

# Questionnaire Code Refactoring

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## Introduction

Why?

We are interested in how lecturers teach code *refactoring*: improve the quality of code that is functionally correct, but not the most elegant/short/efficient implementation.

Who?

Lecturers that have been teaching programming and other computer science-related courses for at least 2 years.

How?

First we ask some general questions. Next, the questionnaire presents three code fragments and asks how you as a lecturer would help a student to improve the code. The questionnaire should take you between 15 and 20 minutes to complete.

## Confidentiality

To help protect your confidentiality, you do not have to reveal information that will personally identify you. The results of this study will be used for research purposes only.

I give permission to use my responses for research purposes \*<sup>1</sup>

- Yes
- No

[new section]

## General information

What is your current occupation/job title? \* [short answer]

In which country do you teach computer science-related courses? \* [short answer]

At which institute(s) do you teach computer science-related courses? You can leave this field empty if you do not want to answer this question. [short answer]

How many years of experience in teaching computer science-related courses do you have? \* [number > 0]

What courses do you teach? \*

- First year courses
- Second year courses
- Third year+ courses
- Other: [short answer]

[new section]

## Role of code quality

Code quality deals with the directly observable properties of source code, such as algorithmic aspects and structure. Some examples of code quality issues are:

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<sup>1</sup> Fields marked with an asterisk (\*) are required.

- Duplicated code.
- An expression that could be shortened.
- Putting the same code in both the true-part and the false-part of an if-statement instead of outside the if-statement.

Although layout and commenting are certainly indicators of code quality, these aspects are beyond the scope of our study.

Code refactoring is editing code step by step while preserving its functionality.

Does code quality appear in the learning goals of your first- and second-year programming courses? \*

- Yes
- No

Do you pay attention to code quality while teaching programming to first- and second-year students? \*

- Yes, it is a major aspect
- Yes, but it has a minor role
- No

Do you explicitly assess/grade code quality aspects in programming assignments? \*

- Yes, it is a major aspect
- Yes, but it has a minor role
- No

If you advise or prescribe tools that deal with code quality/refactoring to your students, which ones are they? [short answer]

[new section]

## Exercises

The following programming exercises are targeted at novice programmers in higher education. We assume that the code is written on a computer with the use of a compiler, and not on paper.

[new section]

### Exercise 1

Given the following programming exercise:

“Implement the sumValues method that adds up all numbers from the array parameter, or only the positive numbers if the positivesOnly boolean parameter is set to true.”

```
int sumValues(int [] values, boolean positivesOnly) {
    // sumValues(new int [] {1, -2, 3, -4, 5}, false) should return 3
    // sumValues(new int [] {1, -2, 3, -4, 5}, true) should return 9
}
```

The listing below shows the method body of a common, functionally correct student solution.

```

1  int sum = 0;
2  for (int i = 0; i < values.length; i++) {
3      if (positivesOnly == true) {
4          if (values[i] >= 0) {
5              sum += values[i];
6          }
7      }
8      else {
9          sum += values[i];
10     }
11 }
12 return sum;

```

How would you assess this solution in a *formative* situation (e.g. feedback during a lecture or lab)? \*

- Acceptable, does not need to be improved
- Acceptable, but could be improved
- Unacceptable, should be improved

Describe all hint(s) you would give to a student to improve this program. Prioritise the hints by numbering the hints and ordering them from important to less important. [long answer]

How would you want the student to edit (refactor) this program step by step? Type the code after each step by copying the code and applying edits. Leave the remaining fields empty after your final step.

Type the code after the first step. The original code has already been copied below and can be edited. [long answer]

Type the code after the second step. [long answer]

Type the code after the third step. [long answer]

Type the code after the fourth step. [long answer]

Type the code after the fifth step. [long answer]

Type the code after the sixth, seventh, eighth, ..., final step. Put the number of each edit step before the code. [long answer]

[new section]

## Exercise 2 - Solution 1

Given another programming exercise for novice programmers:

“Write the code for the method `unevenSum`. This method should return the sum of the numbers at an uneven index in the array that is passed as a parameter, until the number `-1` is seen at an uneven index.”

```

public int unevenSum(int [] array) {
    // unevenSum(new int [] {44,12,20,1,-1,3,5,-1,99,4}) should return 16
}

```

The listing below shows the body of a solution, based on actual student solutions. This solution contains a functional error regarding the stop condition. You may ignore this error when answering the questions.

```

1  int total = 0;
2  boolean stop = false;
3
4  for (int i = 1; i < array.length; i = i + 2) {
5      if (stop == false) {
6          if (array[i] >= 0) {
7              total += array[i];
8          } else if (array[i] < 0) {
9              stop = true;
10         }
11     }
12     else {
13         total = total;
14     }
15 }
16 return total;

```

[repeat exercise questions]

## Exercise 2 - Solution 2

Given the programming exercise from the previous question:

“Write the code for the method `unevenSum`. This method should return the sum of the numbers at an uneven index in the array that is passed as a parameter, until the number `-1` is seen at an uneven index.”

The listing below shows the body of an actual correct student solution (with some variable names translated into English):

```

1  int answer = 0;
2  int index = 0;
3  boolean value = true;
4
5  for(int number: array) {
6      if(index % 2 == 0) {
7          index++;
8      } else {
9          if(number == -1) {
10             value = false;
11         }
12         if(value) {
13             answer = answer + number;
14         }
15         index++;
16     }
17 }
18 return answer;

```

[repeat exercise questions]

[new section]

## Completion

After completing these final questions, click below to submit your response.

Do you have any further remarks? [long answer]

If you would like to receive an update on the results of the study, please provide an email address. [short answer]