Handling User Input

Packages, Utilities, Parsing & Wrappers

Produced by: Dr. Siobhán Drohan
Ms. Mairead Meagher

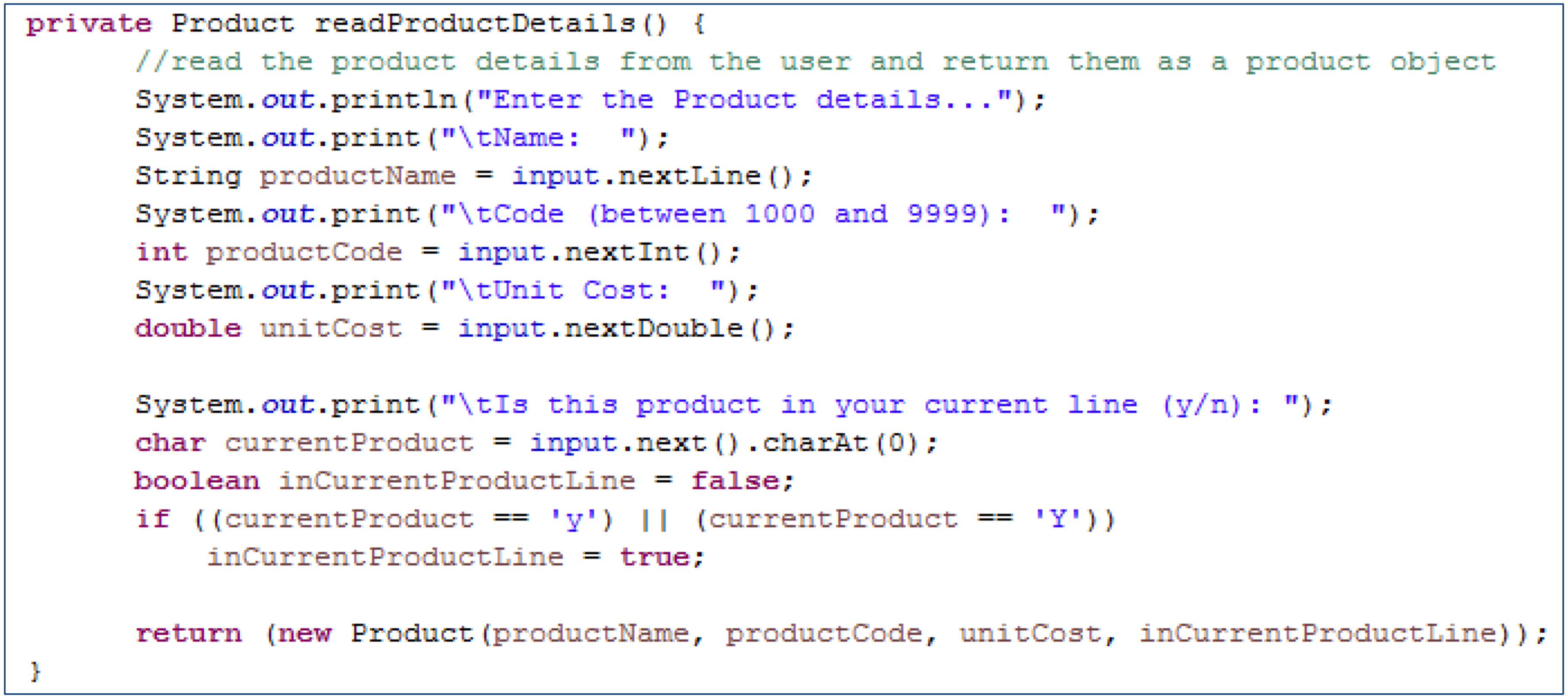
Waterford Institute *of* Technology
INSTITIÚID TEICNEOLAÍOCHTA PHORT LÁIRGE

Department of Computing and Mathematics
http://www.wit.ie/

Recap of making ShopV5.0 robust

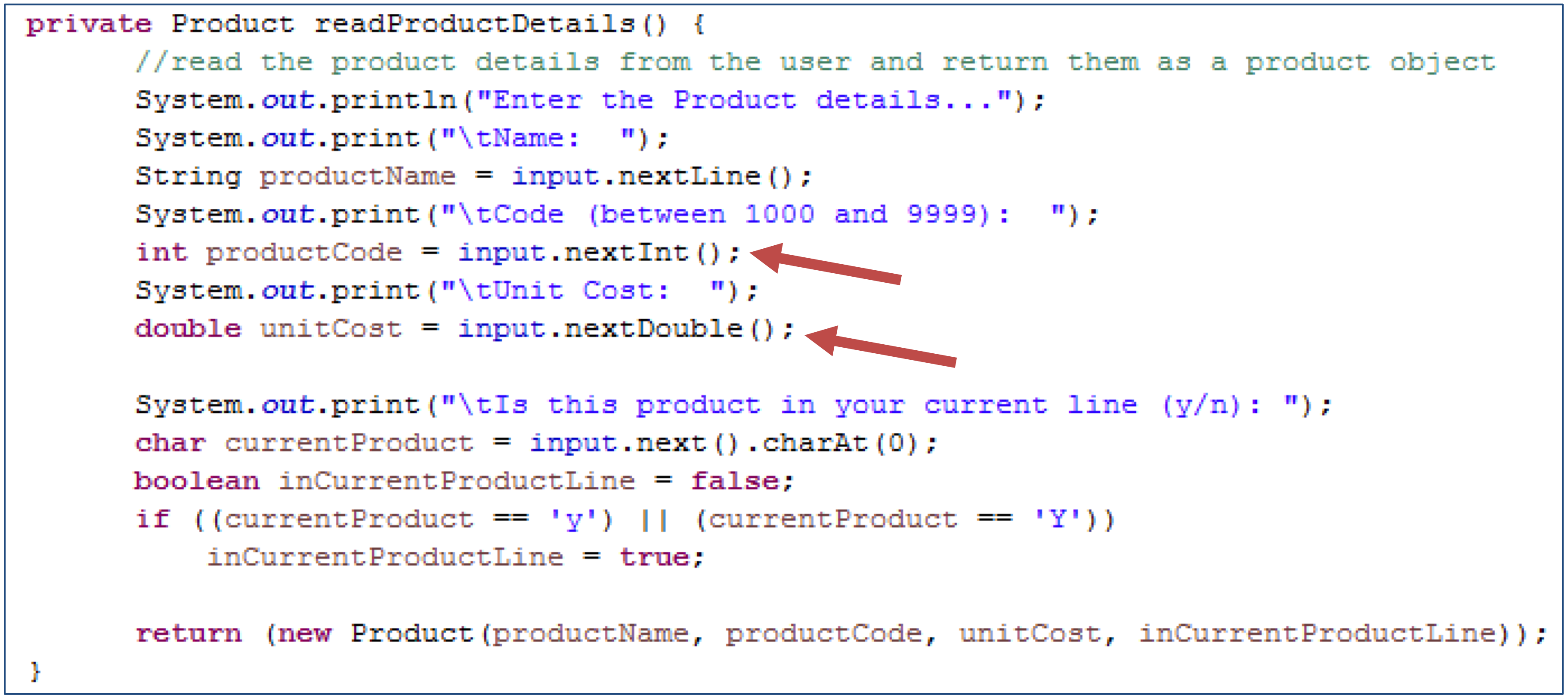
ShopV5.0 – making our app robust

What could cause a runtime exception here?



```java
private Product readProductDetails() {
        //read the product details from the user and return them as a product object
        System.out.println("Enter the Product details...");
        System.out.print("\tName:  ");
        String productName = input.nextLine();
        System.out.print("\tCode (between 1000 and 9999):  ");
        int productCode = input.nextInt();
        System.out.print("\tUnit Cost:  ");
        double unitCost = input.nextDouble();

        System.out.print("\tIs this product in your current line (y/n): ");
        char currentProduct = input.next().charAt(0);
        boolean inCurrentProductLine = false;
        if ((currentProduct == 'y') || (currentProduct == 'Y'))
            inCurrentProductLine = true;

        return (new Product(productName, productCode, unitCost, inCurrentProductLine));
}
```

ShopV5.0 – making our app robust



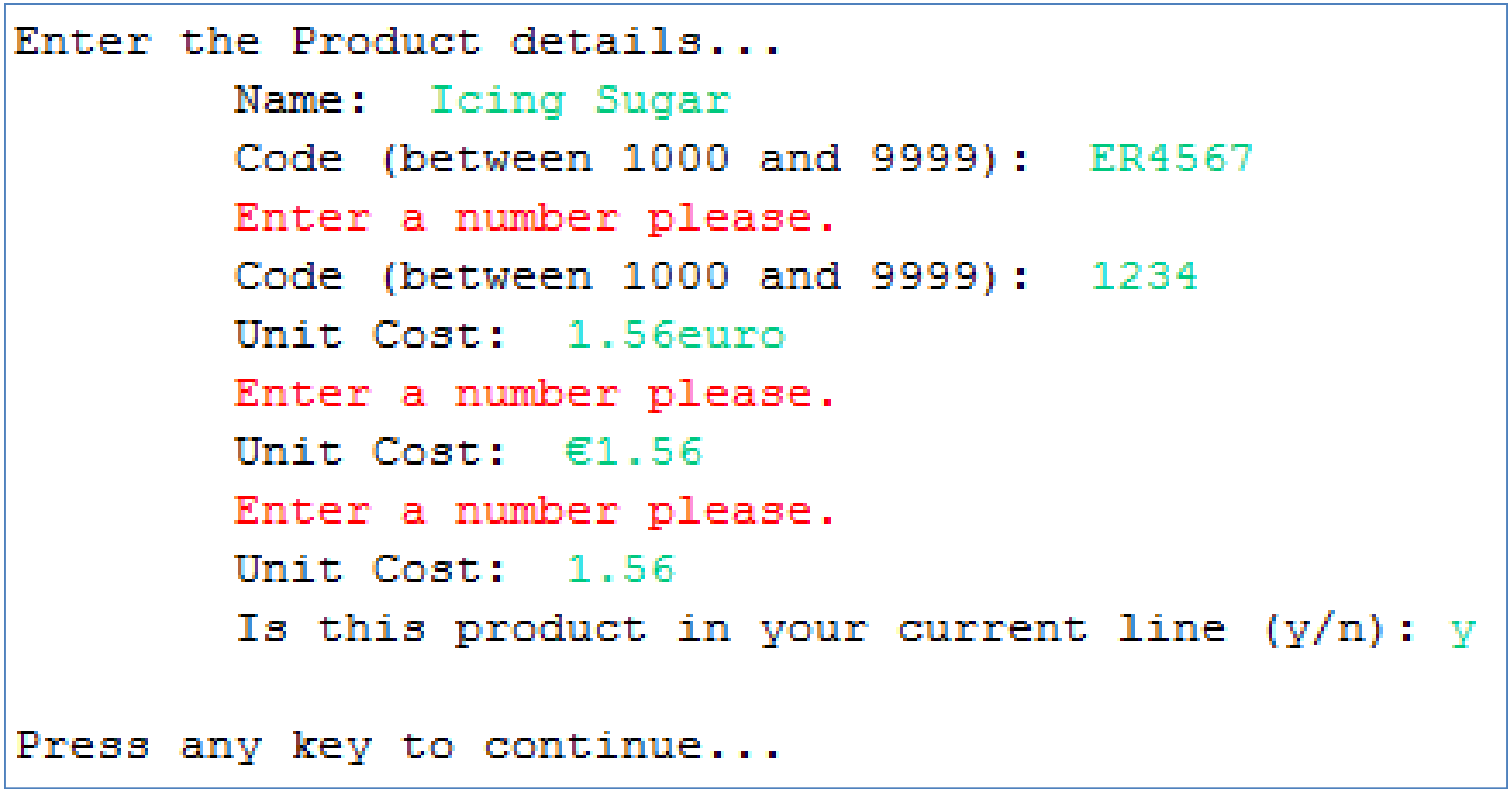
```
private Product readProductDetails() {
        //read the product details from the user and return them as a product object
        System.out.println("Enter the Product details...");
        System.out.print("\tName:  ");
        String productName = input.nextLine();
        System.out.print("\tCode (between 1000 and 9999):  ");
        int productCode = input.nextInt();
        System.out.print("\tUnit Cost:  ");
        double unitCost = input.nextDouble();

        System.out.print("\tIs this product in your current line (y/n): ");
        char currentProduct = input.next().charAt(0);
        boolean inCurrentProductLine = false;
        if ((currentProduct == 'y') || (currentProduct == 'Y'))
            inCurrentProductLine = true;

        return (new Product(productName, productCode, unitCost, inCurrentProductLine));
}
```

ShopV5.0 – making our app robust

```java
System.out.print("\tCode (between 1000 and 9999):  ");
int productCode = input.nextInt();
System.out.print("\tUnit Cost:  ");
double unitCost = input.nextDouble();
```

```java
int productCode = 0;
boolean goodInput = false;
do {
    try {
        System.out.print("\tCode (between 1000 and 9999):  ");
        productCode = input.nextInt();
        goodInput = true;
    }
    catch (Exception e) {
        input.nextLine(); //swallows the buffer contents
        System.err.println("\tEnter a number please.");
    }
}  while (!goodInput);

double unitCost = 0;
goodInput = false;
do {
    try {
        System.out.print("\tUnit Cost:  ");
        unitCost = input.nextDouble();
        goodInput = true;
    }
    catch (Exception e) {
        input.nextLine();  //swallows the buffer contents
        System.err.println("\tEnter a number please.");
    }
}  while (!goodInput);
```

nextInt() and nextDouble() are now exception handled!

