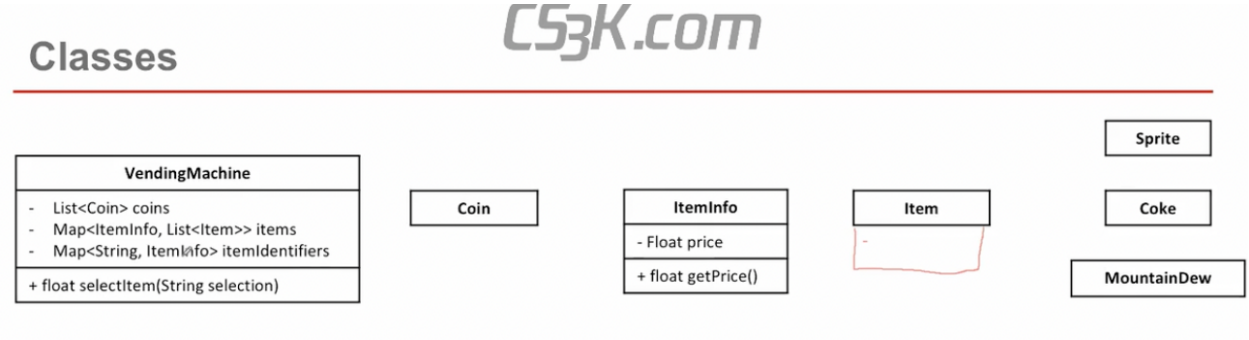
Classes

Use case: Select item

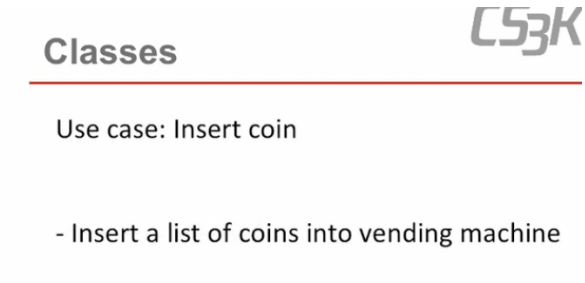
- Vending machine takes an external input, shows the price of that item

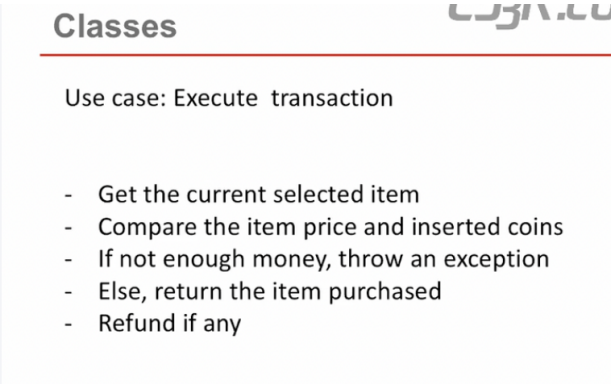
VendingMachine
- List<Coin> coins - List<Item> items - Map<String, Item> itemIdentifiers
+ float selectItem(String selection)

