Unit 2: Using Objects

Topic 1 Lab 2: Intro to Objects Part 2

Name:	

More with Rectangles

1. Continue using your IntelliJ project from the Do Now (LastNameU2T1Lab2)

2. Create a new class in the **src** folder named **`RectangleRunner`** and give it a `main` method (no code to paste yet).

3. Create a second class in the **src** folder named **`Rectangle`** and copy/paste **this code** (different class than the last lab).

4. Look in the Rectangle class:

- **a.** Which methods have **void** return types?
- **b.** Which methods have ***non*-void** return types? What is the type(s) of their return values?
- **c.** Which methods have *no* parameters?
- **d.** Which methods have a parameter?

a.

b.

c.

d.

check

5. In the `RectangleRunner` class, create a `Rectangle` object named `rect1`. Give it a length and width of 10 and 20. On your object, call the `printArea` method and the `printBoxVolume` method with a height of 30. Run the code to see that it works; you should see the following printed output:

```
My area is 200
The volume is: 6000.0
```

Copy and paste the line(s) of code that you wrote below:

check

6. Add *another* line of code to call the `printBoxVolume` a second time with a height of 40. Run your code to make sure you see two different volumes printed (6000 and 8000).

7. Why do *both* calls to `printBoxVolume` use the same 10 and 20 for the length and width, but *different* values for height?

check

8. In the `RectangleRunner` class, keep the line of code where you create `rect1` and delete the rest. Now write some code in the `main` method that use the two methods that *return values* to print a statement like the following, using a height of 25:

```
This rectangle has an area of 200 and a volume of 5000.0
```

Use two variables to store the *returned* area and volume!

Copy and paste the line(s) of code that you wrote below:

check

9. Now modify your code to *remove* the variables that store the returned values and instead call both methods "**in line**" as part of the print statement.

Copy and paste the line(s) of code that you wrote below:

check

10. Here is a line of code that ***doesn't*** compile (disregard that is spans two lines in this document):

```
System.out.println("This rectangle has an area of " + rect1.printArea();
+ " and a volume of " + rect1.printBoxVolume(25));
```

11. Explain why this line of code won't compile (if you need to copy/paste into IntelliJ to inspect the compiler error, feel free to do so!):

Not sure? Note the methods being called on the rect1 object… do they *return* values that can be printed, or not?

check

12. In the `Rectangle` class, here is logic that calculates and returns area:

```
public int calculateArea() {
    return length * width;
}
```

The other three methods in the `Rectangle` class *also* perform calculations that involve `length * width`, which is redundant. Help **reduce redundancy** in the code by replacing `length * width` in the other three `Rectangle` methods with calls to its own `calculateArea` method (review slide **19** for an example).

Test to make sure you didn't break anything by making a call to each revised method from your `main` method in `RectangleRunner`.

Copy/paste the methods that you modified in Rectangle (you should have modified 3 methods):

check

13. When calling `calculateArea` from the `RectangleRunner` class, we need to call it on an

object using **dot notation**, like `rect1.calculateArea()`; why don't we use dot notation when calling the `calculateArea` method from other methods *inside* `Rectangle`?	*check*

Lab continues on the next page

14. Delete the code in your `RectangleRunner` class, then **copy/paste** the following starter code:

```
import java.util.Scanner;

public class RectangleRunner {
    public static void main(String[] args) {
        Scanner myScanner = new Scanner(System.in);
        System.out.print("Enter rectangle 1 length: ");
        int rect1Length = myScanner.nextInt();
        System.out.print("Enter rectangle 1 width: ");
        int rect1Width = myScanner.nextInt();
        System.out.print("Enter rectangle 1 height: ");
        double rect1Height = myScanner.nextDouble();
        System.out.print("Enter rectangle 2 length: ");
        int rect2Length = myScanner.nextInt();
        System.out.print("Enter rectangle 2 width: ");
        int rect2Width = myScanner.nextInt();
        System.out.print("Enter rectangle 2 height: ");
        double rect2Height = myScanner.nextDouble();

        // write the rest of your program below
    }
}
```

Now, write a program in your `main` method to create two different `Rectangle` objects and call appropriate methods in order to produce the following printed output based on the test input:

```
Enter rectangle 1 length: 5
Enter rectangle 1 width: 10
Enter rectangle 1 height: 12.5
Enter rectangle 2 length: 6
Enter rectangle 2 width: 8
Enter rectangle 2 height: 15.75
Rectangle 1's Area: 50, Box Volume: 625.0
Rectangle 2's Area: 48, Box Volume: 756.0
```

Copy/paste the code you wrote:

sample solution in case you need it

CHATBOT!