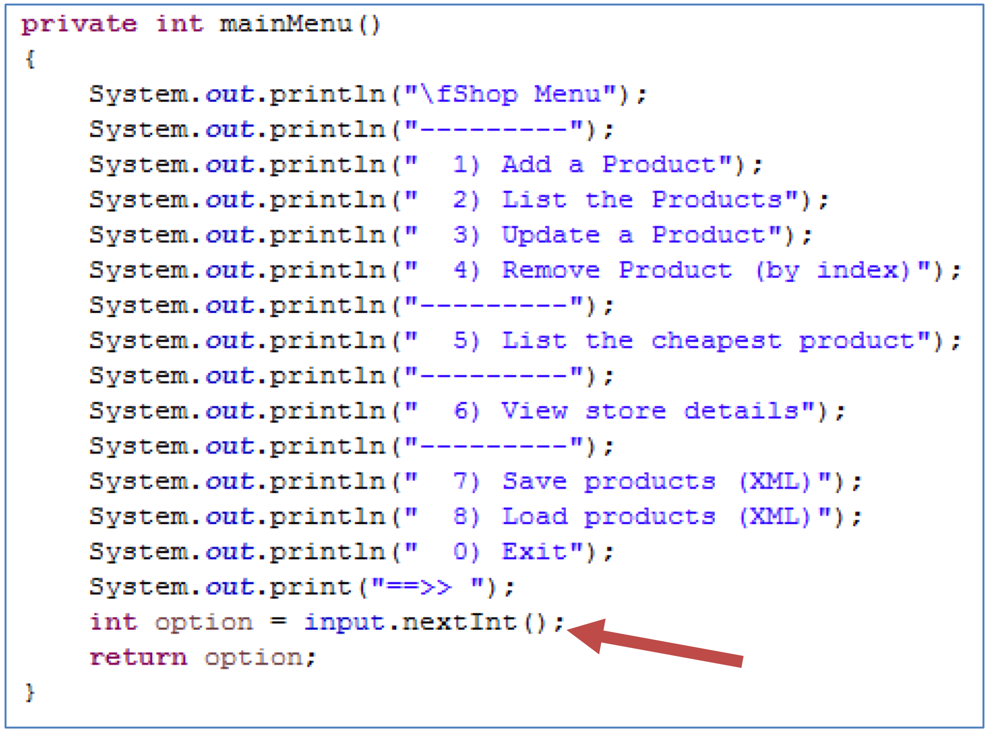


```
Enter the Product details...
        Name:  Icing Sugar
        Code (between 1000 and 9999):  ER4567
        Enter a number please.
        Code (between 1000 and 9999):  1234
        Unit Cost:  1.56euro
        Enter a number please.
        Unit Cost:  €1.56
        Enter a number please.
        Unit Cost:  1.56
        Is this product in your current line (y/n): y

Press any key to continue...
```

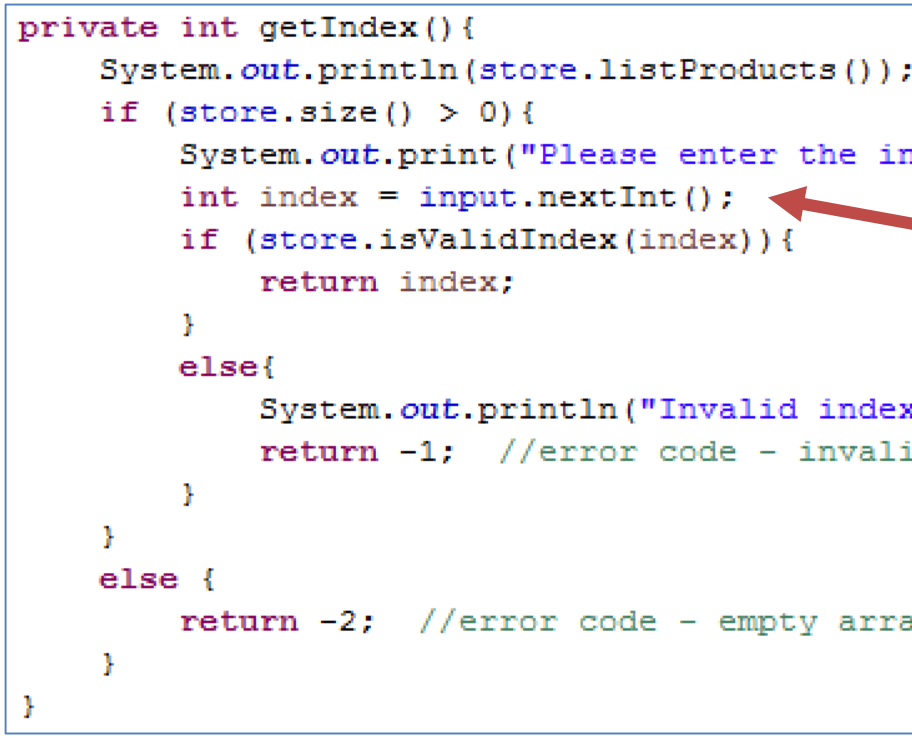
nextInt() and nextDouble() are now exception handled!

ShopV5.0 – making our app robust

- But what about these **int** reads?



```
private int mainMenu()
{
    System.out.println("\fShop Menu");
    System.out.println("---------");
    System.out.println("  1) Add a Product");
    System.out.println("  2) List the Products");
    System.out.println("  3) Update a Product");
    System.out.println("  4) Remove Product (by index)");
    System.out.println("---------");
    System.out.println("  5) List the cheapest product");
    System.out.println("---------");
    System.out.println("  6) View store details");
    System.out.println("---------");
    System.out.println("  7) Save products (XML)");
    System.out.println("  8) Load products (XML)");
    System.out.println("  0) Exit");
    System.out.print("==>> ");
    int option = input.nextInt();
    return option;
}
```

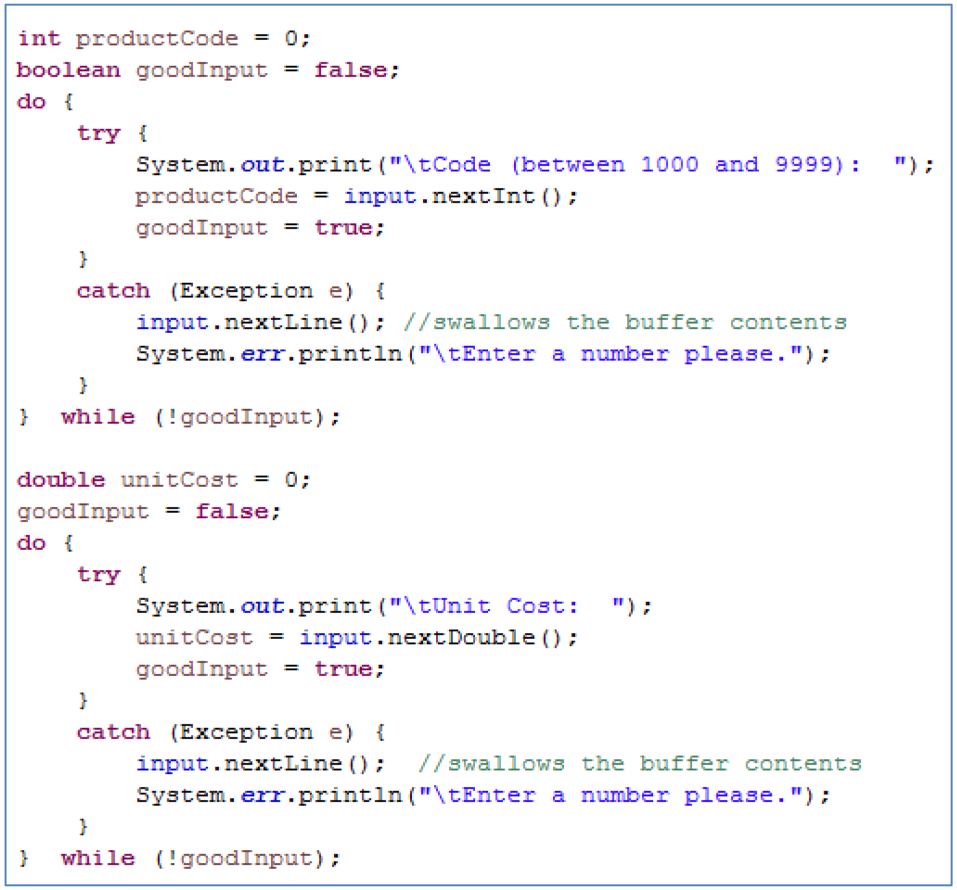


```
private int getIndex(){
    System.out.println(store.listProducts());
    if (store.size() > 0){
        System.out.print("Please enter the in
        int index = input.nextInt();
        if (store.isValidIndex(index)){
            return index;
        }
        else{
            System.out.println("Invalid index
            return -1;  //error code - invali
        }
    }
    else {
        return -2;  //error code - empty arra
    }
}
```

- Do I have to repeat the same code here?
- What happens if I add more int reads?

ShopV5.0 – making our app robust

- In order to have **DRY** code, we should really write a private helper/utility method that can validate our int input.
- How would we write it?

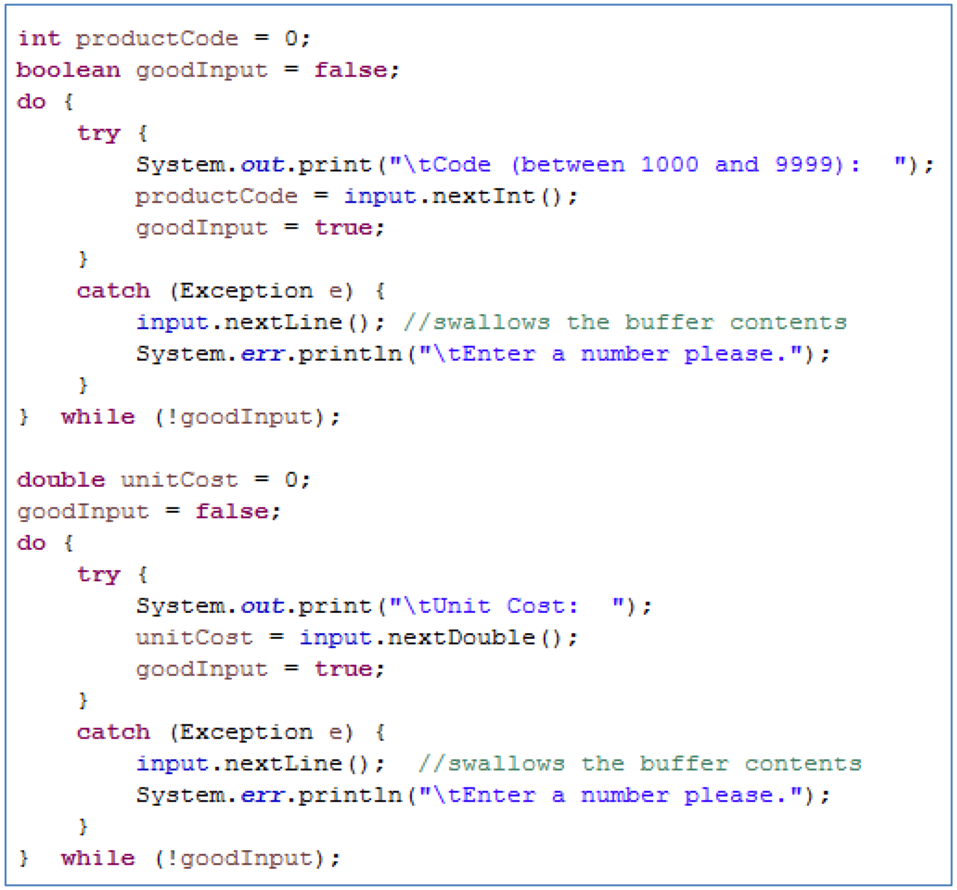


```
int productCode = 0;
boolean goodInput = false;
do {
    try {
        System.out.print("\tCode (between 1000 and 9999):  ");
        productCode = input.nextInt();
        goodInput = true;
    }
    catch (Exception e) {
        input.nextLine(); //swallows the buffer contents
        System.err.println("\tEnter a number please.");
    }
}  while (!goodInput);

double unitCost = 0;
goodInput = false;
do {
    try {
        System.out.print("\tUnit Cost:  ");
        unitCost = input.nextDouble();
        goodInput = true;
    }
    catch (Exception e) {
        input.nextLine();  //swallows the buffer contents
        System.err.println("\tEnter a number please.");
    }
}  while (!goodInput);
```

