TP2: Design quality, bad quality and refactoring

This assignment focuses on the subjects of design quality, the identification of anomalies using metrics and the correction of these anomalies by applying refactorings. All questions should be answered for the AmazeFile (https://github.com/TeamAmaze/AmazeFileManager). To answer the questions, you can use any of the tools presented or mentioned in the lab or in the class. In any case, you should explicitly mention all the tools and sources you have used. Submit a single document per team with the answers to the questions. Include the name of your team and the names of all team members in the report. Include all external references, including articles, links, documentation and tools.

Deadline: 08-Nov, 23:59

Question 1: Measure the design quality of AmazeFile. (30pts)

(a) Present a report with all metrics for AmazeFile (cohesion, complexity, coupling, size) including averages, maximums, standard deviations etc. Present the metrics which we have already discussed (NOM, LOC, LCOM, WMC, CC, CBO etc.). Present the metrics on the appropriate level (project, package, class). (5 pts)
Q: Which metrics should we present? How do we know we have included enough?
A: Simple rules; "Present all the metrics that you refer to in the report. Present all metrics that you use in calculating other metrics."

(b) Comment on the overall quality of the system and its impact on the development and the maintenance of the system (e.g., "the system is cohesive which guarantees the SRP (Single Responsibility Principle) and facilitates maintenance.") (5 pts)
Q: How do we comment? What is the expected level of the comments?
A: Comment based on what we have seen so far, concerning principles, design quality properties. The level should be rather high and abstract. Do not concentrate on specific cases (yet).

(c) In slides 32-34 of the third course, we saw how we can also measure the metrics for the ISO 9126 criteria (Functionality, Reusability,

Understandability, Flexibility, Efficiency, Extensibility). Use this guide and the referenced paper to quantify the quality criteria. (5 pts)

(d) Describe the quality of the system according to the criteria metrics. There are no reference values, but suppose that a high value implies increased quality. (Note: Understandability may be negative, but this is not an issue) (5 pts)

(e) Correlate these values with the values of the individual metrics (NOM, LOC, LCOM, WMC, CC, CBO etc.) with respect to the general quality of the system. Comment on the impact of the individual metrics on the quality criteria. A guide for this explanation can be found in the attached article. Give three (3) specific examples that demonstrate this impact. (10 pts)
Note: consult this article
http://www.ptidej.net/team/admission/Bansiya02-QualityModel.pdf

Question 2: Find five (5) different anomalies in AmazeFile. (30pts)

(a) Define the metric thresholds according to the book "Object-Oriented Metrics in Practice" (available on Moodle) or according to the slides of Semaine 4. If necessary, combine multiple metrics. An anomaly can be present even if it does not violate all the thresholds. Use your judgement to identify the anomalies. (15pts)

(b) Present the anomalies and justify their presence using the metrics. There is a possibility that the tools do not consider some cases as anomalies. In this case, ignore the tools. (10pts)

(c) Name the anomalies in terms of code smells (e.g., low cohesion + high coupling = Feature Envy) (5pts)

Question 3: Correct the anomalies by applying refactorings (40pts)

(a) Explain why each anomaly is corrected by the refactoring you have chosen. (10pts)

(b) Apply the refactorings and present the code before and after the refactoring. If the code is too long, present UML diagrams or a reduced version of the code (e.g., with just the method signatures). (10pts)

(c) Evaluate the quality again with respect to individual metrics (LCOM, CC, WMC, CBO etc.) and verify that the anomaly is corrected from the point of

view of the metrics. The correction can improve the average of the system or just the local metrics for the classes. Report all. (10pts)

(d) Measure the metrics corresponding to the quality criteria (Functionality, Reusability, Understandability, Flexibility, Efficiency, Extensibility). Is there any improvement in terms of these metrics? Justify the changes and explain them based on the individual metrics. (10pts)

Recommended tools

For the metrics:

1. MetricsReloaded - https://plugins.jetbrains.com/plugin/93-metricsreloaded
2. MetricsTree - https://plugins.jetbrains.com/plugin/13959-metricstree
3. Better Code Hub https://bettercodehub.com/
4. Understand https://scitools.com/features/

For the refactorings/code smells:

1. Android Studio - https://developer.android.com/studio
2. SonarCloud - https://sonarcloud.io/

Note of submission

Name your submitted file as "TP2_[team_name].pdf"

Note of evaluation

The document will be evaluated on its precision and exhaustiveness of the responses and the writing quality. Treat it as an official and professional report.