COM6516
Object Oriented Programming and Software Design

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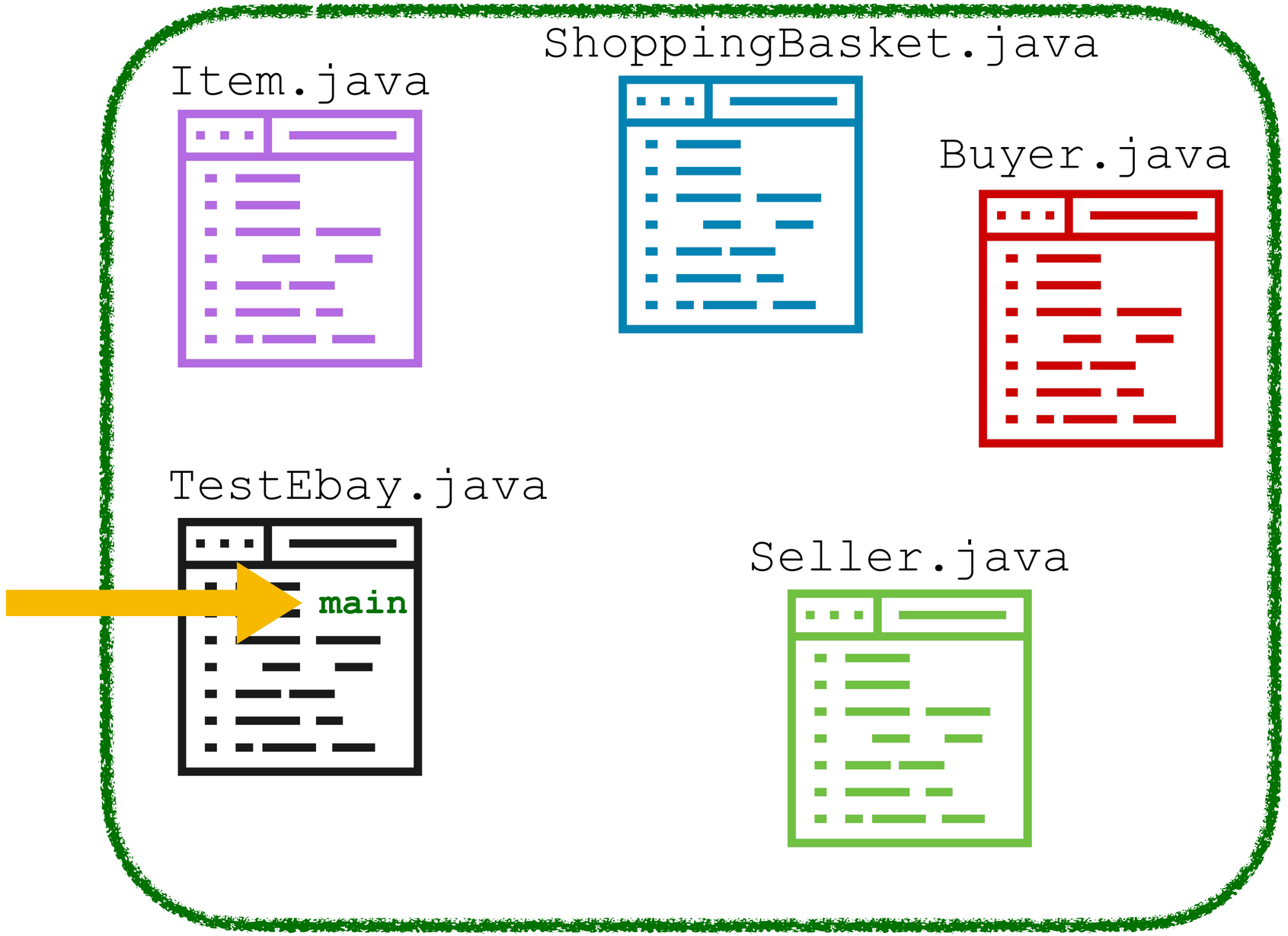
Practical 2

Classes and objects

- Classes with a `main` method
- Testing class behaviour
- Instance fields — public or private?
- Class `Complex`
- Using `equals` methods