ShopV5.0 – making our app robust

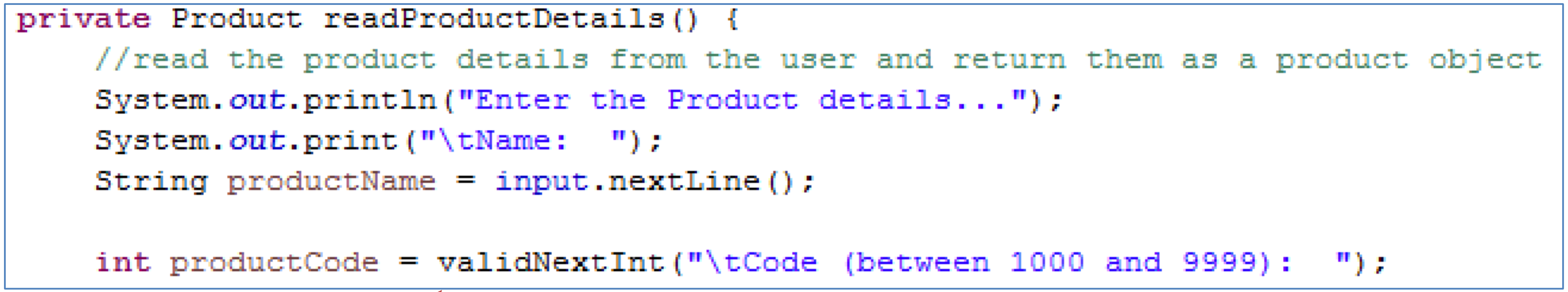
For this new method:

- We need to pass in a “prompt” string to be printed to the console.
- And return a valid int.

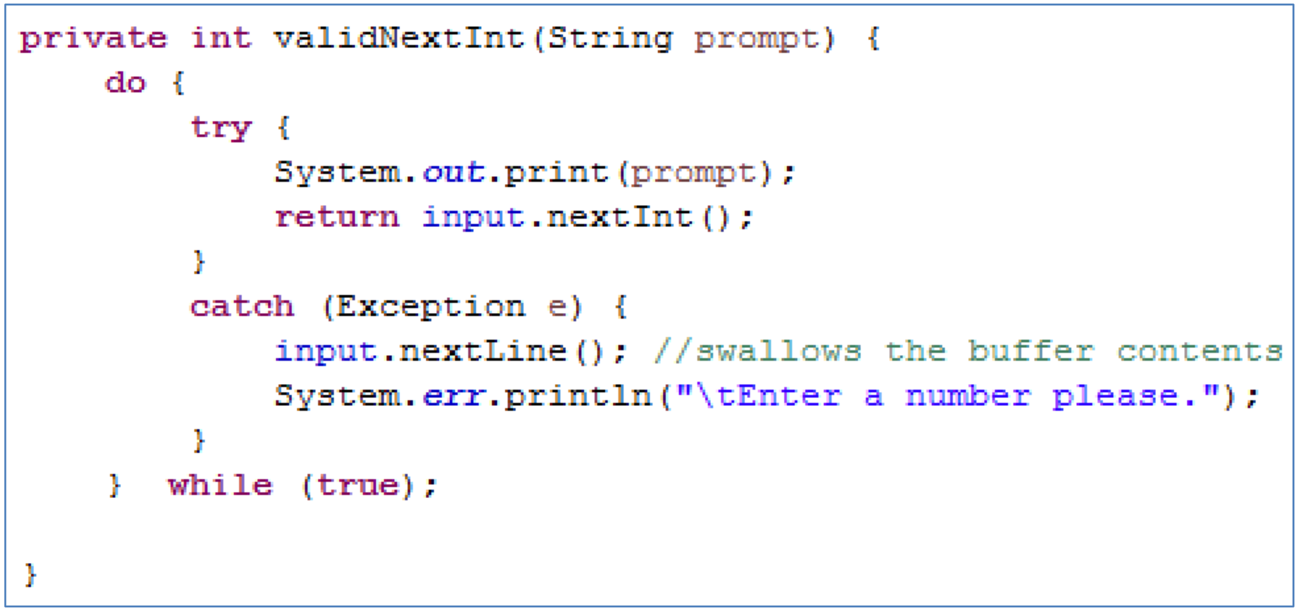


```
int productCode = 0;
boolean goodInput = false;
do {
    try {
        System.out.print("\tCode (between 1000 and 9999):  ");
        productCode = input.nextInt();
        goodInput = true;
    }
    catch (Exception e) {
        input.nextLine(); //swallows the buffer contents
        System.err.println("\tEnter a number please.");
    }
}  while (!goodInput);

double unitCost = 0;
goodInput = false;
do {
    try {
        System.out.print("\tUnit Cost:  ");
        unitCost = input.nextDouble();
        goodInput = true;
    }
    catch (Exception e) {
        input.nextLine();  //swallows the buffer contents
        System.err.println("\tEnter a number please.");
    }
}  while (!goodInput);
```

ShopV5.0 – making our app robust



```java
private Product readProductDetails() {
    //read the product details from the user and return them as a product object
    System.out.println("Enter the Product details...");
    System.out.print("\tName:  ");
    String productName = input.nextLine();

    int productCode = validNextInt("\tCode (between 1000 and 9999):  ");
```



```java
private int validNextInt(String prompt) {
    do {
        try {
            System.out.print(prompt);
            return input.nextInt();
        }
        catch (Exception e) {
            input.nextLine(); //swallows the buffer contents
            System.err.println("\tEnter a number please.");
        }
    }  while (true);

}
```

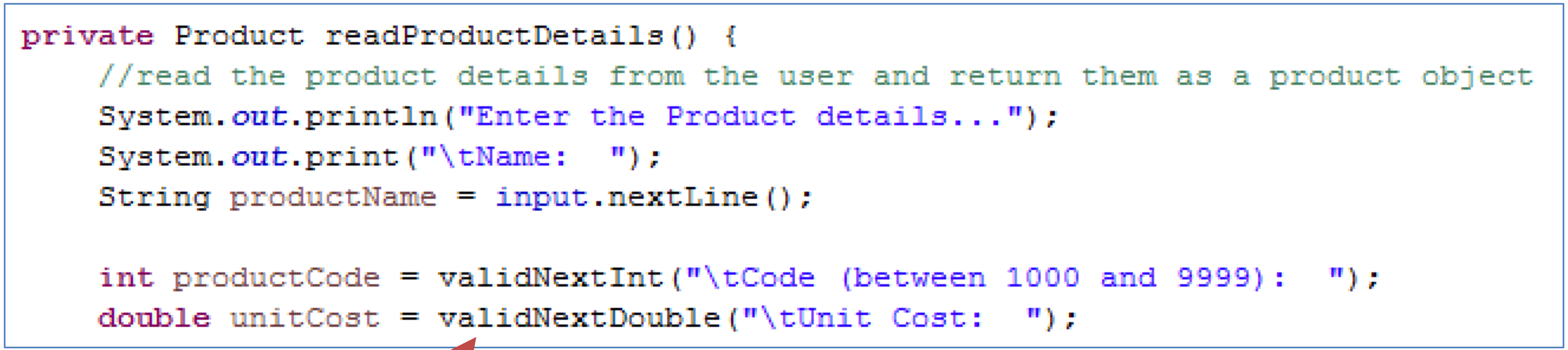
Here we are calling the new helper method to read a valid **int**.

```java
private int mainMenu()
{
    System.out.println("\fShop Menu");
    System.out.println("---------");
    System.out.println("  1) Add a Product");
    System.out.println("  2) List the Products");
    System.out.println("  3) Update a Product");
    System.out.println("  4) Remove Product (by index)");
    System.out.println("---------");
    System.out.println("  5) List the cheapest product");
    System.out.println("---------");
    System.out.println("  6) View store details");
    System.out.println("---------");
    System.out.println("  7) Save products (XML)");
    System.out.println("  8) Load products (XML)");
    System.out.println("  0) Exit");
    int option = validNextInt("==>> ");
    return option;
}
```

```java
private int validNextInt(String prompt) {
    do {
        try {
            System.out.print(prompt);
            return input.nextInt();
        }
        catch (Exception e) {
            input.nextLine(); //swallows the buffer contents
            System.err.println("\tEnter a number please.");
        }
    } while (true);

}
```

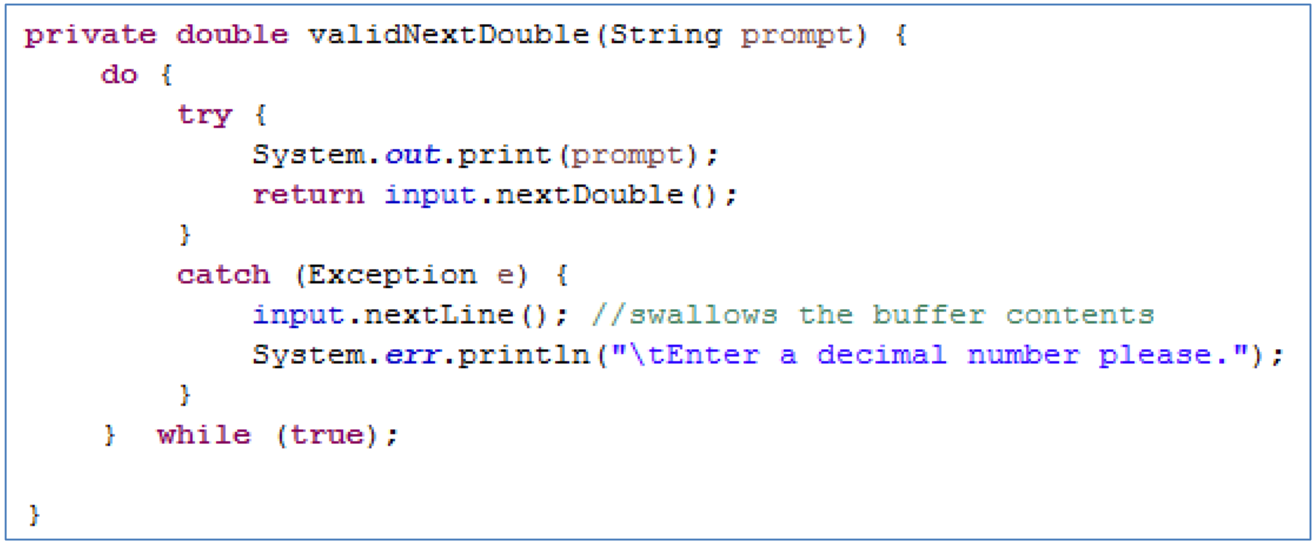
And again, we are calling the new helper method to read a valid **int**.