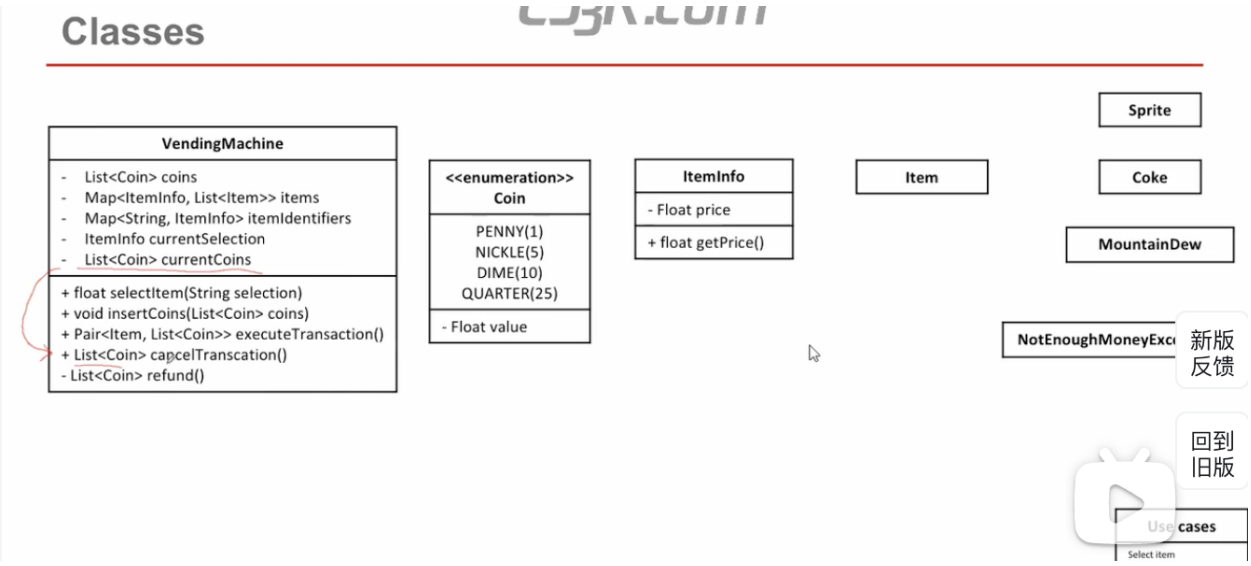
如果用上面的方式定义 vendingmachine 存在的问题是 map 里是用静态的数据“比如 A1，B4”来对应一个动态的 Item，那如果当客户拿到了 Item 的信息就可以对它进行修改。解决方法是可以加一个静态的 class ItemInfo



