

Assignment #1

Group Information

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- Group id: 06
- Project id: 03
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Project description

What is it?

The jdotxt project is an implementation of a todo application. It contains a GUI where users can insert new tasks and mark them as completed. The information is saved in a text file in a location chosen by the user.

How is the source-code organized?

The project contains two packages at the root of the source code:

com.chschmid.jdotxt

This package contains the application's entrypoint and two other packages, one with utilities and the other with the code responsible for building the GUI. The latter has its own subpackages with more utilities and code for the controls of the UI.

com.todotxt.todotxttouch

This package contains some constants and exception-related code at its root. Furthermore, it contains two subpackages, one for utilities and another for task-related code. This code is responsible for parsing, filtering, and sorting (in its own package) the tasks created by the user.

What is static testing and why is it important and relevant?

Static testing is a technique that allows checking for faults in a software application and associated documents without requiring it to be executed, enabling faster feedback. This technique is usually used to find faults in the code, which could make it less maintainable.

Static testing tools used

CheckStyle

This tool is used to make sure the Java code in a project follows the styling rules that have been defined.

Configuration

To use CheckStyle in the project, we executed the following steps:

- Add the CheckStyle configuration to the pom.xml file, as explained in the [Recitation #1](#);
- Create the file `checkstyle-rules.xml` on the `rulesets` folder;
- Change the following configurations on the `checkstyle-rules.xml` file:

```
<module name="Indentation">
  <property name="basicOffset" value="8"/>
  <property name="braceAdjustment" value="8"/>
  <property name="caseIndent" value="8"/>
  <property name="throwsIndent" value="8"/>
  <property name="lineWrappingIndentation" value="8"/>
  <property name="arrayInitIndent" value="8"/>
</module>
```

- The indentation values were changed to better match those used by the project;

```
<!-- See http://checkstyle.org/config\_whitespace -->
<module name="FileTabCharacter">
  <property name="eachLine" value="false"/>
</module>
```

- By default, CheckStyle does not allow the use of tabs. This was changed since the project does make use of tabs.

Report summary

The report emitted by Checkstyle is composed of the summary, files, rules, and details sections.

In the summary section, it is possible to see the number of files, warnings, and errors. In the case of the `jd.txt` project, there are 68 files, 12481 warnings, and 0 errors.

The files section exposes a list with more information about each file, namely the number of warnings and errors.


The section about the rules has information about the rules used by Checkstyle, showing the number of violations and the severity of each one. For the jdotxt project, the rules with the highest number of violations are the *Indentation* and the *FileTabCharacter*.

Lastly, the details section shows every warning and error, with a message and its location.

Bugs solved

Warning *EmptyCatchBlock*

CheckStyle was throwing a warning because of the empty catch blocks present on the source code.

	blocks	EmptyCatchBlock	Empty catch block.	172
Warning				


```
172      } catch (IOException e) {}
173  }
```

To fix this warning, we added a line that prints the stack trace. This way, when an exception is caught, the programmer can better understand the source of the problem.

```
172      } catch (IOException e) {
173          e.printStackTrace();
174      }
```

Warning *AbbreviationAsWordInName*

CheckStyle alerted us to the existence of a function with a name that did not follow the naming convention properly and had two consecutive capital letters.


	naming	AbbreviationAsWordInName	Abbreviation in name 'isMacOSX' must contain no more than '1' consecutive capital letters.	182
Warning				

```
1 usage  👤 Tiago Gomes
183      public static boolean isMacOSX() {
186
```

```
1 usage  👤 Tiago Gomes *
183      public static boolean isMacOsx() {
186
```

Warning *NeedBraces*

CheckStyle presented a warning about the use of braces ({}) on the if constructs.

	blocks	NeedBraces	'if' construct must use '{} 's.	207
Warning				
	blocks	NeedBraces	'if' construct must use '{} 's.	207


```
208      if (original.length() > (offset + replace.length()))
209          b = original.substring(offset + replace.length(), original.length());
```

To fix this warning, we added braces on the corresponding if constructs.

```
208      if (original.length() > (offset + replace.length())) {
209          b = original.substring(offset + replace.length(), original.length());
210      }
```

Warning *NoWhitespaceBefore*

CheckStyle was throwing a warning because of the whitespace before the ";".

	whitespace	NoWhitespaceBefore	',' is preceded with whitespace.	353
Warning				

```
352      Runnable postprocessing ;
353      if (field == IdetxtTaskPanel
```

To fix this issue, we removed the whitespace.

```
352      Runnable postprocessing;
353      if (field == IdetxtTaskPanel
```

Warning *Indentation*

CheckStyle alerted us about the indentation value: it should be 8 instead of 4. We could change the ruleset to fix this problem, but as most of the source code was using an indentation level of 8, we decided to maintain it.