ShopV5.0 – making our app robust



```
private Product readProductDetails() {
    //read the product details from the user and return them as a product object
    System.out.println("Enter the Product details...");
    System.out.print("\tName:  ");
    String productName = input.nextLine();

    int productCode = validNextInt("\tCode (between 1000 and 9999):  ");
    double unitCost = validNextDouble("\tUnit Cost:  ");
```

Lets write a helper method now to read a valid **double**…



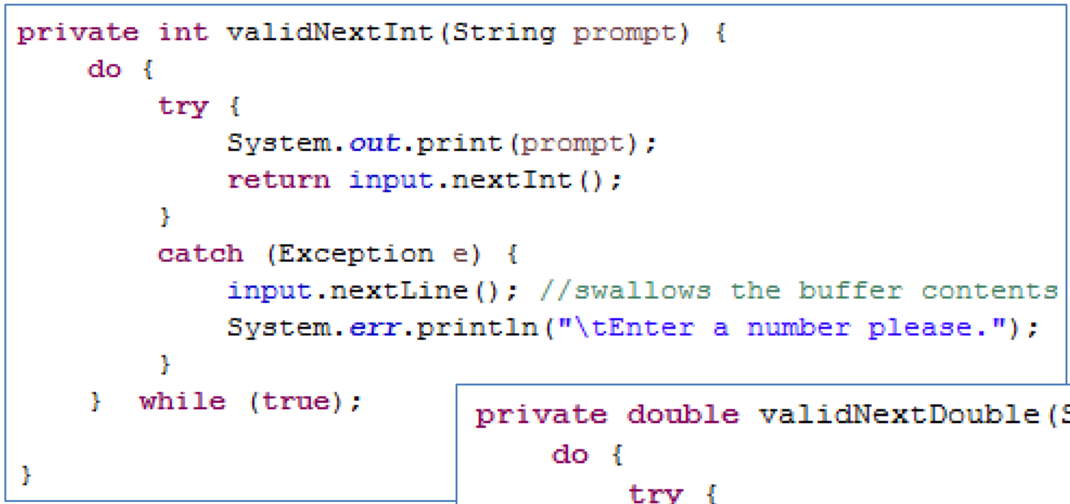
```
private double validNextDouble(String prompt) {
    do {
        try {
            System.out.print(prompt);
            return input.nextDouble();
        }
        catch (Exception e) {
            input.nextLine(); //swallows the buffer contents
            System.err.println("\tEnter a decimal number please.");
        }
    } while (true);

}
```

Using packages and utilities

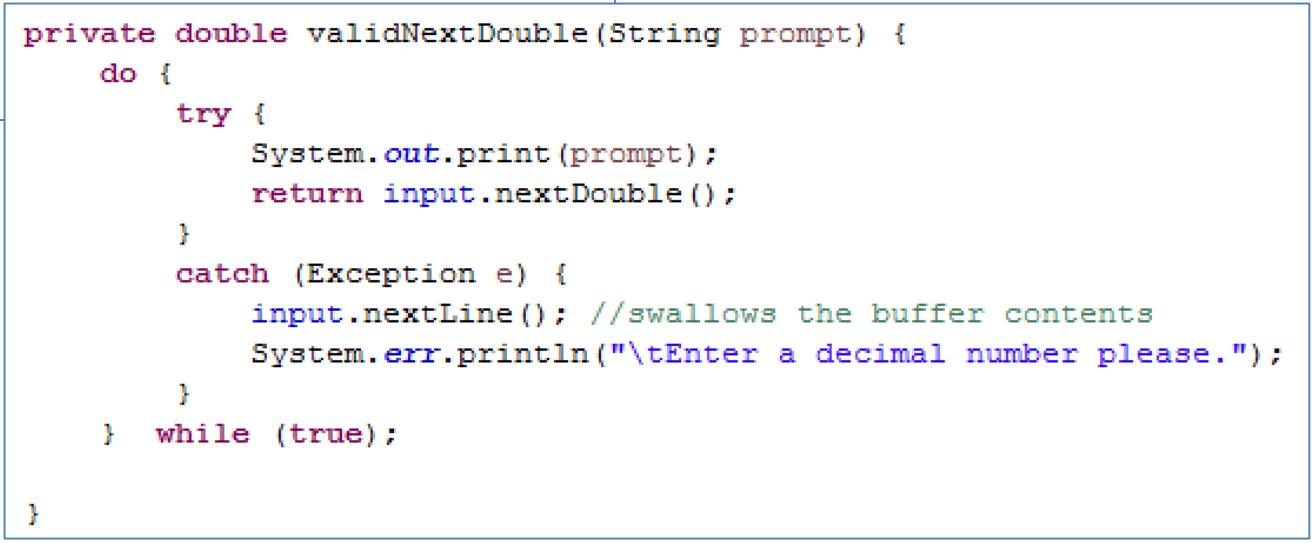
Developing ShopV6.0

ShopV5.0

- MenuController has these two utility methods:



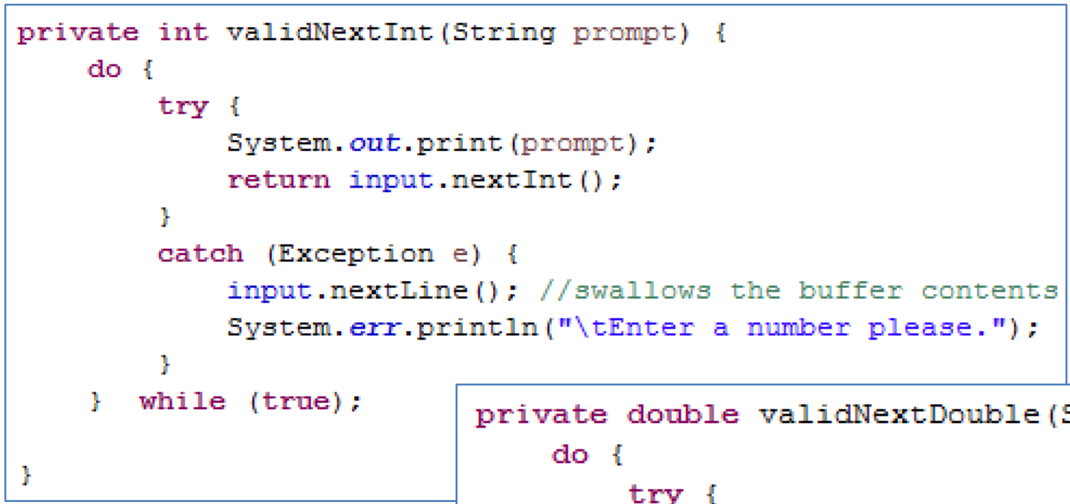
```
private int validNextInt(String prompt) {
    do {
        try {
            System.out.print(prompt);
            return input.nextInt();
        }
        catch (Exception e) {
            input.nextLine(); //swallows the buffer contents
            System.err.println("\tEnter a number please.");
        }
    }  while (true);

}
```



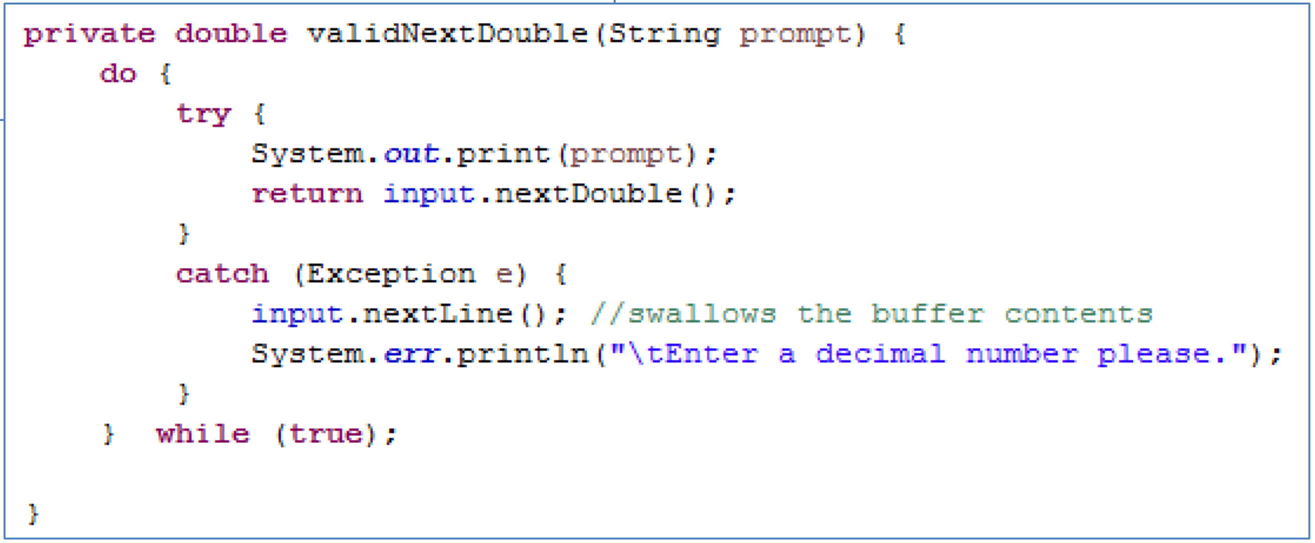
```
private double validNextDouble(String prompt) {
    do {
        try {
            System.out.print(prompt);
            return input.nextDouble();
        }
        catch (Exception e) {
            input.nextLine(); //swallows the buffer contents
            System.err.println("\tEnter a decimal number please.");
        }
    }  while (true);

}
```

ShopV5.0

- MenuController has these two utility methods:



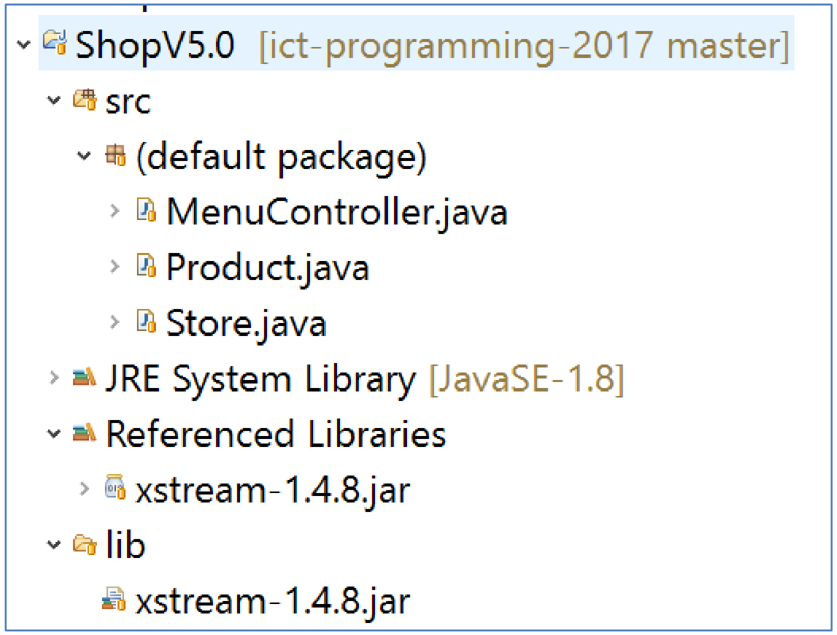
```java
private int validNextInt(String prompt) {
    do {
        try {
            System.out.print(prompt);
            return input.nextInt();
        }
        catch (Exception e) {
            input.nextLine(); //swallows the buffer contents
            System.err.println("\tEnter a number please.");
        }
    } while (true);

}
```



```java
private double validNextDouble(String prompt) {
    do {
        try {
            System.out.print(prompt);
            return input.nextDouble();
        }
        catch (Exception e) {
            input.nextLine(); //swallows the buffer contents
            System.err.println("\tEnter a decimal number please.");
        }
    } while (true);

}
```

Do you think these methods could be used in another app?

