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1.1. Task: Develop a Metric for "Readability"

- a) Develop a calculated, precise metric (cf. with lecture slides) for readability of code on method-level. The goal of the metric is to indicate how easy / fast it is to get the intent of a method.

Constructive Metric Development:

- 1) Identify a relevant quality aspect:
readability of code on method-level

- 2) Model the relevant quality aspect:
readability of code on method-level:
methods that have Java documentation comment, and those who do not

Information:

Java document comment (official form) has the following structure, which we will use to generate our metric:

```
/**
    some comment about the method
*/
```

- 3) Determining a scale:
readability of code on method-level:
a real number r in range $[0,1]$
- 4) Develop the metric calculation
readability of code on method-level:
relation between all the methods that have Java document comment and the all the methods that is there in the code

- 5) Develop measurements
readability of code on method-level:
methods (and their respective Java document comments (if any))
- 6) Apply and improve the metric:
Code Readability on Method-Level:

$$codeReadability = \frac{number_of_methods_that_have_JavaDocStyle_comments}{number_of_all_methods}$$

b) Evaluate your metric by applying it to the example code and discuss the evaluation.

Metric should be interpreted as follows:

- All the Java source has to be traversed and functions has to be counted:
 - all the methods that have Java documentation comment
 - all the methods (irrespective of whether they have Java documentation or not)
- (alternatively, javadoc command of javac can be used to generate a documentation information that gives out which functions have a Java documentation comments)

– Item.java:

1)	Item(final String value, final Item next) ...	- no comment
2)	public Item next() ...	- no comment
3)	public String value() ...	- no comment

– List.java:

4)	private List(final Item head)	- no comment
5)	public static List of(final String... values)	- no comment
6)	public boolean containsValue(final String value, final int itemLimit)	- has "Java document comment" formatted comment
7)	private Predicate<Item> itemValueEqualsTo(final String value)	- no comment
8)	private Stream<Item> itemsStream()	- no comment
9)	public String toString()	- no comment
10)	private boolean endOfList(Item node)	- no comment

The only Java documentation comment that is there in the given code, for demonstration purposes:

```
/**
 * Search through the list for given value while considering
 *    only itemLimit.
 *
 * @param value search value
 * @param itemLimit number of items to consider
 * @return true, if value is in peek of this list
 */
```

$$codeReadability = \frac{number_of_methods_that_have_JavaDocStyle_comments}{number_of_all_methods}$$

$$number_of_methods_that_have_JavaDocStyle_comments = 1$$

$$number_of_all_methods = 9$$

1.2. Task: Develop a Quality Model for Theses

Develop a quality model for bachelor- and master theses. Dimensions which should be included in the quality model are a) process and working behavior, b) thesis report and, c) source code artefacts.

a) Develop at least two characteristics for each dimension and explain each one of them in a few sentences.

a) process and working behaviour

- Methodology:

Aims to evaluate an investigation of a research problem and the reasoning for the application of specific procedures or techniques used to identify, select, process, and analyze information applied to understanding the problem.

- Literature Analysis:

An academic work requires detailed analysis of literature. This characteristic aims to analyze if the author has not only cited the sources but also adapt and reflect on them critically.

b) b) thesis report

- Content:

The content should be a discussion on the research question which is assessed in terms of relevance to solution of the objective and depth and criteria of consistency.

- Form and style:

The formal requirements for this characteristic would be page size, justification, proportional script (text: Times New Roman, titles: Arial), font size, line spacing, paragraphs are to be separated by blank lines , headers and footers, margins etc.

c) c) source code artefact

- Usability:

Here it refers how the source code can easily be used and installed. It also refers to methods for improving ease-of-use of code during the process.

- Coding Standards:

A coding standard lists several rules to be followed during coding, such as the way variables are to be named, the way the code is to be laid out, error return conventions, etc.

b) Develop at least three sub-characteristics for each characteristic and explain each one of them in a few sentences. You don't need to specify any metrics!

- Methodology:

1. Appropriateness:

Appropriateness can mean tailoring the process being used in the thesis. The methods or procedures being used can be in a qualitative way. The argumentation and the choice of adequate research methods.

2. Validity:

Validity of research can be explained as an extent at which requirements of scientific research method have been followed during the process of generating research findings within an appropriate time scale.

3. Reliability:

Reliability refers to the extent to which the same results can be obtained using the same instruments more than one time. In simple terms, if a research is associated with high levels of reliability, then other researchers need to be able to generate the same results, using the same research methods under similar conditions.

- Literature Analysis:

1. Depth of Analysis:

An academic paper requires an extensive and detailed analysis of literature. It is essential to not only analyse general basic literature (textbooks) but also special literature on the respective topic.

2. Quality:

The author should reflect on the basic quality criteria of scientific research (validity, reliability, representativeness, etc.) and demonstrate how they were taken into consideration. Other criteria are the topicality and range of used literature

3. Transparency of references:

Transparency in reporting of research is essential for providing enough information about how the work was performed to allow others to replicate it. In a thesis paper, all explanations that have been adopted literally or analogously have to be marked as such.