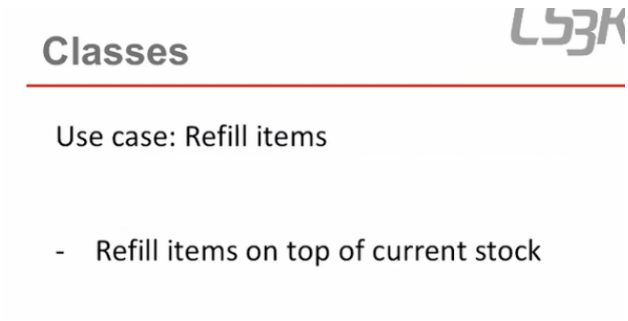
上图漏了一个点，Item class 下面应该包括 itemInfo 信息

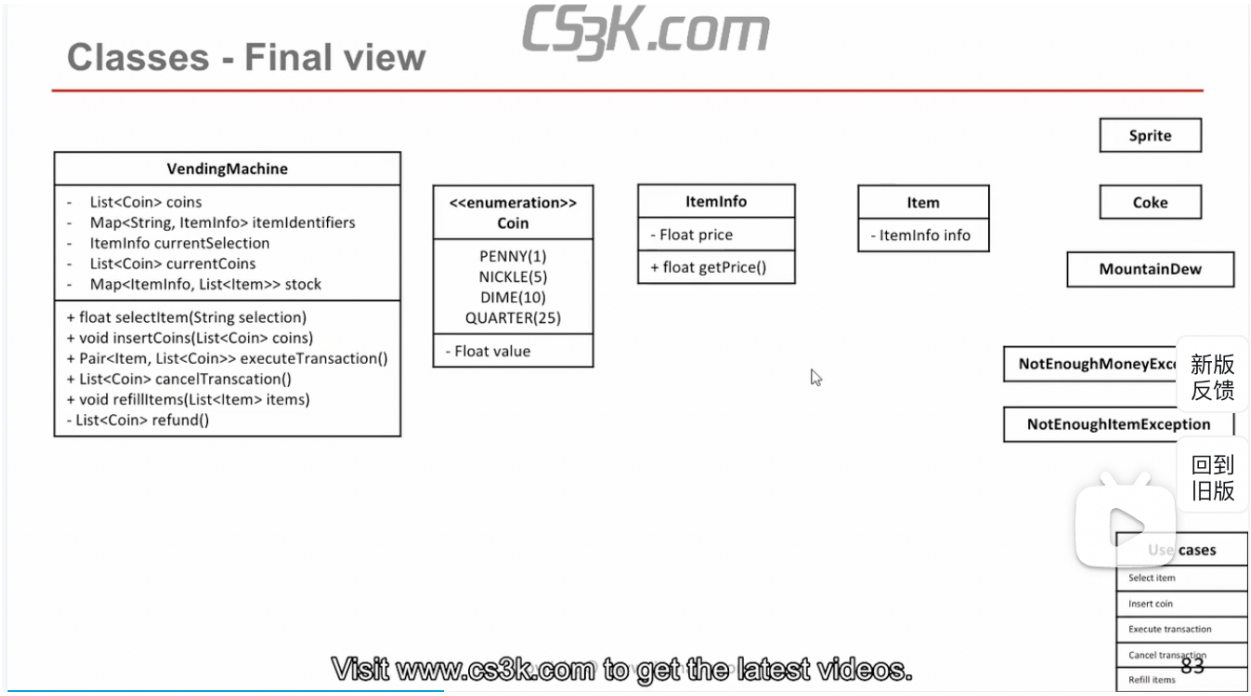


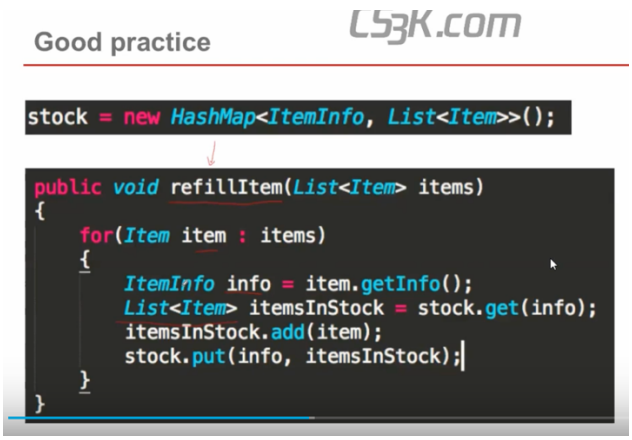




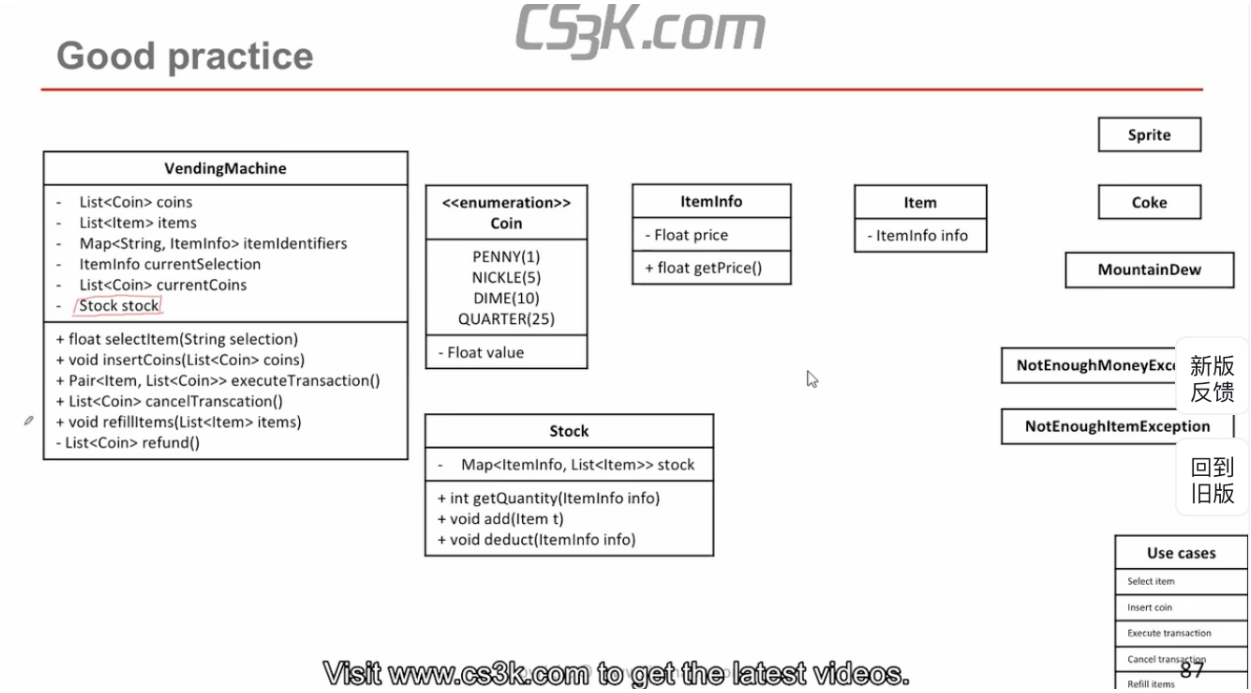
pair 就相当于是可以实现几返回 item 也返回需要的找零







直接把 add method 放到 stock 这个 class 里，nested class 把常用的借口封装起来

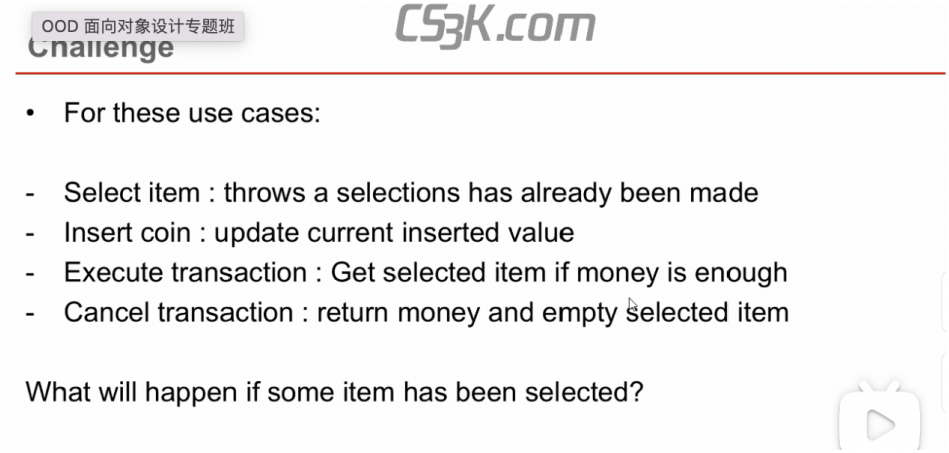


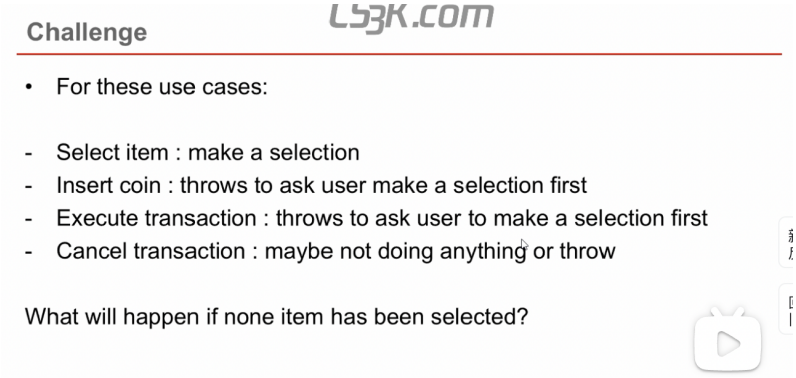
小错误：item 中的 iteminfo info 应该是 protected，这样的话 spirit，coke 继承的时候可以自己贴商标

State Design Pattern

- States
  - HAS_SELECTION - NO_SELECTION

    - COINS_INSERTED - NO_COIN
    - SOLD
    - SOLD_OUT
- State related actions:
    - select item
    - insert coin
    - execute transaction
    - cancel transaction
- what will happen if some item has been selected?





- Insert coin

```
public void insertCoin(List<Coin> coins)
{
    if(selectedItem == null)
    {
        throw new Exception("You need to make a selection first");
    }
    else if(selectedItem != null)
    {
        currentCoins.add(coins);
    }
}
```

Challenge

- 我们刚刚考虑了HAS_SELECTION 和 NO_SELECTION 的情况
- 那么对于：

- COINS_INSERTED
- NO_COIN
- SOLD
- SOLD_OUT

应该怎么办？

```
public void insertCoin(List<Coin> coins)
{
    if(selectedItem == null)
    {
        throw new Exception("You need to make a selection first");
    }
    else if(selectedItem != null)
    {
        currentCoins.add(coins);
    }
    else if(SOLD)
    {
        throw new Exception("Be patient, item is coming out, dont need to pay once more");
    }
    else if(SOLD_OUT)
    {
        throw new Exception("Item has been sold out, please dont pay for nothing");
    }
    ...
}
```

