

Assignment 3: Software Quality & Code Smells

Due date: 03/24/2020

1 Introduction

In this assignment, you will analyze the code quality of jEdit and PDFsam. You will measure different code metrics and will investigate how your code changes affected the metrics both systems.

Luckily, you don't have to compute the code metrics by hand. There are several tools that can help you in this task. A list of tools is given in Section 2.

When preparing this assignment, consider this activity provides an opportunity for you to:

- i. Get familiar with different internal product metrics; and
- ii. Learn how code changes can impact the quality of software.

Remember that the assignments in this class are to be developed in pairs. Ideally, you should work with the same partner you work with on A2.



Read carefully the assignment before proceeding!

2 Tools

There are several tools to automatically compute metrics of code. The tools listed below work on code written in Java. You can use any tool you want (including the ones listed below), as long it computes coupling and cohesion metrics.

2.1 Metrics3

Metrics3¹ is a plugin for the Eclipse IDE. To install the plugin:

1. In Eclipse, select **Help » Install new software...**
2. Enter the next URL in the **Work with** text field.
<https://github.com/qxo/eclipse-metrics-plugin/raw/master/updatesite/>
3. Switch to the next item by pressing tab. The **Install** dialog should automatically refresh.
4. If no item shows up in the **Install** dialog, uncheck the **Group items by category** option.
5. Check the **Metrics plugin for Eclipse** item.
6. Click on the **Next>** button.
7. Click on the **Finish** button.
8. Restart Eclipse if needed.

¹ <https://github.com/qxo/eclipse-metrics-plugin>

Assuming that jEdit and PDFsam are already in your workspace, Metrics3 should be ready to be used. The next instructions apply to any Java project. jEdit is used as an example.

1. In the package explorer, right click in jEdit.
2. In the contextual menu, click on **Properties**.
3. In the **Properties** dialog, select the **Metrics** property.
4. Enable Metrics by checking the respective option.
5. Click the **OK** button.
6. Open the **Metrics** view (**Window » Show View » Other... » Metrics » Metrics View » OK**).
7. Rebuild jEdit.

The computed metrics should show up in the **Metrics** view.

2.2 o3smeasures

DesigniteJava² is another plugin for the Eclipse IDE.

1. In Eclipse, select **Help » Install new software...**
2. Enter the next URL in the **Work with** text field.
<https://raw.githubusercontent.com/mariazevedo88/o3smeasures-plugin/master/site.xml>
3. Switch to the next item by pressing tab. The **Install** dialog should automatically refresh.
4. If no item shows up in the **Install** dialog, uncheck the **Group items by category** option.
5. Check the **o3smeasures** item.
6. Click on the **Next>** button.
7. Click on the **Finish** button.
8. Restart Eclipse if needed.

Assuming that jEdit and PDFsam are already in your workspace, o3smeasures should be ready to be used. The next instructions apply to any Java project. jEdit is used as an example.

1. Open the **o3smeasure** views (**Window » Show View » Other... » o3smeasures**).
2. In the package explorer, right click in jEdit.
3. In the contextual menu, click on **OS3Measures » Analyze Java Project**.

The computed metrics should show up in the **o3smeasure** views.

2.3 Other tools

- jPeek³, is a command-line tool for collecting metrics of code written in Java.
- The community edition of DesigniteJava⁴ is a free and open-source command-line tool for quality assessment of code written in Java.

² <https://github.com/mariazevedo88/o3smeasures-tool>

³ <https://github.com/yegor256/jpeek>

⁴ <http://www.designite-tools.com/designitejava/>

3 Analyzing code metrics

3.1 General metric changes

In the previous assignment, you modified the source code of jEdit and PDFsam in response to some change requests. In this part of the assignment, you will determine how your changes affected the code quality by following the next steps:

1. Compute all metrics for the original versions of each project (i.e., jEdit and PDFsam).
2. Compute all metrics for the modified versions of each project.
3. Identify the ten metrics with the highest value change from one version to the other one.
4. Explain how the metrics changed and why the changes occurred.

3.2 Coupling and cohesion

In this part of the assignment you will use the modified versions of the projects.

Select one or more coupling and cohesion metrics and analyze their results by following the next steps:

1. Select the four non-trivial classes with the **highest cohesion** and the four classes with the lowest cohesion for each project (i.e., jEdit and PDFsam).
 - a. Identify and explain the type of cohesion measured (based on the selected metrics).
 - b. Explain why the selected classes have high/low cohesion.
 - c. Explain the difference between the classes with highest cohesion versus the classes with lowest cohesion.
2. Select the four non-trivial classes with the **highest coupling** and the four classes with the lowest coupling for each project (i.e., jEdit and PDFsam).
 - a. Identify and explain the type of coupling measured (based on the selected metrics).
 - b. Explain why the selected classes have high/low coupling.

Explain the difference between the classes with highest coupling versus the classes with lowest coupling.

4 Deliverables

This assignment has one deliverable to be submitted in Canvas. The deliverable is one document containing:

1. A description of the metrics analyzed, in your own words.
2. The analysis of code metrics as requested in Section 3.

The instructions need to be completed no later than the due date by 12:30pm (i.e., before class).

5 Notes

- The credit of this assignment is based on the completeness of your report, which should include:
 - Explanations of the changes in metrics caused by your code modifications.

- Explanations for the selected classes to have high/low cohesion/coupling.
 - The differences between high- and low-cohesive/coupled classes.
 - The type of coupling/cohesion measured by the metric tool you used.
- You will not receive credit for this assignment if:
 - You do not fill and submit the deliverables.
 - The files you submit cannot be opened.
- You will get points off if:
 - Your reports contain typos or grammar errors.
 - Your submission does not fit the brief.