- Content:

1. Consistency of argumentation:

In academic writing, an argument is usually a main idea, often called a "claim" or "thesis statement", backed up with evidence that supports the idea. Consistency should be there in the title, problem, purpose, and research question improve the logic and transparency .

2. Originality:

Originality in research mean what you are doing is from your own perspective although you may draw arguments from other research work to back up your arguments.

3. Contribution to knowledge:

Contribution to knowledge means creating new knowledge based on the previously available knowledge by doing extensive and innovative research.

- Form and style:

1. Precision:

It refers to the extent of adherence to the prescribed format. More the adherence more the Precision.

2. Illustration through figures and tables:

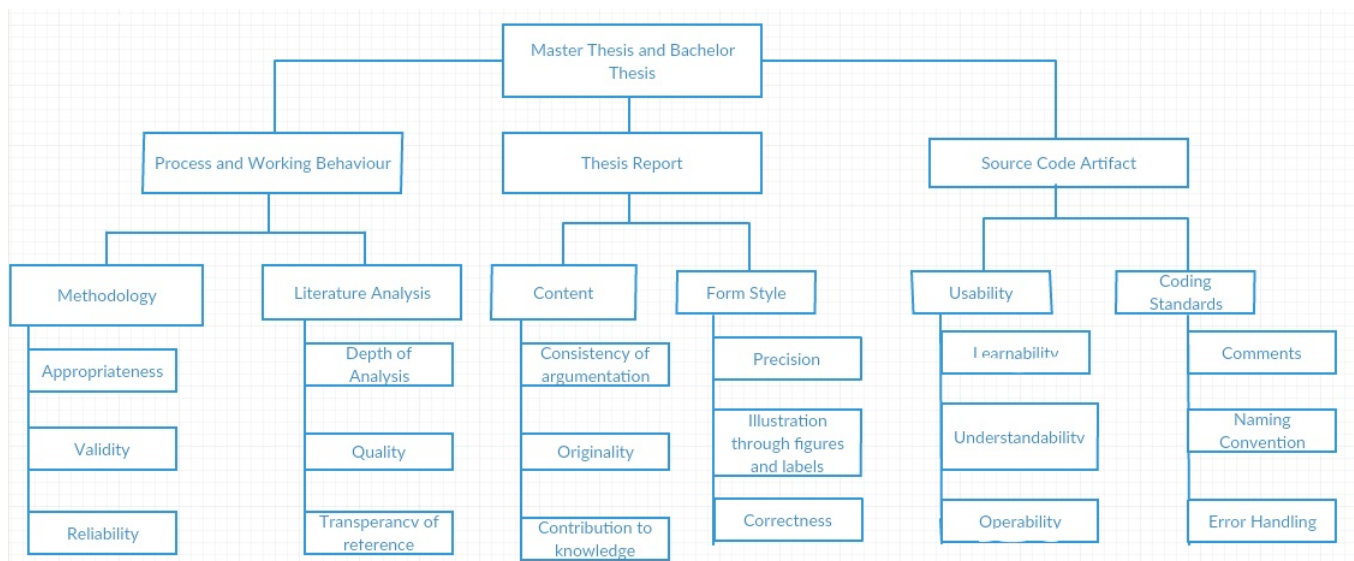
How many sections are using figures and tables to explain the underlying concepts and their examples.

3. Correctness:

How correct are the facts and figures mentioned in the report.

- Usability:
 1. Learnability:
describes the ability of an interface to allow users to accomplish tasks on the first attempt. A more learnable system is one that reduces the time it takes to complete the tasks as users spend more time with the system faster than others.
 2. Understandability:
How easy is it to understand the code. Not so complex code is easier to understand and comment also help in the understandability.
 3. Operability:
How easy is to install and run the code .Also how intuitive or guided the flow is.
- Coding standards:
 1. Comments:
Comments can be helpful to understand the intent or the motive of the method if the code is complex or unreadable. It also helps the non-coder to understand what that method does.
 2. Naming conventions:
It helps to relate similar entities and gives the user a broader picture.
 3. Error Handling:
This is most useful for debugging and preventing the system crash.

c) Visualize your model in an appropriate form.



d) Propose an aggregation formula for the overall assessment based on the (sub-)characteristics of your quality model. The overall assessment should result in a grade from 1.0 to 5.0. Explain and justify your proposal.

The scoring used here is a non- weighted scoring (giving equal importance to Process and Working Behavior, Thesis Report, and Source Code Artifacts) as we are normalizing the total score in the end using the formula below. The metric has different scoring ranges so that the examiner can evaluate each metric in a different way, for example "Validity" metric for Methodology can only be either "the Methodology used in thesis is valid", or

"Methodology used in thesis is invalid", so scoring is 0-1. For another example the "Quality Metric" in Literature Analysis, the scoring is between 0-10, ranging from "lacks quality" to "High quality".

$$a_i = \frac{a_i - \min(a)}{\max(a) - \min(a)} * (high - low) + low$$

- e) Implement your Quality Model as a Spreadsheet (Excel/OpenOffice).
The respective file could be find in the submission archive we sent.