Challenge

- State Design Pattern

States:

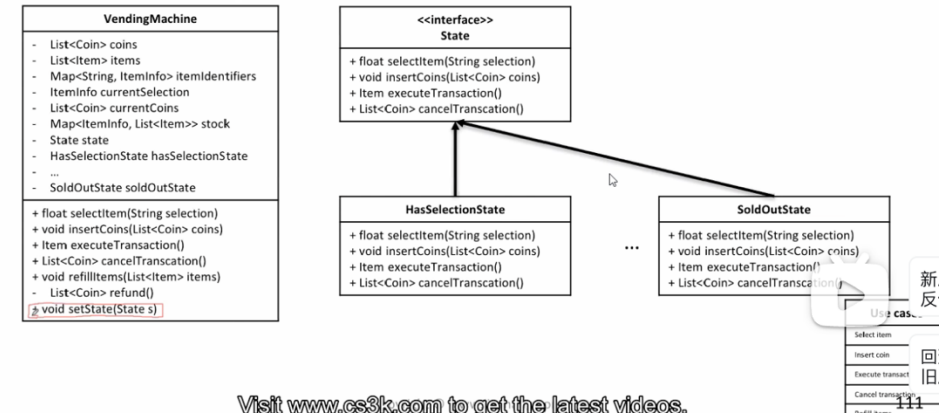
- HAS_SELECTION
- NO_SELECTION
- COINS_INSERTED
- NO_COIN
- SOLD
- SOLD_OUT

- State Design Pattern

State related actions:

- select item
- insert coin
- execute transaction
- cancel transaction

Classes



Vending machine

```
public interface State {
    public void selectItem(String selection);
    public void insertMoney(int value);
    public void executeTransaction();
    public int cancelTransaction();
}
```

右图第一行要有 vendingMachine 的目的是因为你要改变这个 machine 的 state 所以就必须要有这个变量

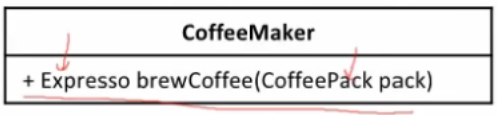
```
public interface State {
    public oid selectItem(String selection);
    public void insertMoney(int value);
    public void executeTransaction();
    pulic int cancelTransaction();
}

public class NoSelectionState implements State {
  VendingMachine vendingMachine;

  public NoSectionsState(VendingMachine vendingMachine) {
    this.vendingMachine = vendingMachine;
  }

  //Implement, and change state
  @Override
  public void selectItem(String selection) {
    vendingMachine.setSelectedItem(selection);
    vendingMachine.changeToHasSelectionState();
  }
}

public class VendingMachine {
```

```
  private State state;
  private NoSelectionState noSelectionState;
  privte HasSelectionState hasSelectionState

  //Constructor: init all state, and set inital state
  public VendingMachine() {
    noSelectionState = new NoSelectionState(this);
    hasSelectionState = new hasSelectionState(this);
    state = noSelectonState;
  }

  //Expose to other State class for changing
  public void changeToHasSelectionState() {
    state = hasSelectionState();
  }

  //API, use different state to implement
  public void selectItem(String selection) {
    state.selectItem(selection);
  }
}
```