Warning				
	indentation	Indentation	'member def modifier' has incorrect indentation level 4, expected level should be 8.	8
Warning				
	indentation	Indentation	'member def modifier' has incorrect indentation level 4, expected level should be 8.	9
Warning				
	indentation	Indentation	'member def modifier' has incorrect indentation level 4, expected level should be 8.	10
Warning				
	indentation	Indentation	'member def modifier' has incorrect indentation level 4, expected level should be 8.	11
Warning				

```
3 usages
public class PredefinedSorters {
    3 usages
    public static final Sorter<Task> DEFAULT = PRIORITY.ascending().then(ID.ascending());
    public static final Sorter<Task> TEXT_ASC = TEXT.ascending().then(ID.ascending());
    public static final Sorter<Task> DATE_ASC = DATE.ascending().then(ID.ascending());
    public static final Sorter<Task> DATE_DESC = DATE.descending().then(ID.ascending());
}
```

To fix this issue, we changed the indentation level from 4 to 8.

```
3 usages
public class PredefinedSorters {
    3 usages
    public static final Sorter<Task> DEFAULT = PRIORITY.ascending().then(ID.ascending());
    public static final Sorter<Task> TEXT_ASC = TEXT.ascending().then(ID.ascending());
    public static final Sorter<Task> DATE_ASC = DATE.ascending().then(ID.ascending());
    public static final Sorter<Task> DATE_DESC = DATE.descending().then(ID.ascending());
}
```

Report after fixes

After configuring the rules and fixing the five bugs, Checkstyle threw 1947 warnings and 0 errors.

PMD

PMD is a tool used to report issues on the source code of an application. It has predefined rules and gives the possibility to customize the ruleset.

Configuration

To use PMD in the project, we executed the following steps

- Add the PMD configuration to the pom.xml file, as explained in the [Recitation #1](#);
- Copy the PMD ruleset files used in the class to the `rulesets` folder;
- Change the plugin configuration in order to enable and disable some rulesets:

```
<rulesets>
  <ruleset>${basedir}/rulesets/pmd-unusedcode.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-basic.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-braces.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-clone.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-codesize.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-comments.xml</ruleset>
  <!--<ruleset>${basedir}/rulesets/pmd-controversial.xml</ruleset>-->
  <ruleset>${basedir}/rulesets/pmd-coupling.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-design.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-empty.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-finalizers.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-imports.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-j2ee.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-javabeans.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-junit.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-logging-jakarta-commons.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-logging-java.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-metrics.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-migrating_to_13.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-migrating_to_14.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-migrating_to_15.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-migrating_to_junit4.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-migrating.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-naming.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-optimizations.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-quickstart.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-strictexception.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-strings.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-sunsecure.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-typeresolution.xml</ruleset>
  <ruleset>${basedir}/rulesets/pmd-unnecessary.xml</ruleset>
```

- Controversial rules were disabled since some did not make sense and were even marked as deprecated by PMD's documentation.


Report summary

Before applying our custom configuration, the original report contained multiple violations with priority 1. The ones with the most violations were *AvoidUsingShortType* and *VariableNamingConventions*. For priority 2, we mostly see violations related to *SystemPrintln* and *AvoidReassigningParameters*, but we did not see many violations with this priority level. For priority levels 3-5, a large variety of violations are reported across the entire project. The report also contains the file and line where each violation is detected, along with a short description.

Bugs solved

Warning *ClassWithOnlyPrivateConstructorsShouldBeFinal*

PMD was throwing a warning because of a class that only has private constructors. In this case, the class should be marked as final.

Rule	Violation	Line
ClassWithOnlyPrivateConstructorsShouldBeFinal 	A class which only has private constructors should be final	3-17

```
11 usages  matosjoaops
class ContextParser {
    1 usage
    private final static Pattern CONTEXT_PATTERN = Pattern
        .compile( regex: "(?:^|\\s)@([\\w_\\.\\-\\:\\\\\/]+)", Pattern.UNICODE_CHARACTER_CLASS);
    1 usage
    private static final ContextParser INSTANCE = new ContextParser();

    1 usage  matosjoaops
    private ContextParser() {
    }

    matosjoaops
    public static ContextParser getInstance() { return INSTANCE; }

    matosjoaops
    public List<String> parse(String inputText) {
        if (inputText == null) {
            return Collections.emptyList();
        }

        Matcher m = CONTEXT_PATTERN.matcher(inputText);
        List<String> contexts = new ArrayList<>();
        while (m.find()) {
            String context = m.group(1);
            contexts.add(context);
        }
        return contexts;
    }
}
```