ShopV6.0 – utilities and packages



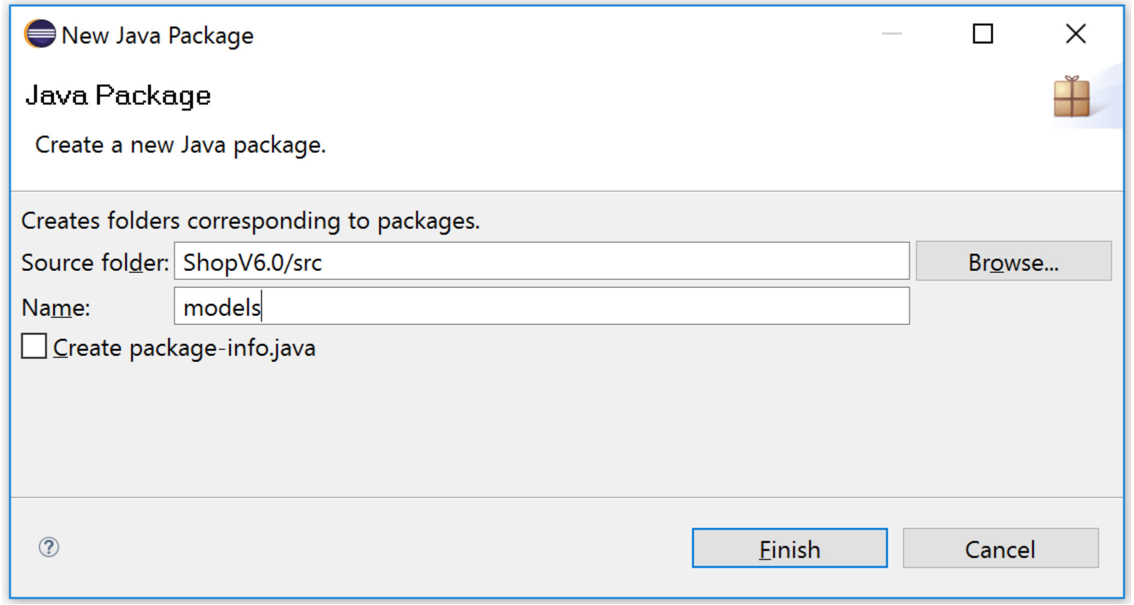
```
ShopV5.0  [ict-programming-2017 master]
  src
    (default package)
      MenuController.java
      Product.java
      Store.java
  JRE System Library [JavaSE-1.8]
  Referenced Libraries
    xstream-1.4.8.jar
  lib
    xstream-1.4.8.jar
```

- In the next few slides, we will remove these methods from the MenuController class and put them into a separate "utility" class.

- As our app is getting larger, we will start using "packages" to structure our app.

ShopV6.0 – utilities and packages

- Create a new app called ShopV6.0.
- Right-click on the **src** folder and select New → Package. Enter "models" as the package name.



New Java Package

Java Package

Create a new Java package.

Creates folders corresponding to packages.

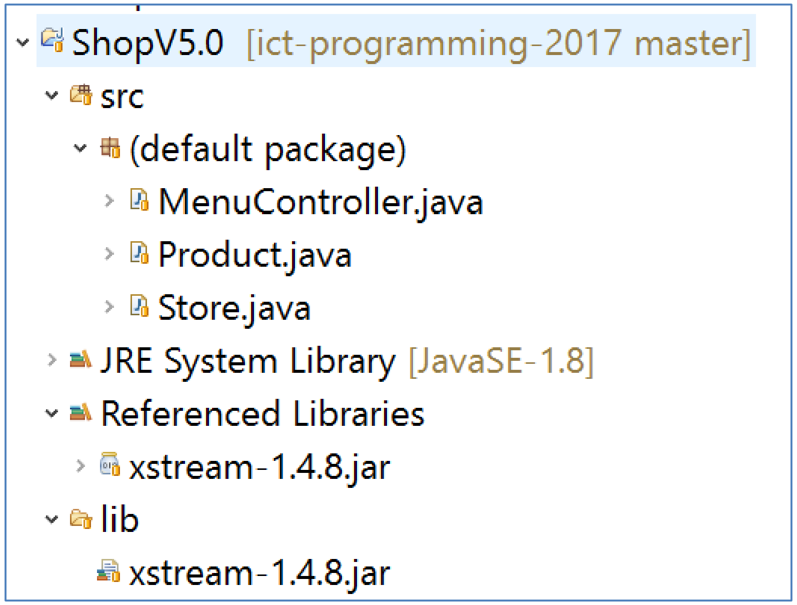
Source folder: ShopV6.0/src

Name: models

☐ Create package-info.java

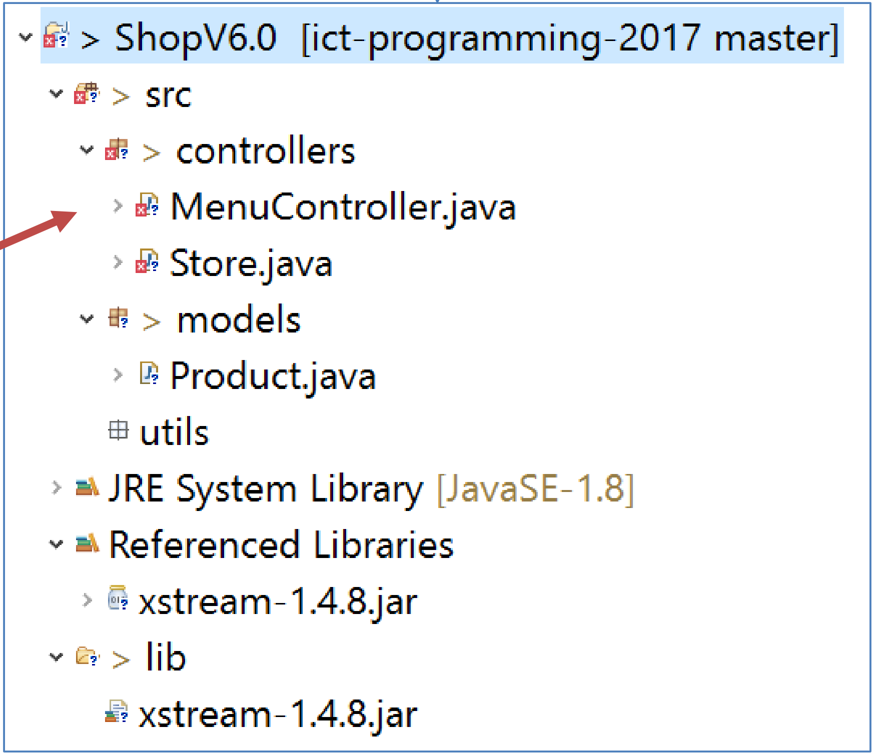
- Create two more packages: "controllers" and "utils".

ShopV6.0 – utilities and packages



```
ShopV5.0  [ict-programming-2017 master]
  src
    (default package)
      MenuController.java
      Product.java
      Store.java
  JRE System Library [JavaSE-1.8]
  Referenced Libraries
    xstream-1.4.8.jar
  lib
    xstream-1.4.8.jar
```

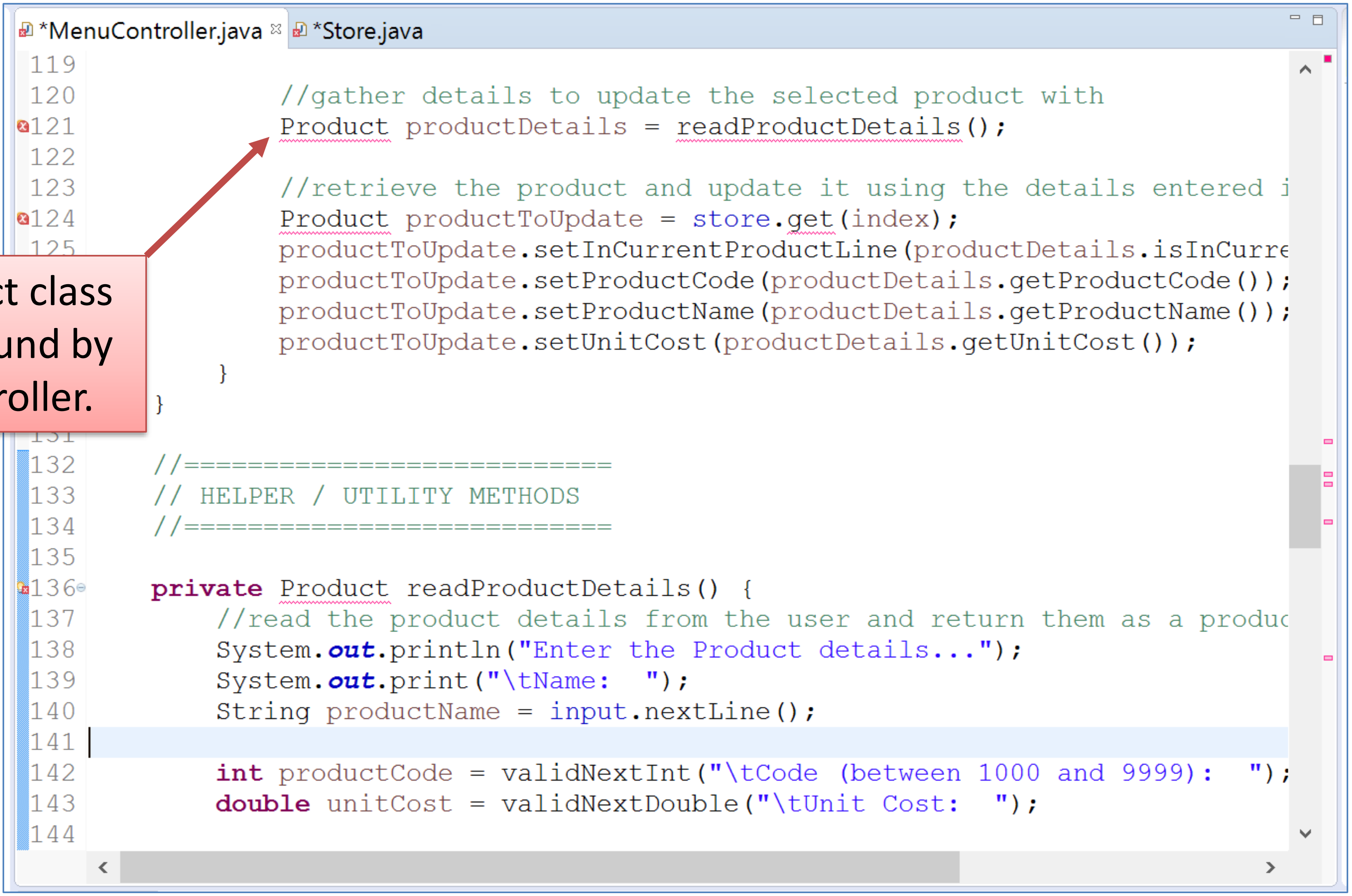
Copy the ShopV5.0 files into the ShopV6.0 project to the locations specified in the screen shot below.



```
> ShopV6.0  [ict-programming-2017 master]
  > src
    > controllers
      MenuController.java
      Store.java
    > models
      Product.java
    utils
  JRE System Library [JavaSE-1.8]
  Referenced Libraries
    xstream-1.4.8.jar
  > lib
    xstream-1.4.8.jar
```

When we have copied all the existing code to this new format, you can see we have errors!