Coffee Machine

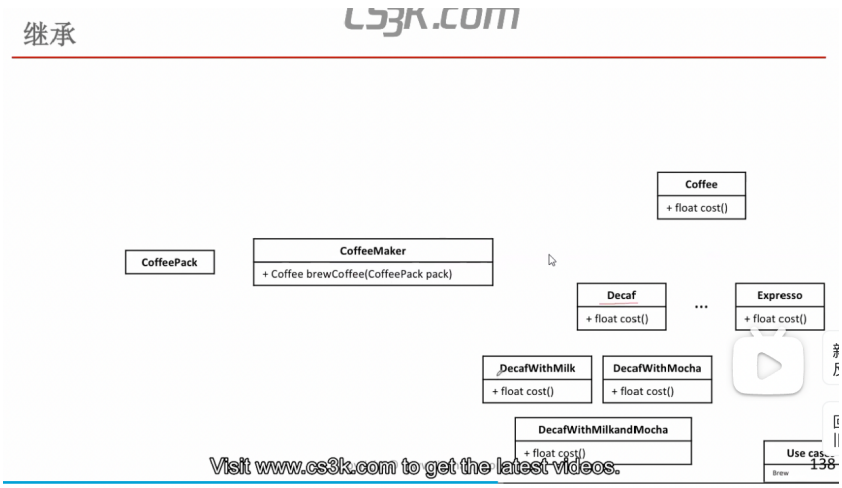
- Use case: Brew

Coffee machine expected to use a coffee pack to get expresso coffee

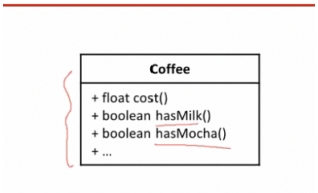


如果需要能制作出多种咖啡
(价格不同)，需要怎么做？

做法一：利用继承，缺点是如果后面有很多不同种的 coffee 那就必须再加新的类，



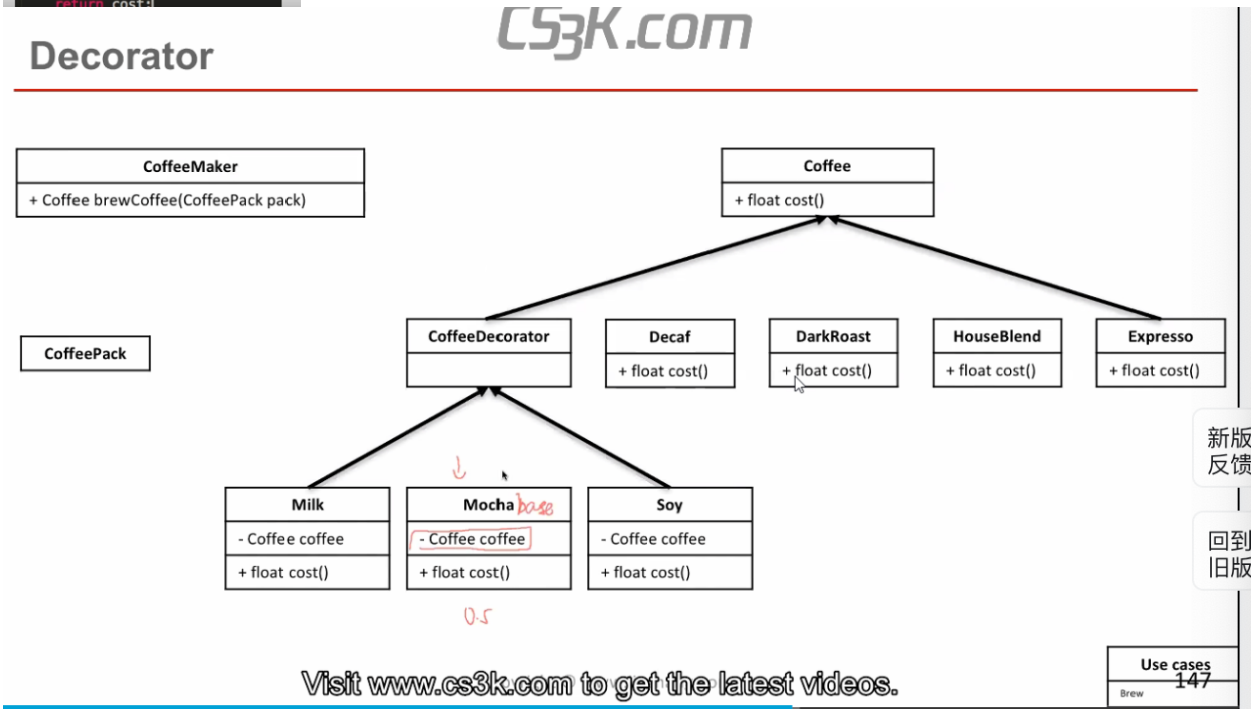
解决办法是可以直接在 coffee 这个类上加 hasMilk，hasMocha 这些属性



