

CODAPPS

Classes and methods

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1. Beyond variables... we need methods and classes to create our app!

In the previous lesson we discovered variables, comparing them to the ingredients of a recipe: the basic stuff we need to create an app.

All good, but should we just open an empty text file and write these variables? Just like a cake does not get created just with wheat and eggs, our app needs more than variables to be created!

What we miss here is:

- methods (also called functions). Just like "baking", "mixing", "adding milk"... we need to write code describing what the app does.
- classes. Classes are a bit like the "kitchen worktop": a place where we will write our variables and methods in a clean and orderly way - good chefs work in well organized kitchens!

2. Methods: to make your variables "do something" in your app

Let's create an Integer variable representing the price of an item, as we discussed in the previous lesson:

Creating a variable to store the price of an item

```
Float priceItemInEuros;  
priceItemInEuros = 5.99f; ①
```

① don't forget the **f** next to the number, so that it is indeed recognized as **Float**.

Ok, this **priceItemInEuros** is the ingredient of our recipe. We might need to use it in many ways in our app:

- convert its price in Yuan
- add the VAT to it
- add the price of this item to the total price of the items in the basket of the customer
- show it on the screen of our app

- etc...

Each of this action is a **method**. A method needs first to be defined (created), then only it can be applied.

a. Defining a method

How does one create or define method? Let's create one that adds the French VAT to the price of the item:

Creating a method adding the VAT to the price of an item

```
private Float addFrenchVAT(Float priceWithoutVAT) { ①
    Float priceWithVAT; ②
    //the regular rate of the VAT in France is 20% so we multiply the price by 1.20 to
    find the new price ③
    priceWithVAT = priceWithoutVAT * 1.20; ②
    return priceWithVAT; ②
}④
```

- ① title of the method you create, then the method start at the opening curly brace `{`.
- ② the method itself
- ③ an explanation, not some code! The line starts with `//` to show this is some explanations for humans like you and me, not some code in our app.
- ④ this closing curly brace signals the end of the definition of the method.

The first line (title of the method) is pretty intimidating, the rest is pretty clear. So let's have closer look:

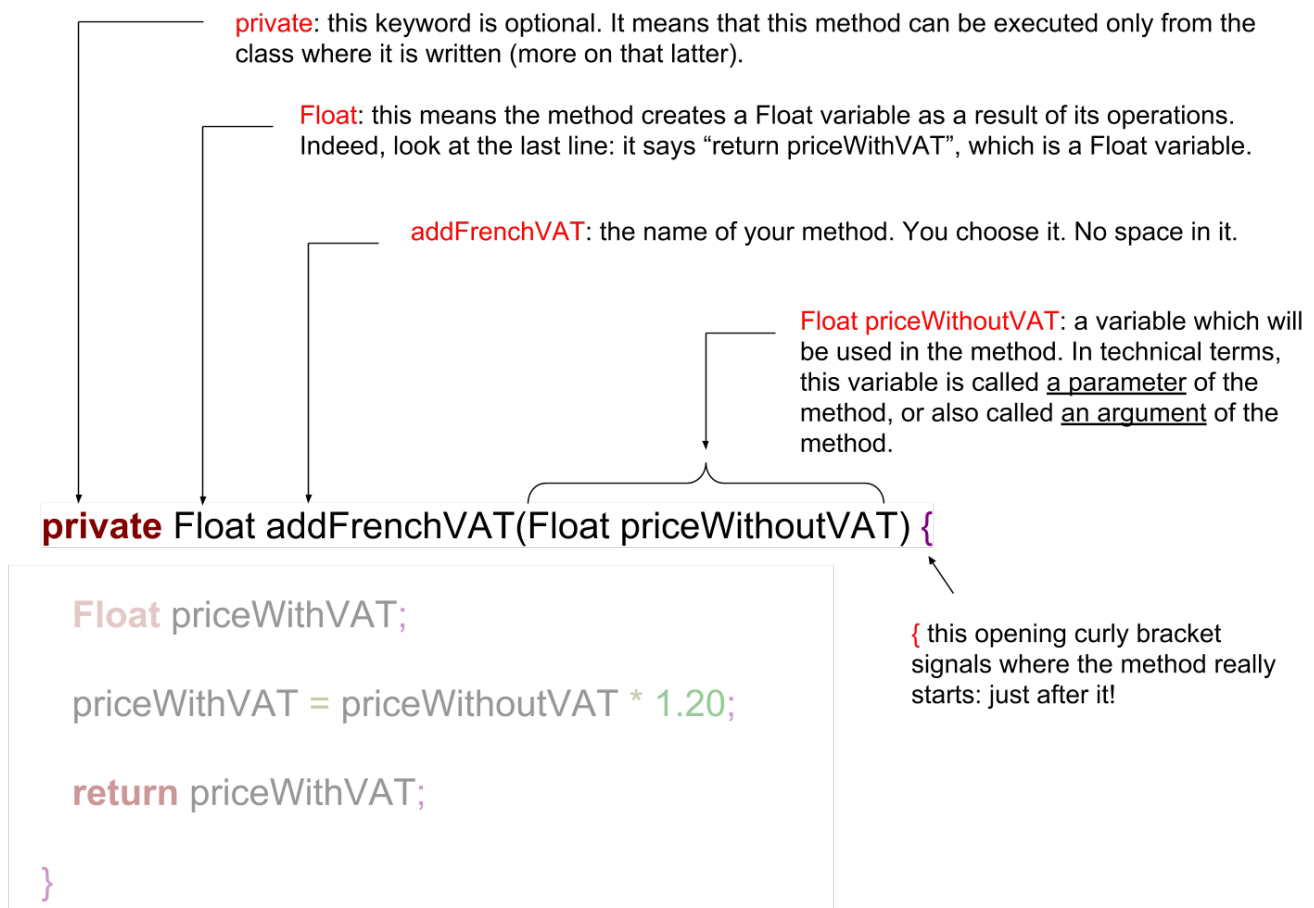


Figure 1. Explaining the title of the method

The three lines inside the method itself are pretty simple:

The three lines of the method

```
private Float addFrenchVAT(Float priceWithoutVAT) {  
    Float priceWithVAT; ①  
    priceWithVAT = priceWithoutVAT * 1.20; ②  
    return priceWithVAT; ③  
} ④
```

- ① create a Float variable that will contain the price with VAT
- ② assign the value `priceWithoutVAT * 1.20` to it
- ③ "Return" means that the method is finished and gives back a result, here: a Float variable which is the price with VAT.
- ④ Don't forget the closing curly brace `}` when finishing the definition of a method.

b. Executing a method

We have defined a method called `addFrenchVAT` which takes a Float variable as parameter (the price without VAT), and returns a price with VAT.

Defining a method does nothing in itself, a bit like a recipe does nothing as long as nobody uses it. How do we use a method?

If the method was defined in the same file where we are coding, then it is very simple:

Executing a method

```
Float priceItemInEuros = 5.99f; ①  
Float priceItemsInEurosWithVAT; ②  
priceItemsInEurosWithVAT = addFrenchVAT(priceItemInEuros); ③
```

- ① don't forget the **f** next to the number, so that it is indeed recognized as **Float**.
- ② we create a variable that will store the price of our item, including the VAT.
- ③ we assign a value to **priceItemsInEurosWithVAT**. Which one? The value returned by the method **addFrenchVAT**.

The variable **priceItemsInEurosWithVAT** should now contain the value 7.188 (5.99 multiplied by 1.20).



Your turn!

Create a method called "addVAT" and which takes a price for paramter, and returns a price with VAT

*Then apply this method to a variable named **price** which has 5.99 for value*

Here is the solution (and read the note below):

```
java> private Float addVAT(Float price){  
java> Float priceWithVAT;  
java> priceWithVAT = price * 1.20f;  
java> return priceWithVAT;  
java> }  
Created method java.lang.Float addVAT(java.lang.Float)  
java> Float price = 5.99f;  
java.lang.Float price = 5.99  
java> Float priceAndVAT = addVAT(price);  
java.lang.Float priceAndVAT = 7.188  
java>
```

Figure 2. Creating a method and applying it

A note on the interactive exercise: it is not easy nor comfortable to write a method on the interactive console...