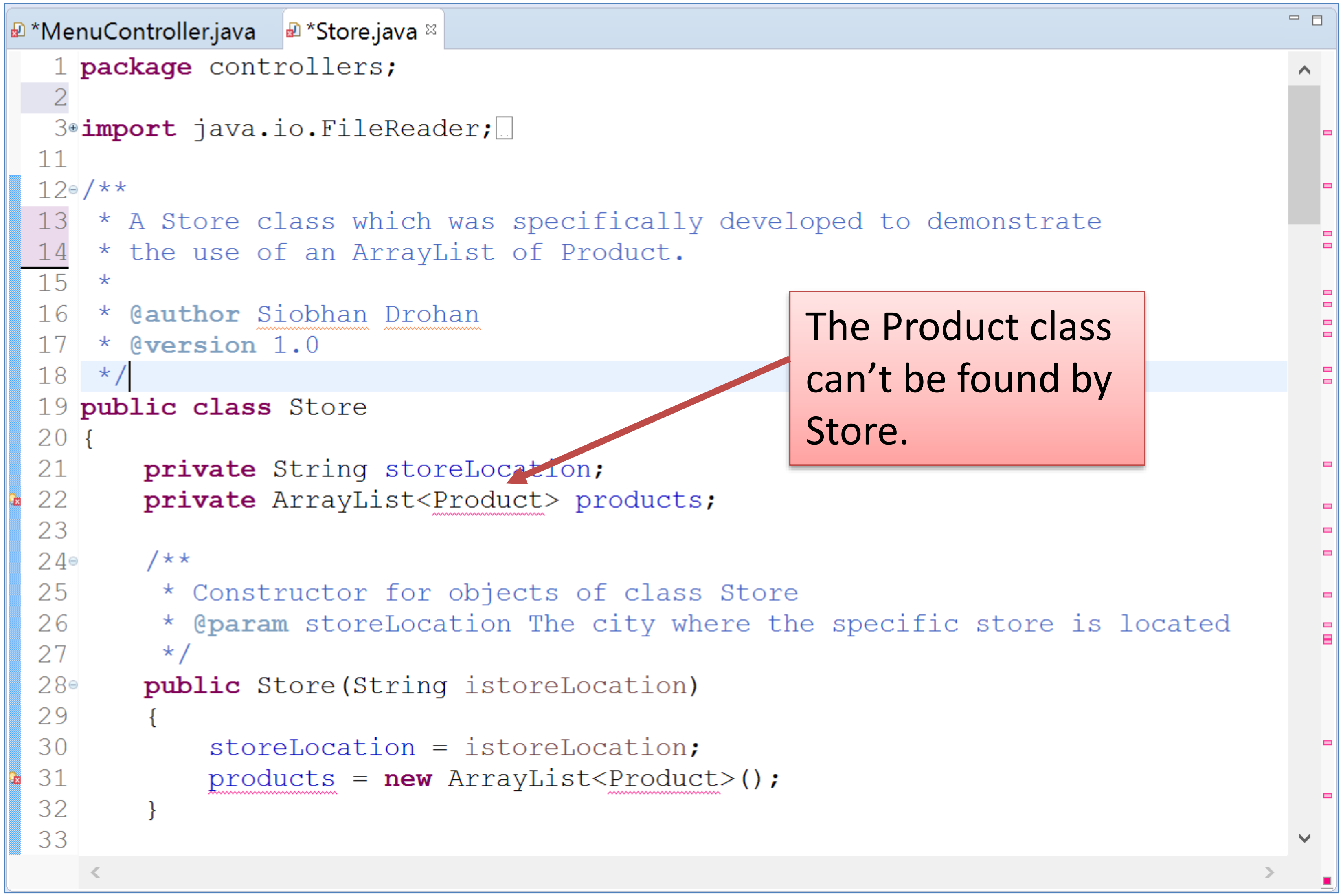
ShopV6.0 – utilities and packages



```
            //gather details to update the selected product with
            Product productDetails = readProductDetails();

            //retrieve the product and update it using the details entered i
            Product productToUpdate = store.get(index);
            productToUpdate.setInCurrentProductLine(productDetails.isInCurre
            productToUpdate.setProductCode(productDetails.getProductCode());
            productToUpdate.setProductName(productDetails.getProductName());
            productToUpdate.setUnitCost(productDetails.getUnitCost());
        }
    }

    //=========================
    // HELPER / UTILITY METHODS
    //=========================

    private Product readProductDetails() {
        //read the product details from the user and return them as a produc
        System.out.println("Enter the Product details...");
        System.out.print("\tName:  ");
        String productName = input.nextLine();

        int productCode = validNextInt("\tCode (between 1000 and 9999):  ");
        double unitCost = validNextDouble("\tUnit Cost:  ");

```

The Product class can't be found by MenuController.

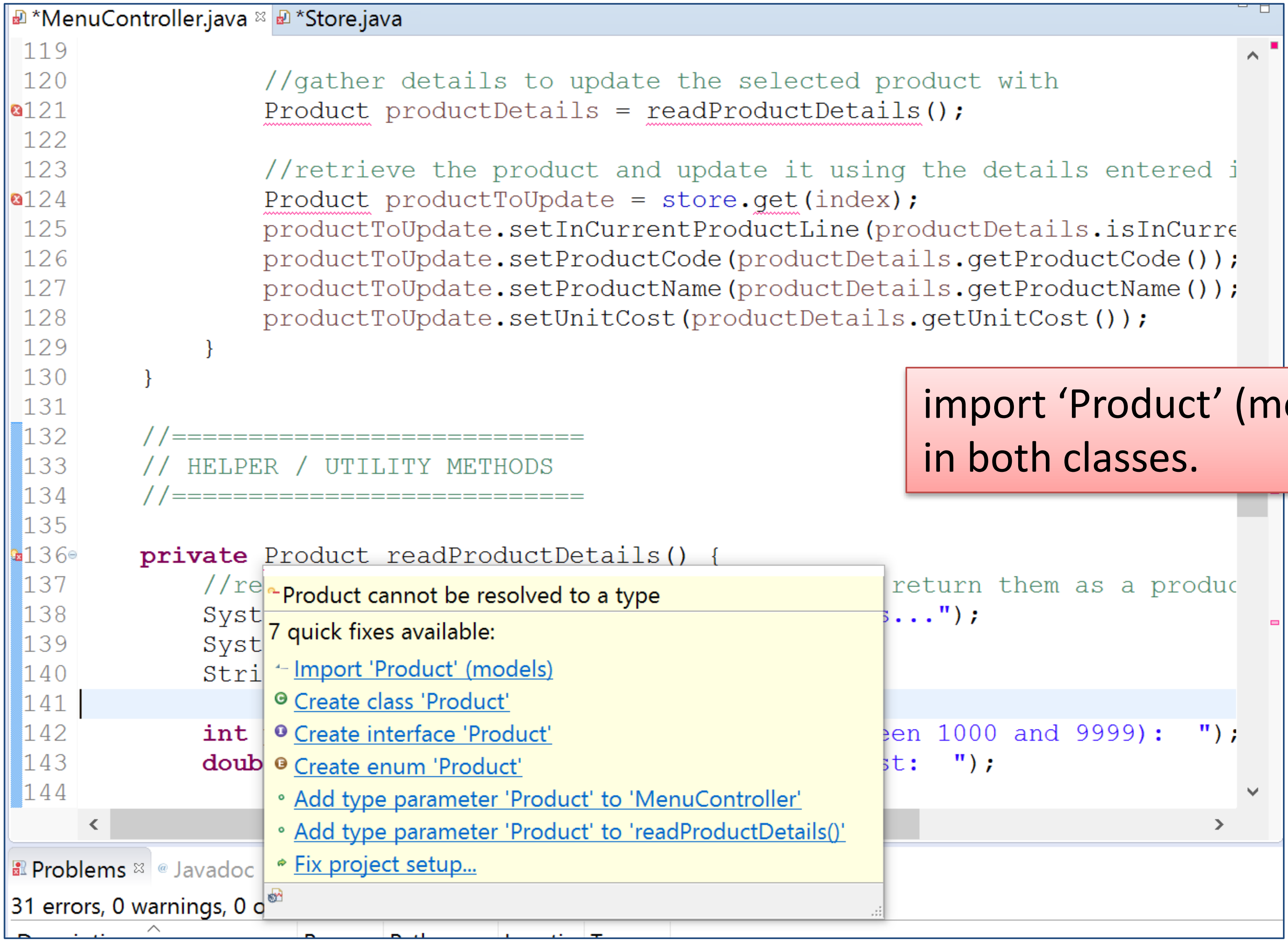
ShopV6.0 – utilities and packages



```java
package controllers;

import java.io.FileReader;

/**
 * A Store class which was specifically developed to demonstrate
 * the use of an ArrayList of Product.
 *
 * @author Siobhan Drohan
 * @version 1.0
 */
public class Store
{
    private String storeLocation;
    private ArrayList<Product> products;

    /**
     * Constructor for objects of class Store
     * @param storeLocation The city where the specific store is located
     */
    public Store(String istoreLocation)
    {
        storeLocation = istoreLocation;
        products = new ArrayList<Product>();
    }

```

The Product class can't be found by Store.

ShopV6.0 – utilities and packages



```
            //gather details to update the selected product with
            Product productDetails = readProductDetails();

            //retrieve the product and update it using the details entered i
            Product productToUpdate = store.get(index);
            productToUpdate.setInCurrentProductLine(productDetails.isInCurre
            productToUpdate.setProductCode(productDetails.getProductCode());
            productToUpdate.setProductName(productDetails.getProductName());
            productToUpdate.setUnitCost(productDetails.getUnitCost());
        }
    }

    //==========================
    // HELPER / UTILITY METHODS
    //==========================

    private Product readProductDetails() {
        //re                                                return them as a produc
        Syst                                               s...");
        Syst
        Stri

        int                                                een 1000 and 9999):  ");
        doub                                               st:  ");
```

Product cannot be resolved to a type

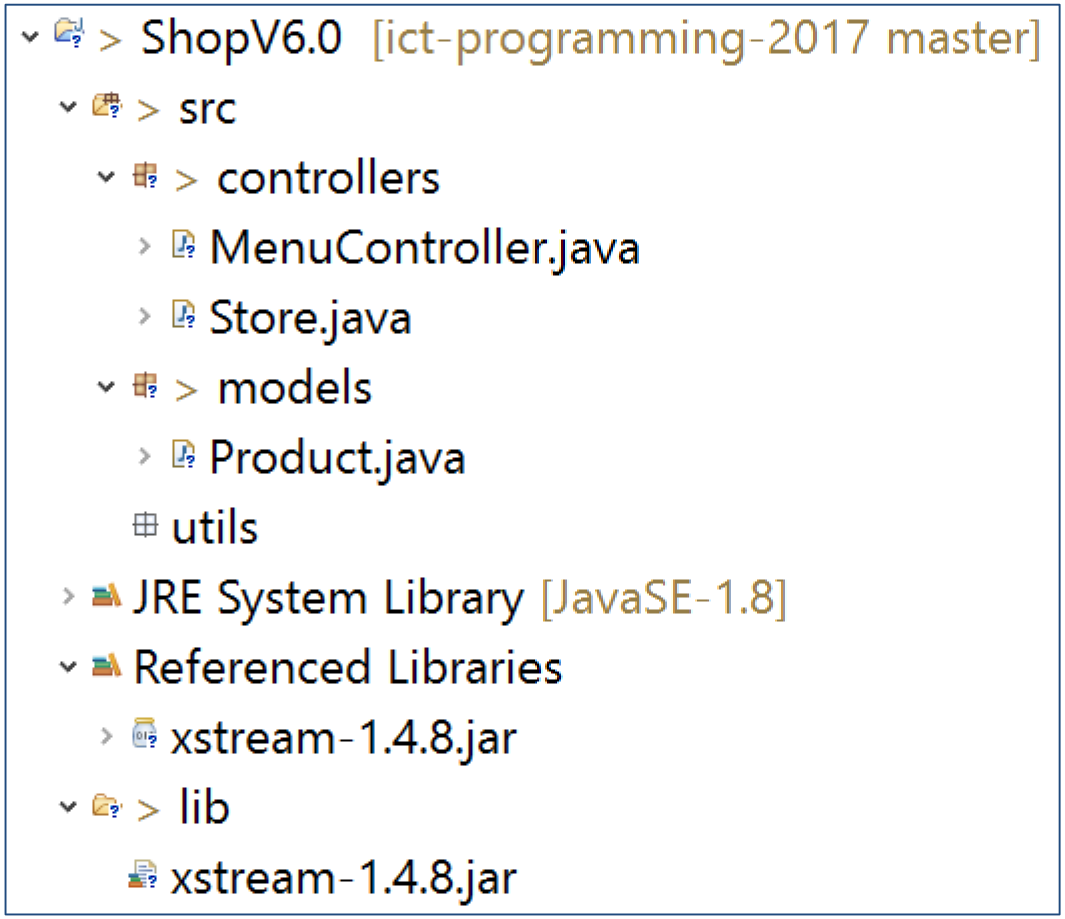
7 quick fixes available:

- Import 'Product' (models)
- Create class 'Product'
- Create interface 'Product'
- Create enum 'Product'
- Add type parameter 'Product' to 'MenuController'
- Add type parameter 'Product' to 'readProductDetails()'
- Fix project setup...

31 errors, 0 warnings, 0 o

import 'Product' (models) in both classes.