这个缺点是首先如果加很多份 mocha 或者 milk 价格不会 adjust，而且 cost（）可能会很长，

另一种继承

```
public float cost()
{
    if(hasMilk())
    {
        cost += 0.5;
    }

    if(hasMocha())
    {
        cost += 0.5;
    }

    if(hasSoy())
    {
        cost += 0.5;
    }

    ...

    return cost;
```



coffeeDecorator 是 Coffee 的一个子类

```
public class Expresso extends Coffee
{

    public Expresso()
    {
        description = "Expresso";
    }

    public float cost()
    {
        return 1.99;
    }
}
```

```
public class Mocha extends CoffeeDecorator
{
    Coffee coffee;

    public Mocha(Coffee coffee)
    {
        this.coffee = coffee;
    }

    public String getDescription()
    {
        return coffee.getDescription() + ", Mocha";
    }

    public float cost()
    {
        return coffee.getCost() + 0.5;
    }
}
```

```
public void test()
{
    Coffee coffee_1 = new Expresso();

    System.out.println(coffee_1.getDescription() + " $ " + coffee_1.getCost());

    Coffee coffee_2 = new Mocha(coffee_1);

    System.out.println(coffee_2.getDescription() + " $ " + coffee_2.getCost());

    Coffee coffee_3 = new Mocha(coffee_2);

    System.out.println(coffee_3.getDescription() + " $ " + coffee_3.getCost());
}
```

```
Expresso $ 1.99

Expresso, Mocha $ 2.49

Expresso, Mocha, Mocha $ 2.99
```

Decorator Design Pattern

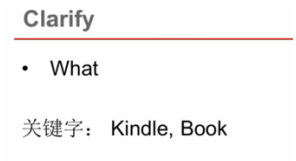
```
public interface Coffee {
  public double getCost();
  public String getDescripton();
}

public class Expresso implements Coffee {
  public Expresso() {
    description = "Expresso";
  }

  public float getCost() {
    return 1.99;
  }

  public String getDecription() {
    return description;
  }
}

public abstract class CoffeeDecorator implements Coffee {
  protected final Coffe decoratedCoffee;

  public CoffeeDecorator(Coffee c) {
    this.decoratedCoffee = c;
  }
```

```
  public double getCost() {
    return decoratedCoffee.getCost();
  }

  public double getDescription() {
    return decoratedCoffee.getDescription();
  }
}

public class WithMocha extends CoffeeDecorator {
  public WithMocha(Coffee coffee) {
    super(c);
  }

  public String getDescription() {
    return super.getDescription() + ", Mocha";
  }

  public float getCost() {
    return super.getCost() + 0.5;
  }
}

public void test() {
  Coffee c = new Expresso();
  c = new WithMocha(c);
  c = new WithMocha(c);
  // Expresso, Mocha, Mocha $2.99
  System.out.println(c.getDescription() + "$ " + c.getCost());
}
```

Kindle

Factory Design Pattern

- Simple Factory: 将 if-else 放入一个单独的 factory 里面
- Factory method
- Abstract Factory



关键字： Kindle

需不需要设计不同版本？

- Design: get price
- Design: Memory difference

关键字： Book

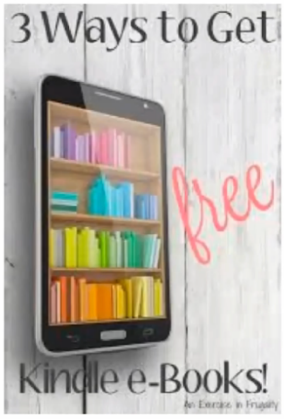
- 支持哪些格式的电子书？

Clarify

- 对于本题：

- 不需要考虑不同的版本
- 不需要考虑内存和书的大小
- 支持pdf, epub 和 mobi三种格式

Clarify



如何获取电子书？

- 是否支持Upload
- 是否支持Download

对于付费的电子书，提供哪些支付功能？

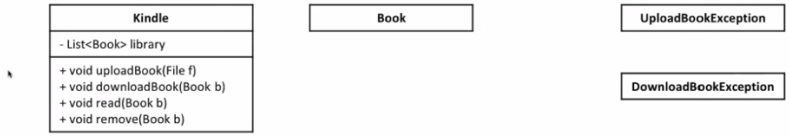
Payment -> Strategy design pattern

Clarify

- 对于本题：支持上传，下载
- 对于本题：不需要考虑付费

Core Object

Classes



不好的方案：

- How would read book work?

```
public void read(Book book)
{
    if(book.getFormat == Format.PDF)
    {
        PDFReader reader = new PDFReader(book);
        reader.display();
    }
    else if(book.getFormat == Format.MOBI)
    {
        MOBIReader reader = new MOBIReader(book);
        reader.display();
    }
    else if(book.getFormat == Format.EPUB)
    {
        EPUBReader reader = new EPUBReader(book);
        reader.display();
    }
}
```