15. Create a new **ChatBot** class, then copy/paste **this code** into it.

16. Study the code for the `ChatBot` class, and determine how many of each of the following the class has:

How many instance variables?	
How many constructors?	
How many methods *don't* return a value?	
How many methods that *do* return a value?	
How many methods have at least one parameter?	
How many methods have *no* parameters?	

check answers

17. Create a new **`ChatBotRunner`** class (a **client** class that will *use* the `ChatBot` class), write the class and the main method, and in the main method, do the following:

A. Create a `ChatBot` object using the constructor; store the object in a variable named `debbie` (or whatever you want to name the variable), and pass in appropriate values that *you choose* as parameters to the constructor (you will need to look at the constructor to know how many values to pass in, and of what type).

B. Write a program of your choosing that uses *each* of the 6 `ChatBot` methods at least once.

- For the methods that have *non*-void return values, you can decide whether to store the return values in variables or call the methods "in line"; either way, you should include printed output that displays the returned values in some way.

6. Copy/paste the code you wrote in your ChatBotRunner class below that calls each method at least once:

sample code

Insert a screenshot of the printed output:

Freestyle!

7. Add **two** new methods of your choosing to the `ChatBot` class:

- one method that is a **void** method (returns no value)
- one that *returns* some value (i.e. a non-void method)

8. Add a comment above each new method in the `ChatBot` class that explains what it does.

9. Write some code in your `ChatBotRunner` class to call each new method, and for the non-void method, do something with the returned value.

Copy/paste the new methods you added to ChatBot:

Copy/paste the code you wrote in ChatBotRunner to call your two new methods:

Done!

Submit in Google Classroom:

Turn in

Answer 4 (back)

4. Look in the Rectangle class: **a.** Which methods have **void** return types? **b.** Which methods have ***non*-void** return types? What is the type(s) of their return values? **c.** Which methods have *no* parameters? **d.** Which methods have a parameter?	a. printArea and printBoxVolume b. calculateArea and calculateBoxVolume c. calculateArea and printArea d. calculateBoxVolume and printBoxVolume

```java
// method that calculates and returns area
public int calculateArea() {
    return length * width;
}

// method that calculates and prints area
public void printArea() {
    int area = length * width;
    System.out.println("My area is " + area);
}

// method that calculates and returns volume
// of a box with length, width, and height
public double calculateBoxVolume(double height) {
    return length * width * height;
}

// method that calculates and prints volume
// of a box with length, width, and height
public void printBoxVolume(double height) {
    double volume = length * width * height;
    System.out.println("The volume is: " + volume);
}
```

Answer 5 (back)

```
public class RectangleRunner {
    public static void main(String[] args) {
        Rectangle rect1 = new Rectangle(10, 20);
        rect1.printArea();
        rect1.printBoxVolume(30);
    }
}
```

Answer 7 (back)

7. Why do *both* calls to `printBoxVolume` use the same 10 and 20 for the length and width, but *different* values for height?	Because both are being called on the `rect1` object, which is a `Rectangle` initialized with length 10 and width of 20, so both of those values are used in each printBoxVolume method call. The *height* is different though because that value is being passed by the client as a parameter.

Your code should look like:

```
public class RectangleRunner {
    public static void main(String[] args) {
        Rectangle rect1 = new Rectangle(10, 20);
        rect1.printArea();
        rect1.printBoxVolume(30);
        rect1.printBoxVolume(40);
    }
}
```

Answer 8 (back)

Storing the **returned** values of `calculateArea` and `calculateBoxVolume` method in variables:

```
public class RectangleRunner {
    public static void main(String[] args) {
        Rectangle rect1 = new Rectangle(10, 20);
        int area = rect1.calculateArea();  // storing return value in a variable named area
        double volume = rect1.calculateBoxVolume(25); // storing return value in a variable named volume
        System.out.println("This rectangle has an area of " + area + " and a volume of " + volume);
    }
}
```

Answer 9 (back)

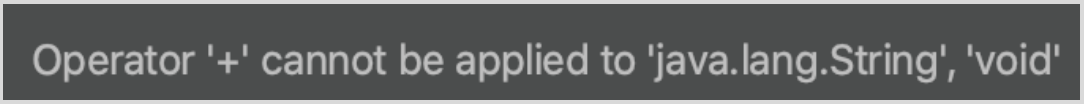
Calling the two methods that return values "**in line**" as part of a print statement:

```
public class RectangleRunner {
    public static void main(String[] args) {
        Rectangle rect1 = new Rectangle(10, 20);
        System.out.println("This rectangle has an area of " + rect1.calculateArea() + " and a volume of " + rect1.calculateBoxVolume(25));
    }
}
```

Answer 11 (back)

You **can't** call *void* methods **in line**; `printArea` and `printBoxVolume` are both methods that return *no* values (they have *void* return types), and so there is no value that can be printed in a string!