ShopV6.0 – utilities and packages



```
ShopV6.0 [ict-programming-2017 master]
  src
    controllers
      MenuController.java
      Store.java
    models
      Product.java
    utils
  JRE System Library [JavaSE-1.8]
  Referenced Libraries
    xstream-1.4.8.jar
  lib
    xstream-1.4.8.jar
```

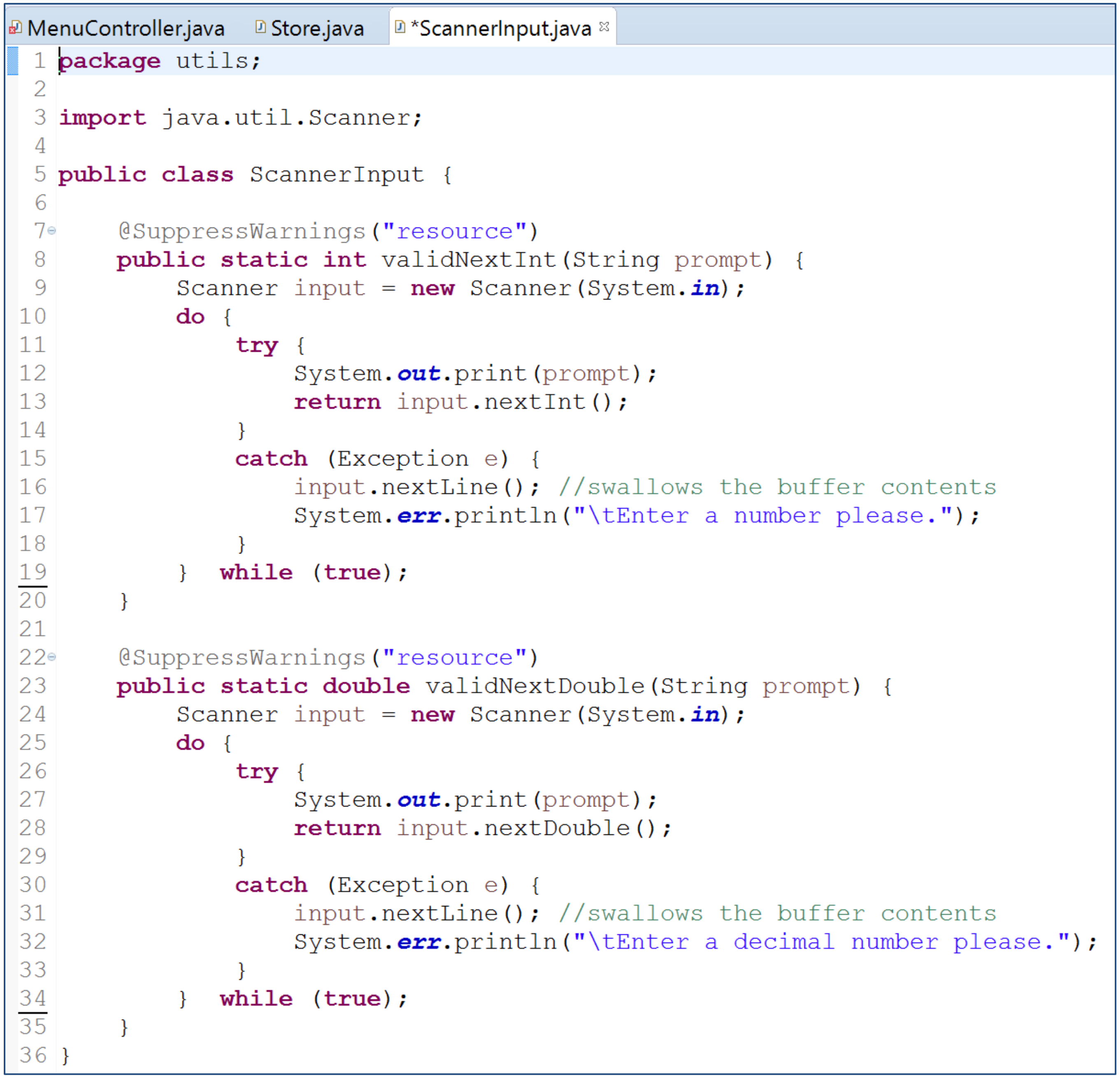
- The errors are now gone.
- Test the app to make sure it is running as expected.

ShopV6.0 – utilities and packages

Creating our first utility class…

- In the **utils** package, create a new class called **ScannerInput**.
- Cut the validNextDouble and validNextInt methods from MenuController and paste them into ScannerInput.
- Change the accessor modifier for these methods from private to public. Make each method static.
- Add a local Scanner object for each method and import the Scanner class.

Creating our first utility class…



```java
package utils;

import java.util.Scanner;

public class ScannerInput {

    @SuppressWarnings("resource")
    public static int validNextInt(String prompt) {
        Scanner input = new Scanner(System.in);
        do {
            try {
                System.out.print(prompt);
                return input.nextInt();
            }
            catch (Exception e) {
                input.nextLine(); //swallows the buffer contents
                System.err.println("\tEnter a number please.");
            }
        }  while (true);
    }

    @SuppressWarnings("resource")
    public static double validNextDouble(String prompt) {
        Scanner input = new Scanner(System.in);
        do {
            try {
                System.out.print(prompt);
                return input.nextDouble();
            }
            catch (Exception e) {
                input.nextLine(); //swallows the buffer contents
                System.err.println("\tEnter a decimal number please.");
            }
        }  while (true);
    }
}
```

ShopV6.0 – utilities and packages

Calling the methods in our first utility class…

MenuController can’t find our new methods…

```java
private Product readProductDetails() {
    //read the product details from the user and return them as a product object
    System.out.println("Enter the Product details...");
    System.out.print("\tName:   ");
    String productName = input.nextLine();

    int productCode = validNextInt("\tCode (between 1000 and 9999):   ");
    double unitCost = validNextDouble("\tUnit Cost:   ");

    System.out.print("\tIs this product in your current line (y/n): ");
    char currentProduct = input.next().charAt(0);
    boolean inCurrentProductLine = false;
    if ((currentProduct == 'y') || (currentProduct == 'Y'))
        inCurrentProductLine = true;

    return (new Product(productName, productCode, unitCost, inCurrentProductLine));
}
```

ShopV6.0 – utilities and packages

Calling the methods in our first utility class…

import static utils.ScannerInput.*;

```
private Product readProductDetails() {
    //read the product details from the user and return them as a product object
    System.out.println("Enter the Product details...");
    System.out.print("\tName:  ");
    String productName = input.nextLine();

    int productCode = validNextInt("\tCode (between 1000 and 9999):  ");
    double unitCost = validNextDouble("\tUnit Cost:  ");

    System.out.print("\tIs this product in your current line (y/n): ");
    char currentProduct = input.next().charAt(0);
    boolean inCurrentProductLine = false;
    if ((currentProduct == 'y') || (currentProduct == 'Y'))
        inCurrentProductLine = true;

    return (new Product(productName, productCode, unitCost, inCurrentProductLine));
}
```

ShopV6.0 – utilities and packages

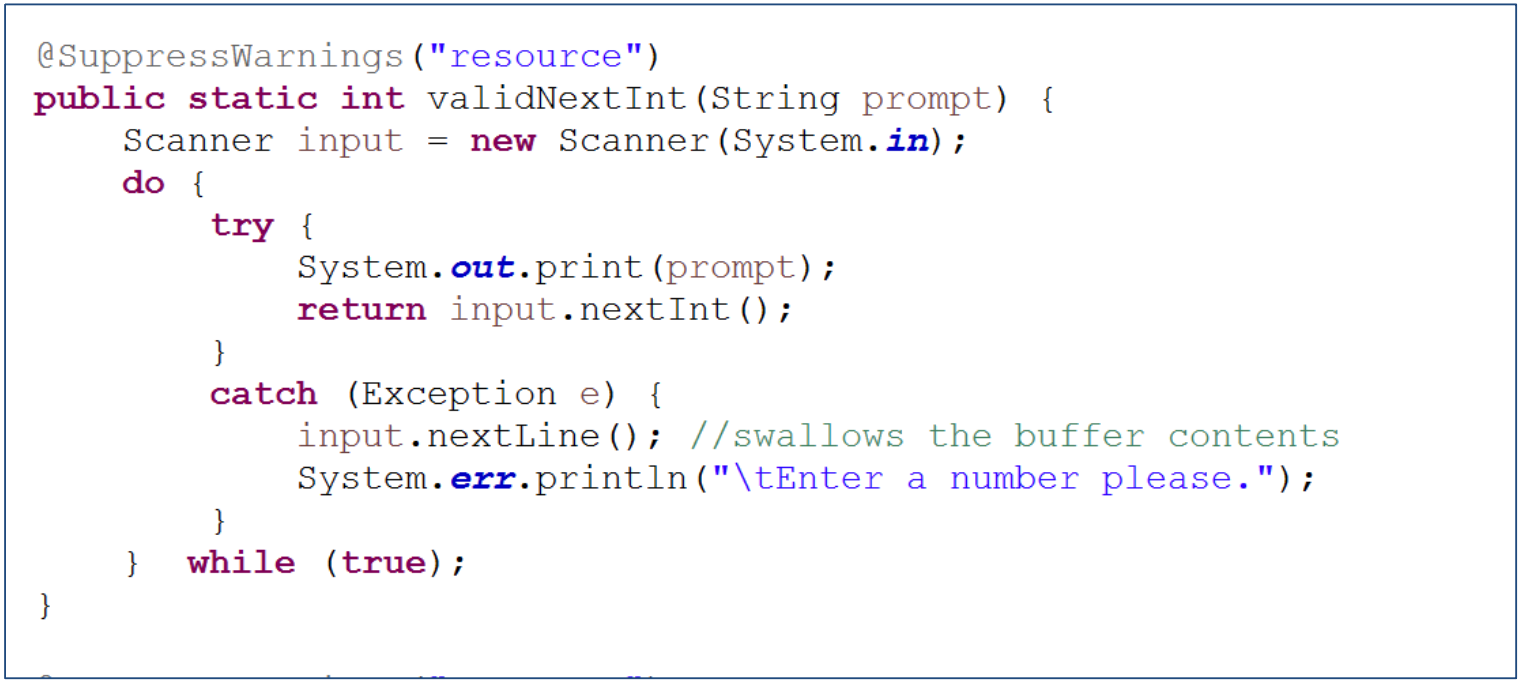
- When testing the app, you might notice that our dummy reads for emptying the buffer are now causing a problem!
- We can get rid of these now and, as we are creating a new Scanner object for each **int** and **double** read, we don’t have to worry about emptying our buffers anymore!

Wrappers and Parsing

Another approach for validating input in ShopV6.0

Another approach to validating input

- Currently, our validation of **int** input is as follows:



```java
@SuppressWarnings("resource")
public static int validNextInt(String prompt) {
    Scanner input = new Scanner(System.in);
    do {
        try {
            System.out.print(prompt);
            return input.nextInt();
        }
        catch (Exception e) {
            input.nextLine(); //swallows the buffer contents
            System.err.println("\tEnter a number please.");
        }
    } while (true);
}
```

Another approach to validating input

- We can use wrapper classes and parsing for validating input:

```
public class ScannerInput {

    @SuppressWarnings("resource")
    public static int validNextInt(String prompt) {
        Scanner input = new Scanner(System.in);
        do {
            try {
                System.out.print(prompt);
                return Integer.parseInt(input.next());
            }
            catch (NumberFormatException e) {
                System.err.println("\tEnter a number please.");
            }
        }  while (true);
    }
```