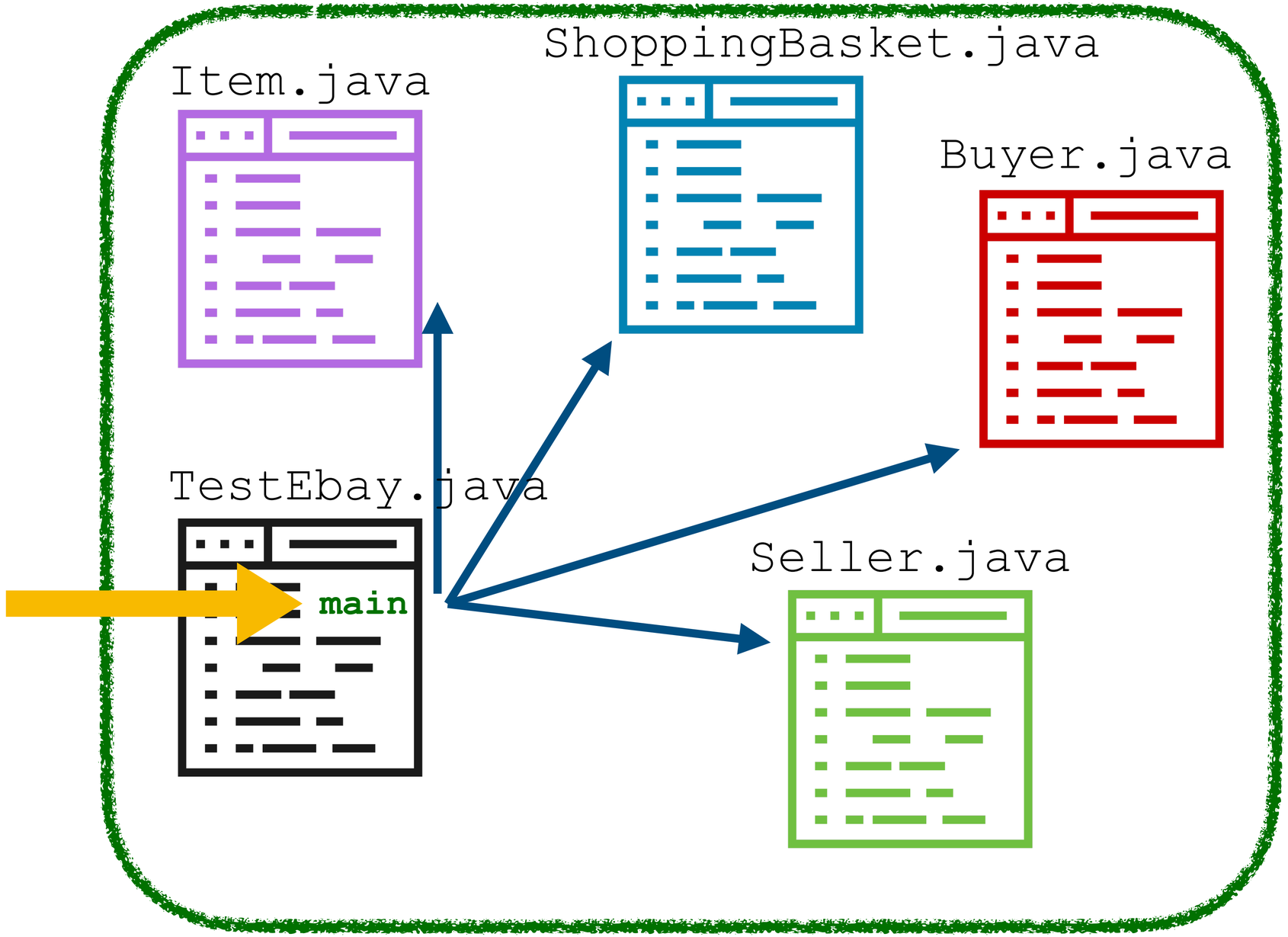
Classes with a `main` method

You may have several files with classes in your software…



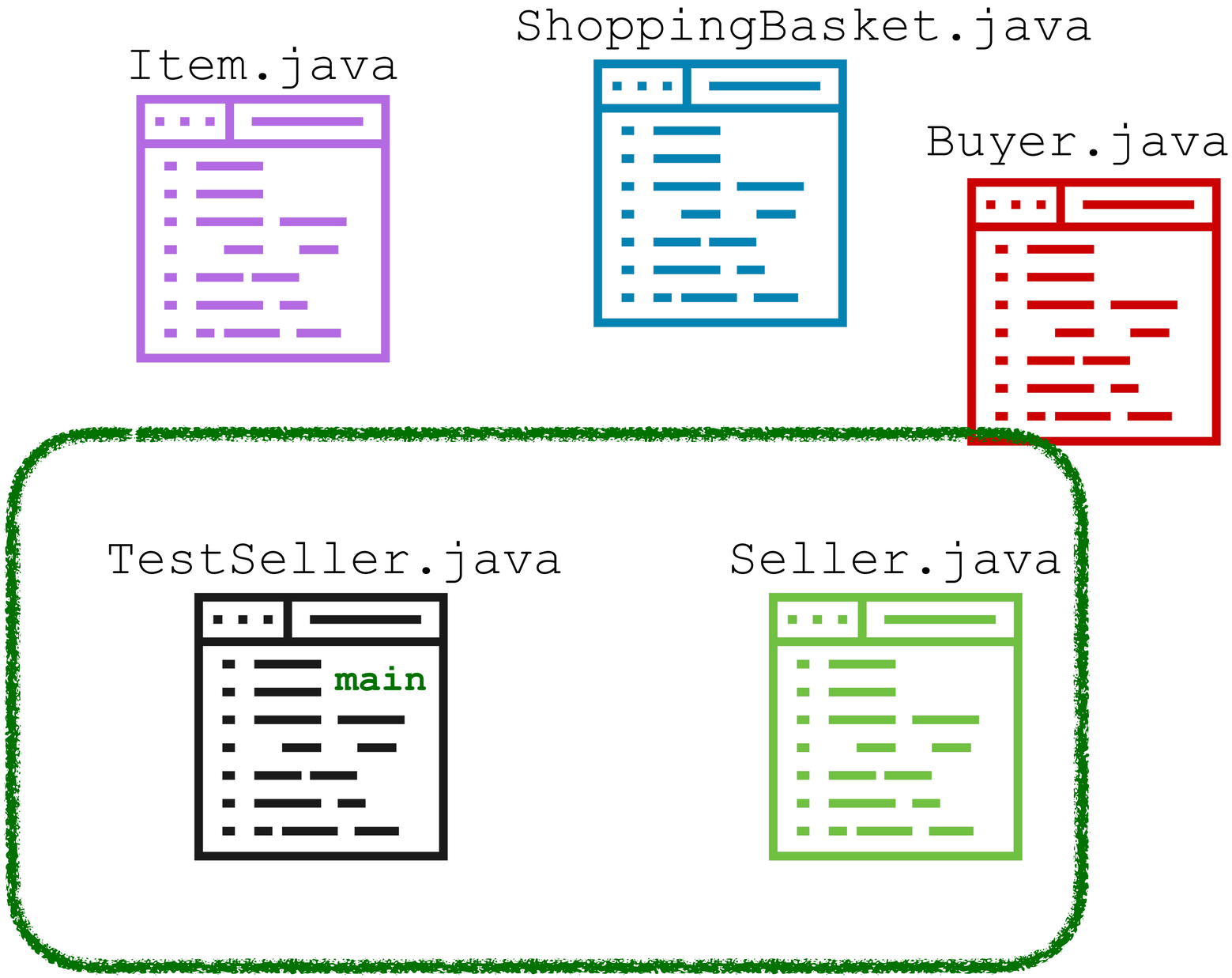
Classes with a `main` method

You may have several files with classes in your software…



Classes with a `main` method

You may have several files with classes in your software…



Testing class behaviour

- Writing and using test classes helps you to get code working quickly
- The class below has a main method that will be invoked when the bytecode interpreter executes it

```
public class TestFoodStore {
    public static void main(String[] args){
        // create a new FoodStore object called MyFoodStore
        // by invoking the constructor
        FoodStore MyFoodStore = new FoodStore(10);

        // display the amount stored by calling the getAmountStored
        // method associated with the MyFoodStore object
        System.out.println("Contains " + MyFoodStore.getAmountStored());
    }
}
```

Testing class behaviour

- Writing and using test classes helps you to get code working quickly
- The class below has a main method that will be invoked when the bytecode interpreter executes it

```
/**
 * test class for Customer
 */
public class CustomerTest {
    public static void main(String[] args) {
        // create a new customer
        Customer firstCustomer = new Customer(“A.Client", "Sheffield");
        // print out customer information
        System.out.println(firstCustomer.toString());
    }
}
```

Testing class behaviour

- If we have two files called `CustomerTest.java` and `Customer.java`, then the code can be compiled by either

```
javac CustomerTest1.java
```

or

```
javac Customer*.java
```

- Both approaches will create class files `CustomerTest.class` and `Customer.class`
- Running `CustomerTest` by typing `java CustomerTest` will execute the `main` method

Instance fields — public or private?