So if you find it difficult, this is normal. You will need time and practice to get used to this logic.

The good news is, **it is much easier to write our code in NetBeans**, because we have a lot of help showing where we might have forgotten to close a parenthesis `)` or a `;` ...

This is what we are going to learn now, but just before that we just need to see a last thing about methods:

c. The case of methods which don't return a result

We need to see a case where methods perform an action, but don't return anything.

Let's define such a method:

Creating a method which returns nothing

```
Float price = 5.99f; ①
private void addFrenchVAT() { ②
    price = price * 1.20; ③
} ④
```

① we have created a variable named `price`

② now we define a method like the one before in this lesson, except that:

- `Float` has been replaced by `void`, which is an English term meaning "nothing"
- it has no parameter: there is nothing in the parenthesis `()`

① the method does one thing: it multiplies the value of the variable `price` by 1.20

② this is the end of the method. There is no "return" statement.

Now, if we want to apply this method, we can just write:

```
addFrenchVAT();
```

and this will have for effect to multiply the value of the variable `price` by 1.20.

You will sometimes find lines of code like the one we just saw:

```
strangeWordFollowedByEmptyParentheses();
```

Then remember it is probably a method that impacts some variables somewhere else in the code, without returning a variable.

Ok, this was quite dense but we are almost there. Now, we are going to see how to **organize** the ingredients (the variables) and the cooking instructions (the methods) in our recipe (our app!).

- where to write code?
- how does one part of the code affects another?

3. Classes: to code in an organized and methodical way.

Writing code is like cooking: you can do it in the small kitchen of your apartment, by improvising as you go, or you can do it in the big kitchens of a large restaurant, with a team of cooks and a strict organization about who does what.

Different programming languages have different "styles of cooking":

- most allow you to "cook as you go": just open an empty text file, write the variables you want, create your methods, then write another line of code to run your methods, and you're launched! But that can be messy.
- other programming languages oblige you to have what is called an **"object-oriented"** way of cooking: it is a style where you need to classify your code in smaller, different parts, according to some strict rules. This is less fun for beginners, but it leads to writing some code which is easier to understand and work with in the long term.

The language we use in this course is called **Java**, and is famous for imposing an **"object-oriented"** way of coding.

"Object-oriented" programming can be complex and intimidating, and there are [full courses](#) and [books](#) devoted to the topic. But if we learn it for a simple project, that's quite simple.

There are just 2 principles we need to understand:

- The code we write must be written inside classes (classes are just files, so this one is easy)
- These classes can act as variables

If you understand these two principles you're good to code!

a. The code is written inside "classes"

A class is just a file in your app. It contains the variables and the methods that you want.

When you created a **Form** named **Form1** for your app in module 2, it created a file called **Form1.java**, where you can write stuff:

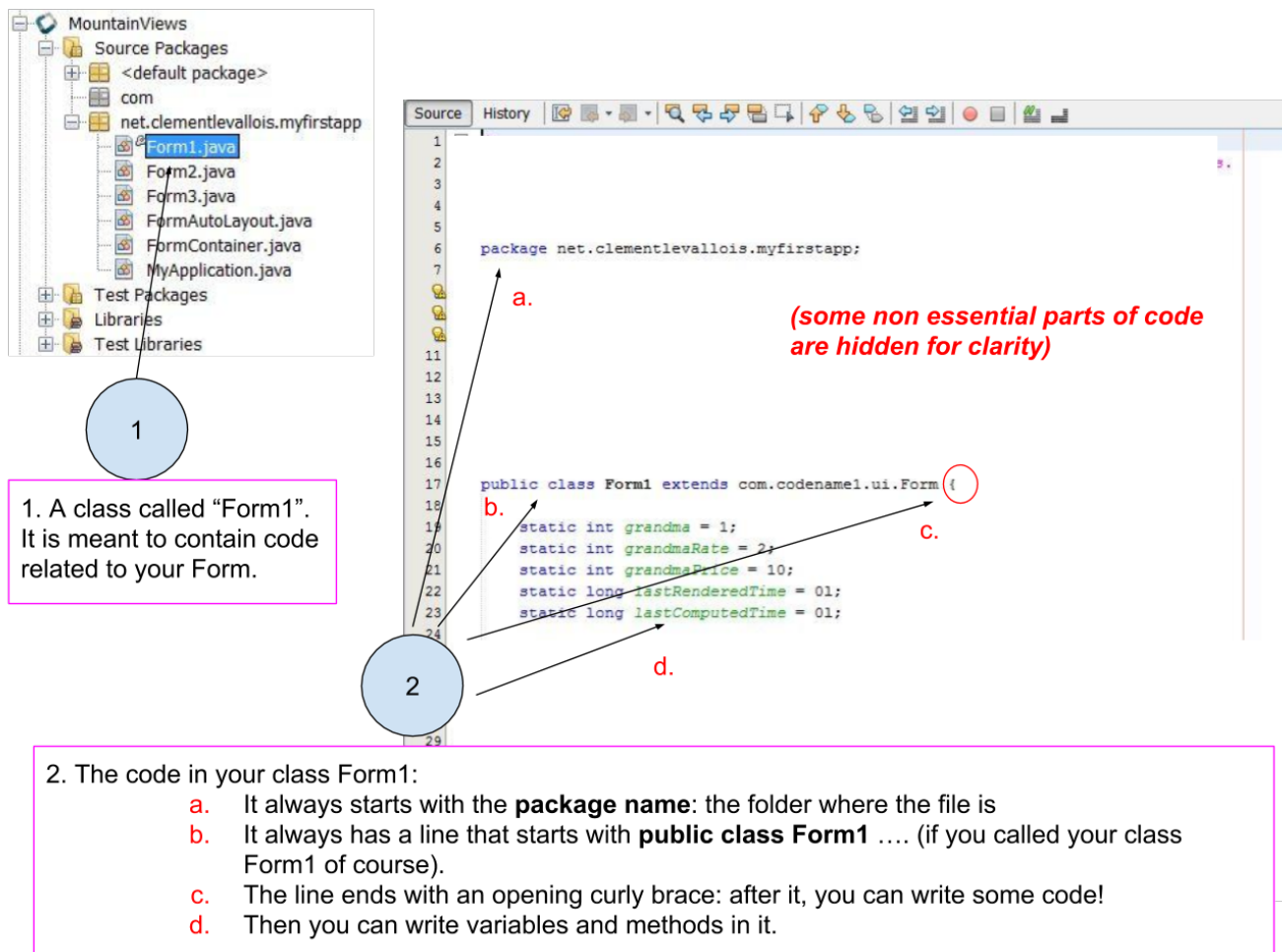


Figure 3. What is a class - simply a file

One of the most powerful consequences of this is for the organization of variables:

- Let's imagine you create 2 Forms: Form1 and Form2.
- You want to create 2 Buttons: one in Form1, one in Form2
- Like this: `Button myButton = new Button();` somewhere in Form1 and `Button myButton = new Button();` somewhere in Form2
- Is your code going to be a mess because when you change `myButton` in Form1, the program thinks you also mean `myButton` in Form2?
- No: the 2 buttons are clearly separated in 2 different classes, so you are fine.

(this kind of details might seem trivial to you, and it is! But 90% of headaches in coding come from struggling with these small issues).

A last important note on variables:

- if I create a variable `Integer score` at the top of the class, it is called a "global variable" and it can be used anywhere in the class, including inside methods.
- but variables created inside methods exist only inside the method where it was created.

To illustrate:

scorePlayer is a global variable: it is created just at the beginning of the class. It can be used anywhere in the class. NetBeans shows global variables in green.

pointsToAdd is a variable created in the method "addPointsToScore". It can be used only in the method where it was created.