To fix this warning, we added the final keyword to the class.


```
11 usages  matosjoaops *
final class ContextParser { You, Yesterday • Uncommitted changes
    1 usage
    private final static Pattern CONTEXT_PATTERN = Pattern
        .compile( regex: "(?:^|\\s)@([\\w_\\.\\-\\:\\\\\/]+)", Pattern.UNICODE_CHARACTER_CLASS);
    1 usage
    private static final ContextParser INSTANCE = new ContextParser();

    1 usage  matosjoaops
    private ContextParser() {
    }



    matosjoaops
    public static ContextParser getInstance() { return INSTANCE; }

    matosjoaops
    public List<String> parse(String inputText) {
        if (inputText == null) {
            return Collections.emptyList();
        }

        Matcher m = CONTEXT_PATTERN.matcher(inputText);
        List<String> contexts = new ArrayList<>();
        while (m.find()) {
            String context = m.group(1);
            contexts.add(context);
        }
        return contexts;
    }
}
```

Warning MethodNamingConventions

PMD was throwing a warning because a method was not following the camel case convention.

Rule	Violation	Line
MethodNamingConventions 	The native method name 'SetCurrentProcessExplicitAppUserModelID' doesn't match '[a-z][a-zA-Z0-9]*'	52
MethodNamingConventions 	The native method name 'SetCurrentProcessExplicitAppUserModelID' doesn't match '[a-z][a-zA-Z0-9]*'	52


```
matosjoaops
private static native NativeLong SetCurrentProcessExplicitAppUserModelID(WString appID);
```

To fix this warning, we changed the first character of the method name from upper to lower case.

```
new *
private static native NativeLong setCurrentProcessExplicitAppUserModelID(WString appID);
```

Warning AvoidReassigningParameters

PMD was throwing a warning saying there was a parameter reassignment.

Rule	Violation	Line
AvoidReassigningParameters 	Avoid reassigning parameters such as 'text'	59


```

1 usage  matosjoaops
public PrioritySplitResult split(String text) {
    if (text == null) {
        return new PrioritySplitResult(Priority.NONE, text: "");
    }
    Priority priority = Priority.NONE;
    Matcher priorityMatcher = PRIORITY_PATTERN.matcher(text);
    if (priorityMatcher.find()) {
        priority = Priority.toPriority(priorityMatcher.group(1));
        text = priorityMatcher.group(2);
    }
    return new PrioritySplitResult(priority, text);
}

```

To fix this warning, we created a new variable to be assigned instead of the parameter.

```

1 usage  matosjoaops *
public PrioritySplitResult split(String text) {
    if (text == null) {
        return new PrioritySplitResult(Priority.NONE, text: "");
    }
    Priority priority = Priority.NONE;
    Matcher priorityMatcher = PRIORITY_PATTERN.matcher(text);
    String newText = text;
    if (priorityMatcher.find()) {
        priority = Priority.toPriority(priorityMatcher.group(1));
        newText = priorityMatcher.group(2);
    }
    return new PrioritySplitResult(priority, newText);
}

```

Warning *LocalVariableCouldBeFinal*

PMD showed us a warning regarding a local variable that could be declared as final.

LocalVariableCouldBeFinal 	Local variable 'viewGUI' could be declared final	79-112
---	--	--------

```
78      // Start GUI
      matosjoaops +1
79      Runnable viewGUI = new Runnable() {
          matosjoaops +1
80      @Override
81      public void run() {
82      File todoFileDir;
```

The "final" keyword was added to the declaration to fix the warning.

```
78      // Start GUI
      matosjoaops +1 *
79      final Runnable viewGUI = new Runnable() {
          matosjoaops +1
80      @Override
81      public void run() {
82      File todoFileDir;
```

ImmutableField

PMD showed us a warning regarding a field whose value was never reassigned and could be made final.

ImmutableField	Private field 'filterPrios' could be made final; it is only initialized in the declaration or constructor.	88
----------------	--	----

```
88      1 usage
      private ArrayList<Priority> filterPrios = new ArrayList<Priority>();
      2 usages
```

The "final" keyword was added, making the warning disappear.

```
88      1 usage
      private final ArrayList<Priority> filterPrios = new ArrayList<Priority>();
      2 usages
```

Report after fixes

After applying our configuration, all violations related to the controversial ruleset disappeared (the most notable absence was *AvoidUsingShortType*). For the fixes, the individual instances that we

addressed also disappeared.