This compiler error message in IntelliJ…



…means you *can't* use "+" to concentrate a String with a void value

Answer (back)

You should have made three replacements, outlined below:

```java
// method that calculates and prints area
public void printArea() {
    int area = calculateArea();
    System.out.println("My area is " + area);
}

// method that calculates and returns volume
// of a box with length, width, and height
public double calculateBoxVolume(double height) {
    return calculateArea() * height;
}

// method that calculates and prints volume
// of a box with length, width, and height
public void printBoxVolume(double height) {
    double volume = calculateArea() * height;
    System.out.println("The volume is: " + volume);
}
```

Answer (back)

13. When calling `calculateArea` from the `RectangleRunner` class, we need to call it on an object using **dot notation**, like `rect1.calculateArea()`; why don't we use dot notation when calling the `calculateArea` method from other methods *inside* `Rectangle`?	Because *outside* the Rectangle class, like in the RectangleRunner client class, we need to create a Rectangle object *first* and use that object to call the method. But *inside* the Rectangle class, one method can call another method without first creating an object -- this is because we are inside the *class definition* itself, and methods can call each other freely. **We will talk more about this in Unit 5 when we write our own classes!**

Sample solution (back)

```java
import java.util.Scanner;

public class RectangleRunner {
    public static void main(String[] args) {
        Scanner myScanner = new Scanner(System.in);
        System.out.print("Enter rectangle 1 length: ");
        int rect1Length = myScanner.nextInt();
        System.out.print("Enter rectangle 1 width: ");
        int rect1Width = myScanner.nextInt();
        System.out.print("Enter rectangle 1 height: ");
        double rect1Height = myScanner.nextDouble();
        System.out.print("Enter rectangle 2 length: ");
        int rect2Length = myScanner.nextInt();
        System.out.print("Enter rectangle 2 width: ");
        int rect2Width = myScanner.nextInt();
        System.out.print("Enter rectangle 2 height: ");
        double rect2Height = myScanner.nextDouble();

        // creating two Rectangle objects
        Rectangle rect1 = new Rectangle(rect1Length, rect1Width);
        Rectangle rect2 = new Rectangle(rect2Length, rect2Width);

        // obtaining the area and volume
        int area1 = rect1.calculateArea();
        int area2 = rect2.calculateArea();
        double volume1 = rect1.calculateBoxVolume(rect1Height);
        double volume2 = rect2.calculateBoxVolume(rect2Height);

        // printing the required information
        System.out.println("Rectangle 1's Area: " + area1 + ", Box Volume: " + volume1);
        System.out.println("Rectangle 2's Area: " + area2 + ", Box Volume: " + volume2);
    }
}
```

Answers (back)

How many instance variables?	**2**
How many constructors?	**1**
How many methods *don't* return a value?	**3**
How many methods that *do* return a value?	**3**
How many methods have at least one parameter?	**4**
How many methods have *no* parameters?	**2**

DETAILS

How many instance variables?	**2:** **`name`** and **`number`**
	`// instance variables`
	`private String name;`
	`private int number;`

How many constructors?	**1:**
	`// constructor`
	`public ChatBot(String chatBotName, int faveNum) {`
	`    name = chatBotName;`
	`    number = faveNum;`
	`}`

How many methods *don't* return a value?	**3**: the methods with `void` (and no return statement)
	`public void greeting(String yourName)`
	`public void weather()`
	`public void favoriteNumber(int yourNumber)`

How many methods that *do* return a value?	**3**: all the methods with a return type *other than void* (and have a `return` statement):
	`public double convertFeetToMeters(int numFeet)`
	`public int addNumbers(int num1, int num2, int num3)`
	`public String goodbye()`

How many methods have at least one parameter?	**4**:
	`public void greeting(String yourName)`
	`public double convertFeetToMeters(int numFeet)`

	`public void favoriteNumber(int yourNumber)` `public int addNumbers(int num1, int num2, int num3)`

How many methods have *no* parameters?	**2:**
	`public void weather()`
	`public String goodbye()`

Sample code (back)

Sample code showing the creation of a ChatBot object, then calling all of its 6 various methods.

```java
public class ChatBotRunner {
    public static void main(String[] args) {
        ChatBot debbie = new ChatBot("Debbie", 10);

        // calling the void methods
        debbie.greeting("Mr. Miller");
        debbie.favoriteNumber(15);
        debbie.weather();

        // calling the non-void methods
        double meters = debbie.convertFeetToMeters(20);
        System.out.println("There are " + meters + " in 20 feet");

        int sum = debbie.addNumbers(13, 16, 24);
        System.out.println("The sum is " + sum);

        String message = debbie.goodbye();
        System.out.println(message);
    }
}
```

Printed output (colors match the code above that produced the output)

```
Hello, Mr. Miller my name is Debbie
and I am a chat bot! How are you today?
My favorite number is 10
That is 5 away from your number!
I actually don't know much about the weather! Ha ha!
But I know it's warm and dry inside a computer! Ha ha!
There are 6.096 in 20 feet
The sum is 53
It was nice talking with you! Have a great day! Sincerely, Debbie
```