Here I show what happens if you try to use it elsewhere: NetBeans does not recognize it and says "cannot find symbol". The build of your app will fail.

```
1  /*
2   * Copyright 2017 Clement Levallois
3   * http://www.clementlevallois.net
4   */
5  package net.clementlevallois.myfirstapp;
6
7  /**
8   * GUI builder created Form
9   *
10   * @author LEVALLOIS
11   */
12  public class Form4 extends com.codename1.ui.Form {
13
14      Integer scorePlayer;
15
16      private Integer addPointsToScore() {
17          Integer pointsToAdd = 3;
18          scorePlayer = scorePlayer + pointsToAdd;
19          return scorePlayer;
20      }
21
22      private Integer subtractPointsToScore() {
23          Integer pointsToSubstract = 3;
24          scorePlayer = scorePlayer - pointsToSubstract;
25          return scorePlayer;
26      }
27
28      private Integer addTwiceToScore() {
29          scorePlayer = scorePlayer + 2 * pointsToAdd;
30          return scorePlayer;
31      }
32  }
```

Figure 4. The scope of variables

What we just discussed about "can a variable created here be used there" is called the **scope of the variable**. It can be a tricky subject but you got the essentials.

b. Classes need to be instantiated

Ok, that's the hardest part to figure. What does this even mean?

Simply: let's forget the cooking metaphor and take the metaphor of a car: the code written inside a class (the variables, the methods...) is your car, ready to drive.

Instantiating the class is like turning the ignition key and running the engine.

Like this:

Instantiating a class to use it

```
Form4 myForm; ①
myForm = new Form4(); ②
myForm.addTwiceToScore(); ③
```

- ① Form4 is the class where my code is. I create a variable called "myForm". **Form4 is the type of my variable**
- ② I instantiate this variable: I create a new instance of it.
- ③ Now I can use / run / execute the code inside my file Form4.java, by writing: **myForm.xxxxx**

Let's provide an example. Do you remember the code we put in **MyApplication.java** to show the Form we created at the start of our app?

Instantiating a Form in MyApplication.java

```
public void start() {  
    Form1 myForm1 = new Form1(); ①  
    myForm1.show(); ②  
}
```

- ① We instantiate our Form
- ② And now we can use methods of this Form. Here, we use the method **show()** which has for effect to display the **Form** on screen.

Another common way to instantiate an object is this one:

Getting the present time and storing it in a variable

```
public void start() {  
    LocalDateTime timeNow = LocalDateTime.now(); ①  
}
```

- ① This stores the time at the moment when this line of code is executed, in the variable **timeNow**

c. ... but not always: static methods

In some cases, you don't want or don't need to go through the instantiation step. For example:

- you can create 2 Buttons and set the text on them:

Creating 2 buttons

```
Button button1 = new Button();  
button1.setText("press me");  
Button button2 = new Button();  
button1.setText("click me");
```

But what if you need to have a setting common to all buttons?

For example, having the text of **all buttons** in CAPITALIZED letters, whatever the text?

To achieve this effect, the creators of the class **Button** added a **static method** to their code: a method which applies to all buttons which will be instantiated.

And you use it like this:

Using a static method

```
Button.setCapTextDefault(true);
```

Notice that the button is not instantiated (there is no `new Button()`). The method `setCapTextDefault` is ran directly from the class `Button` (don't forget the capital B here), and will apply to all future Buttons that you will instantiate.

You can create such methods yourself just by adding the keyword `static` in front of the title of your method.

Each time you see a line of code looking like `Example.method()`, this means a static method of the class `Example` is being used.

The most famous example of a static method is this one:

Showing something in the console

```
System.out.println("oh hey!");
```

This line will write "oh hey" in the console of your app.

But we discuss here some technical details that will make much more sense when we will actually code an app.

You just finished an important lesson on the fundamentals of coding, congratulations!

Don't hesitate to come back often and re-read it, it is really a fundamental part of the course.

If you feel that some things remain unclear, or could be better explained: just [open an issue on Github](#), it will be a pleasure exchanging with you.

The end

Questions? Want to open a discussion on this lesson? Visit the forum [here](#) (need a free Github account).

Find references for this lesson, and other lessons, [here](#).

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