If we had defined our instance field as follows

```
// instance field
public int numDeposits;
```

we could access the value from code outside the class, and we could change it

```
FoodStore MyFoodStore = new FoodStore(10);
…
System.out.println("number of deposits " + MyFoodStore.numDeposits);
```

This breaks encapsulation and is not good practice because the class no longer has control over its instance fields — e.g., it may have other fields that have to be recomputed once this one changes

Instance fields — public or private?

We make the field private and prepare the accessor method

```
// instance field
Private int numDeposits;
// accessor method
public int getNumDeposits() {
    return(numDeposits);
}
```

and access the value through the method

```
FoodStore MyFoodStore = new FoodStore(10);
…
System.out.println("number of deposits "
                    + MyFoodStore.getNumDeposits());
```

Class Complex

```
public class Complex {
    private double realPart;
    private double imagPart;
    public Complex(double r, double i) {
        realPart = r;
        imagPart = I;
    }
    public double getReal() {
        return realPart;
    }
    public double getImag() {
        return imagPart;
    }
    public Complex add(Complex c) {
        return (new Complex(realPart+c.getReal(), imagPart+c.getImag()));
    }
}
```

Class Complex

Implementing an operator as an instance method:

```
public Complex add(Complex c) {
    return (new Complex(realPart+c.getReal(), imagPart+c.getImag()));
}

Complex sum = c1.add(c2);
```

Implementing an operator as a class method:

```
public static Complex add(Complex c1, Complex c2) {
    return (new Complex(c1.getReal()+c2.getReal(),
                        c1.getImag()+c2.getImag()));
}

Complex sum = Complex.add(c1,c2);
```

Using `equals` methods

Testing for `equals` involves distinguishing between **identity** and **equality**

- Two objects that refer to the same memory location are **identical**
- Two objects that have the same state, or the same behaviour are **equal**

To test whether two objects are **equal**, we have to write `equals` methods

Using `equals` methods

It generally involves the following steps:

- Test whether the two objects are **identical** (have the same reference)
- Test whether the other object is `null`
- Test whether the objects belong to the same class
- Compare all instance fields, using `==` for primitive types, and `equals` methods for objects

See the following article for an extended discussion —

http://www.angelikalanger.com/Articles/JavaSolutions/SecretsOfEquals/Equals.html

Using `equals` methods

```
public class ItemWithEquals {
    …
    public boolean equals(Object obj) {
        if (this == obj) {   // check if identical objects
            return true;
        }
        else if (obj == null) {
            return false;    // false if parameter is null
        }
        else if (this.getClass() != obj.getClass()) {
            return false;    // false if objects have different classes
        }
        else {               // do something specific for Item
            ItemWithEquals otherItem = (ItemWithEquals) obj;
            return (name.equals(otherItem.getName()) &&
                    price == otherItem.getPrice());
        }
    }
}
```

Using `equals` methods

Test `Item` objects using the generic `equals` method from the `Object` class:

```
public class TestItemEquals {
    public static void main(String[] args) {
        Item item1 = new Item("baked beans", 0.3);
        Item item2 = new Item("tomato soup", 0.4);
        Item item3 = new Item("baked beans", 0.3);
        Item item4 = item1;
        String testObject = "Hello World";

        System.out.println(item1.equals(item2));          // false
        System.out.println(item1.equals(item3));          // false
        System.out.println(item1.equals(item4));          // true
        System.out.println(item1.equals(testObject));     // false
        …
    }
}
```

Using `equals` methods

Test `Item` objects using the `equals` method from the `ItemWithEquals` class:

```
public class TestItemEquals {
    public static void main(String[] args) {
        ItemItemEquals itemA = new ItemItemEquals("baked beans", 0.3);
        ItemItemEquals itemB = new ItemItemEquals("tomato soup", 0.4);
        ItemItemEquals itemC = new ItemItemEquals("baked beans", 0.3);
        ItemItemEquals itemD = item1;
        String testObject = "Hello World";

        System.out.println(itemA.equals(itemB));          // false
        System.out.println(itemA.equals(itemC));          // true
        System.out.println(itemA.equals(itemD));          // true
        System.out.println(itemA.equals(testObject));     // false
        …
    }
}
```