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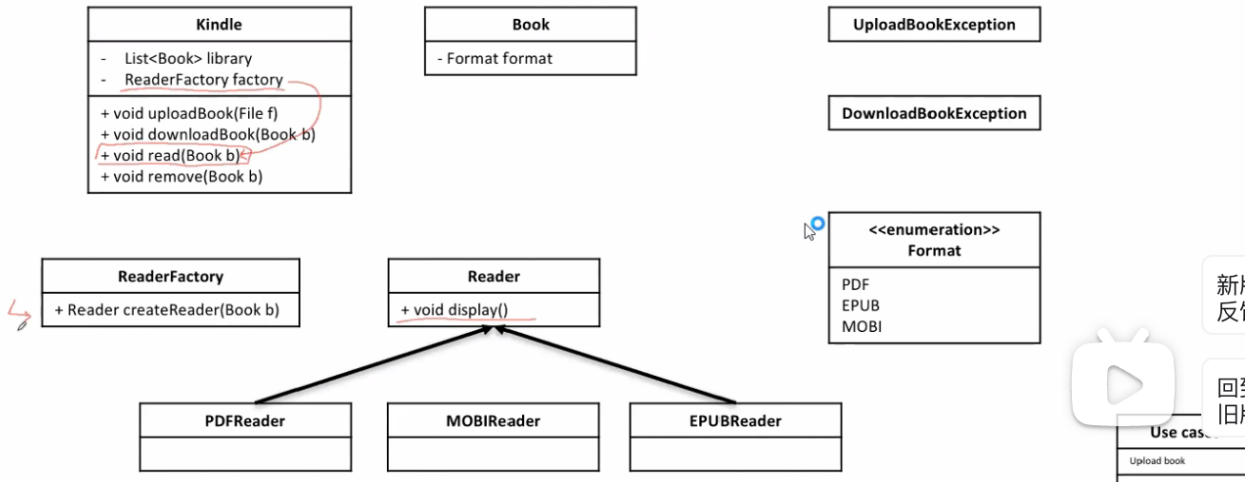
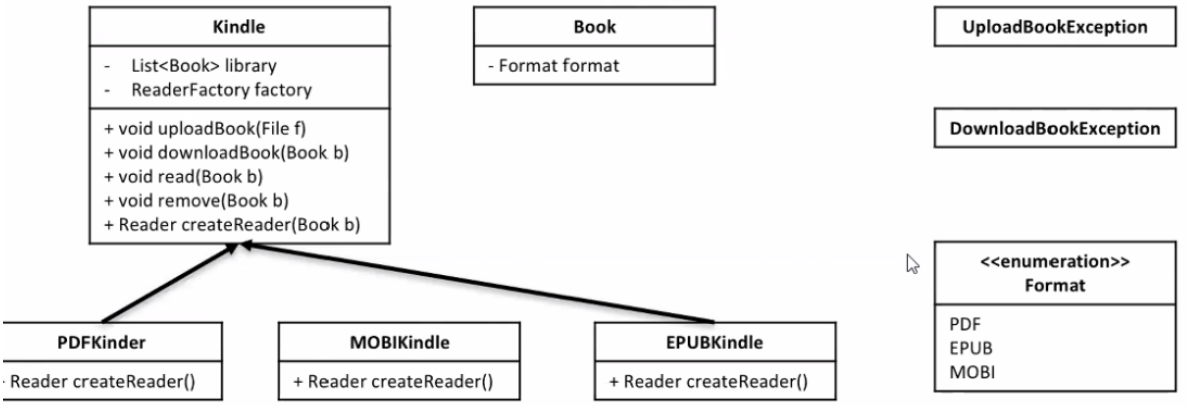
- Solution: Factory design pattern

Factory design pattern



Factory method



Abstract factory