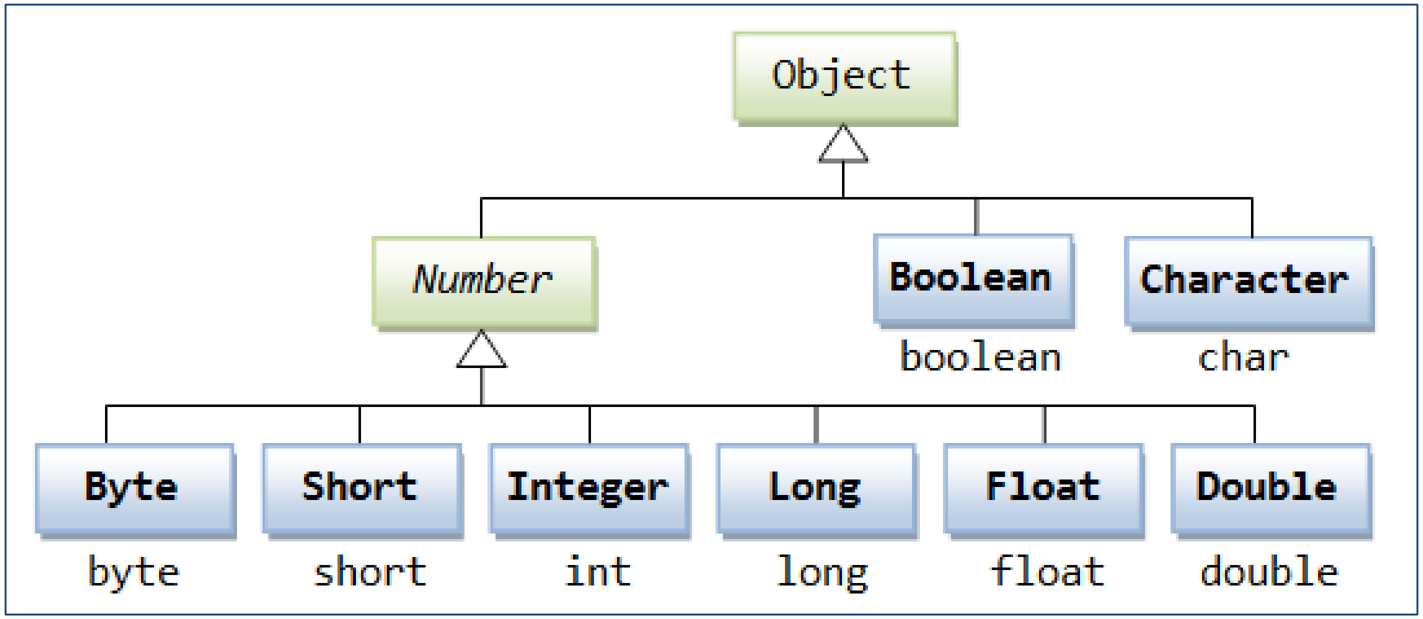
Wrapper classes

- Normally, when we work with Numbers, we use primitive data types such as byte, int, long, double, etc.
- However, in development, we come across situations where we need to use objects instead of primitive data types.
- In order to achieve this, Java provides **wrapper classes**.

https://www.tutorialspoint.com/java/java_numbers.htm

Wrapper classes

- All the wrapper classes (Integer, Long, Byte, Double, Float, Short) are subclasses of the abstract class Number.



https://www.tutorialspoint.com/java/java_numbers.htm

Wrapper classes

- The object of the wrapper class contains or wraps its respective primitive data type.
- Converting primitive data types into object is called **autoboxing**, and this is taken care by the compiler.
- Therefore, while using a wrapper class you just need to pass the value of the primitive data type to the constructor of the Wrapper class.

https://www.tutorialspoint.com/java/java_numbers.htm

Wrapper classes

- The Wrapper object will be converted back to a primitive data type, and this process is called **unboxing**.
- The **Number** class is part of the java.lang package.

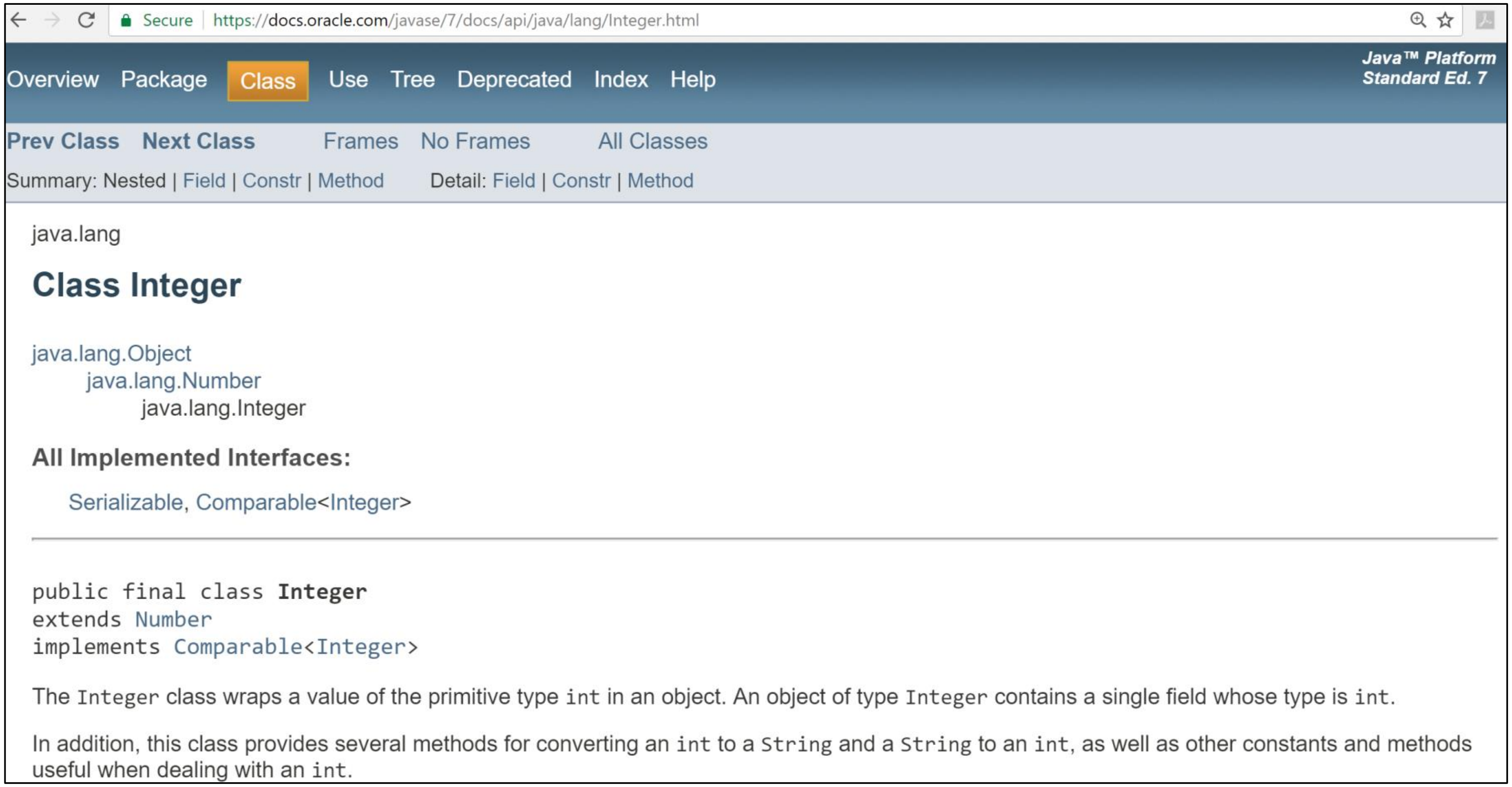
https://www.tutorialspoint.com/java/java_numbers.htm

Wrapper classes – boxing/unboxing

```
public class Test {
        public static void main(String args[]) {
                Integer x = 5; // boxes int to an Integer object
                x =  x + 10;   // unboxes the Integer to an int
                System.out.println(x);    //prints 15 to console
        }
}
```

https://www.tutorialspoint.com/java/java_numbers.htm

Parsing


Secure
https://docs.oracle.com/javase/7/docs/api/java/lang/Integer.html
Overview Package Class Use Tree Deprecated Index Help
Java™ Platform Standard Ed. 7
Prev Class Next Class Frames No Frames All Classes
Summary: Nested | Field | Constr | Method Detail: Field | Constr | Method

java.lang

Class Integer

java.lang.Object
    java.lang.Number
        java.lang.Integer

All Implemented Interfaces:

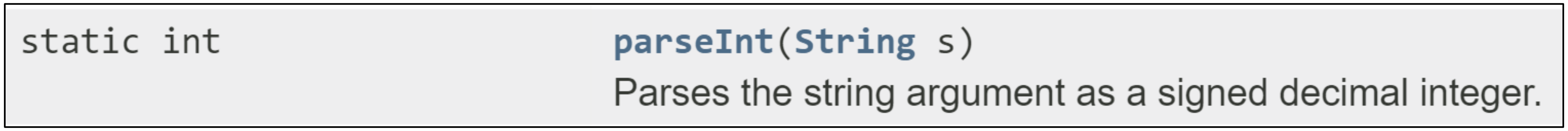
Serializable, Comparable<Integer>

```
public final class Integer
extends Number
implements Comparable<Integer>
```

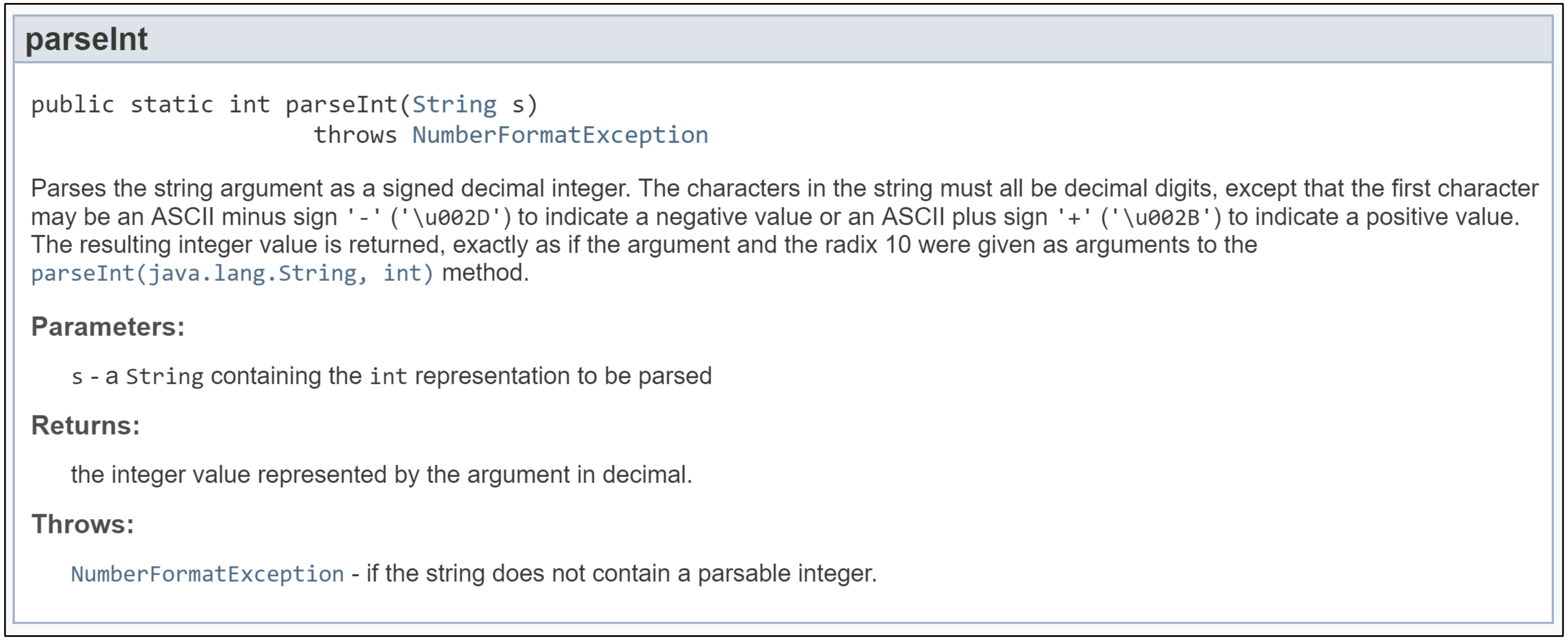
The `Integer` class wraps a value of the primitive type `int` in an object. An object of type `Integer` contains a single field whose type is `int`.

In addition, this class provides several methods for converting an `int` to a `String` and a `String` to an `int`, as well as other constants and methods useful when dealing with an `int`.

Parsing



`static int`	`parseInt(String s)` Parses the string argument as a signed decimal integer.



parseInt

```
public static int parseInt(String s)
                    throws NumberFormatException
```

Parses the string argument as a signed decimal integer. The characters in the string must all be decimal digits, except that the first character may be an ASCII minus sign `'-'` (`'\u002D'`) to indicate a negative value or an ASCII plus sign `'+'` (`'\u002B'`) to indicate a positive value. The resulting integer value is returned, exactly as if the argument and the radix 10 were given as arguments to the `parseInt(java.lang.String, int)` method.

Parameters:

`s` - a `String` containing the `int` representation to be parsed

Returns:

the integer value represented by the argument in decimal.

Throws:

`NumberFormatException` - if the string does not contain a parsable integer.

Any Questions?

Waterford Institute *of* Technology
INSTITIÚID TEICNEOLAÍOCHTA PHORT LÁIRGE

Department of Computing and Mathematics
http://www.wit.ie/