**CS673 Software Engineering** 

**Team 1 - PennyWise**

**Software Test Document**

| Team Member | Role(s) | Signature | Date |
| --- | --- | --- | --- |
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| Jisoo Lee | Requirement leader | *Jisoo Lee* | 09/14/23 |
| Brian Fenstermacher | Team Leader | *Brian Fenstermacher* | 09/17/23 |
| Mali Rivera | QA Leader | *Mali Rivera* | 9/17/23 |
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|  |  |  |  |

**Revision history**

| **Version** | **Author** | **Date** | **Change** |
| --- | --- | --- | --- |
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[References](#_heading=h.2et92p0)

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# Testing Summary

In this section, you will summarize what was tested, who is involved in testing, testing techniques used, and testing result. You may have the following tests

* + Unit Testing
  + Integration testing
  + System Testing
  + Acceptance Testing
  + Regression Testing

Unit Test (Mali):

* Please see the Automated Testing Report below for testing reports
* Developers are writing unit tests for their code and QA leader is writing integration tests
* For unit testing, we are using JUnit5 and integrate Mockito
* Mockito is a framework that is used to mock interfaces so that dummy functionality can be added to a mock interface for Unit Testing purposes
* Steps: add dependencies, write tests with Junit5 and Mockito, run unit tests.
* 1. Setup dependencies

<dependency>

<groupId>org.mockito</groupId>

<artifactId>mockito-all</artifactId>

<version>2.0.2-beta</version>

</dependency>

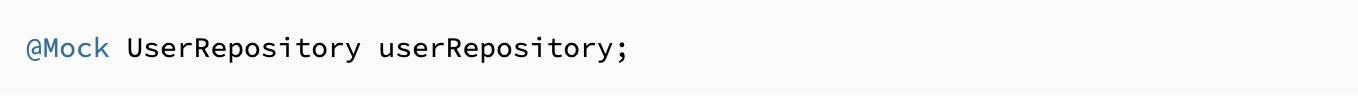
<dependency>

<groupId>junit</groupId>

<artifactId>junit</artifactId>

<version>4.8.2</version>

</dependency>

* 2. Integrate Mockito with Junit5 extension 
* 3. Use @Mock annotation to inject a mock instance that can be used anywhere in the test class (mock objects can be injected in method parameters)
* 
* 4. Inject a mock object into a test method



JUnit 5 User Guide:

<https://junit.org/junit5/docs/current/user-guide/>

Mockito documentation:

<https://site.mockito.org/>

Mockito integration with Junit5 extension:

<https://www.baeldung.com/mockito-junit-5-extension>

How to Write Test Cases in Java Application using Mockito and Junit:

<https://www.geeksforgeeks.org/how-to-write-test-cases-in-java-application-using-mockito-and-junit/>

Integration Test (Mali):

* Please see the Automated Testing Report below for testing reports
* Developers are writing unit tests for their code and QA leader is writing integration tests
* For integration testing, we are using MockMVC to test the web layer.
* Steps: add dependencies, write tests with MVC run integration tests
* 1. Add dependencies

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-web</artifactId>

</dependency>

<dependency>

<groupId>org.springframework.boot</groupId>

<artifactId>spring-boot-starter-test</artifactId>

</dependency>

* 2. Create JUnit test class to test MVC controller request and responses



* write JUNit tests for HTTP GET, POST, PUT and DELETE APIs.

Integration Testing in Spring:

<https://www.baeldung.com/integration-testing-in-spring>

MockMVC spring:

<https://docs.spring.io/spring-framework/reference/testing/spring-mvc-test-framework.html#:~:text=The%20Spring%20MVC%20Test%20framework%2C%20also%20known%20as,and%20response%20objects%20instead%20of%20a%20running%20server>.

Spring Boot MockMVC Examples:

<https://www.geeksforgeeks.org/spring-boot-mockmvc-example/>

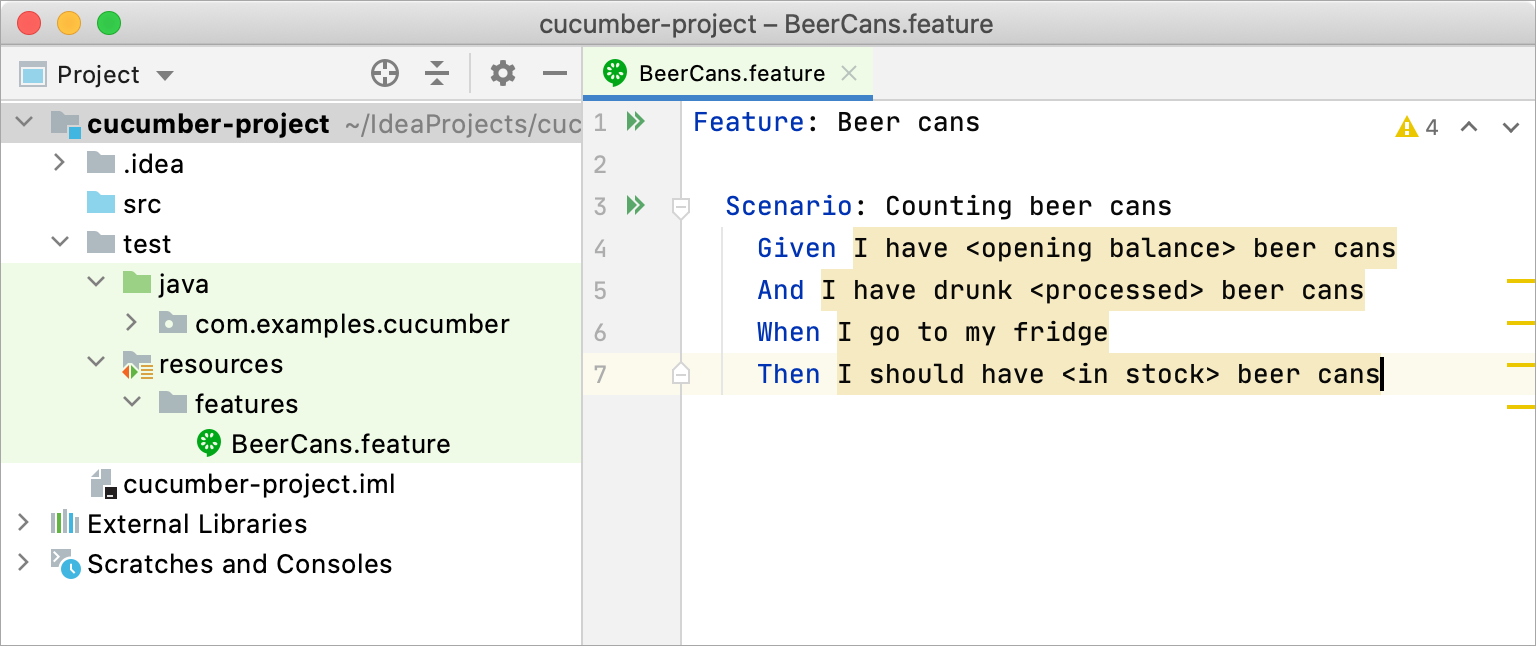
<https://howtodoinjava.com/spring-boot2/testing/spring-boot-mockmvc-example/>

Acceptance Test: (Jisoo / Chaitanya)

* jUnit5 and Cucumber

For acceptance testing, we will use Cucumber which is a behavior-driven development framework.

Steps: add dependencies, write acceptance tests with Cucumber, run acceptance tests.



This is the structure of the project example for using Cucumber in Maven.

1. Add xml form: adding dependencies for our project.

<dependencies>

<!-- JUnit 5 -->

<dependency>

<groupId>org.junit.jupiter</groupId>

<artifactId>junit-jupiter-api</artifactId>

<version>5.8.1</version> <!-- Use the latest version -->

<scope>test</scope>

</dependency>

<!-- Cucumber for Java -->

<dependency>

<groupId>io.cucumber</groupId>

<artifactId>cucumber-java</artifactId>

<version>7.2.3</version> <!-- Use the latest version -->

<scope>test</scope>

</dependency>

</dependencies>

2. Writing acceptance tests with Cucumber: Cucumber allows developers to write in human syntax.

MyFeature.feature example:

Feature: My Feature

Scenario: User Registration

Given the user is on the registration page

When the user enters a valid username and password

And clicks the register button

Then the user should be registered successfully

3. Create step definition:

(<https://www.jetbrains.com/help/idea/creating-step-definition.html#add-cucumber-definitions> )

4. Run a Cucumber acceptance test within JUnit:

(<https://www.jetbrains.com/help/idea/running-cucumber-tests.html> )

Example:

import io.cucumber.junit.Cucumber;

import io.cucumber.junit.CucumberOptions;

import org.junit.runner.RunWith;

@RunWith(Cucumber.class)

@CucumberOptions( features =

{"classpath:features/BeerCans.feature"}, glue =

{"com.examples.cucumber"})

public class RunCucumberTest { }

* Cucumber set-up in IntelliJ

(<https://www.jetbrains.com/help/idea/enabling-cucumber-support-in-project.html#add-cucumber-library> )

* Run Cucumber test in IntelliJ (<https://www.jetbrains.com/help/idea/running-cucumber-tests.html#cucumber-run-configuration> )
* Cucumber (<https://www.jetbrains.com/help/idea/running-cucumber-tests.html#cucumber-run-configuration> )

# Manual Testing Report

In this section, you will give a detailed description of each manual test case performed and the result. If this is a previous You shall list what are existing tests developed in the previous semester and what are new tests developed currently.

Here is a sample template that can be used for each test case. For system tests or acceptance tests, you may also include some screenshots.

* Test case ID, name
* New or old:
* Test items: (what do you test )
* Test priority (high/medium/low)
* Dependencies (to other test case/requirement if any):
* Preconditions: (if any)
* input data:
* Test steps:
* Postconditions:
* Expected output:
* Actual output:
* Pass or Fail:
* Bug id/link: (this should link to your github issue id)
* Additional notes:

(You can use an additional spreadsheet for this section as well)

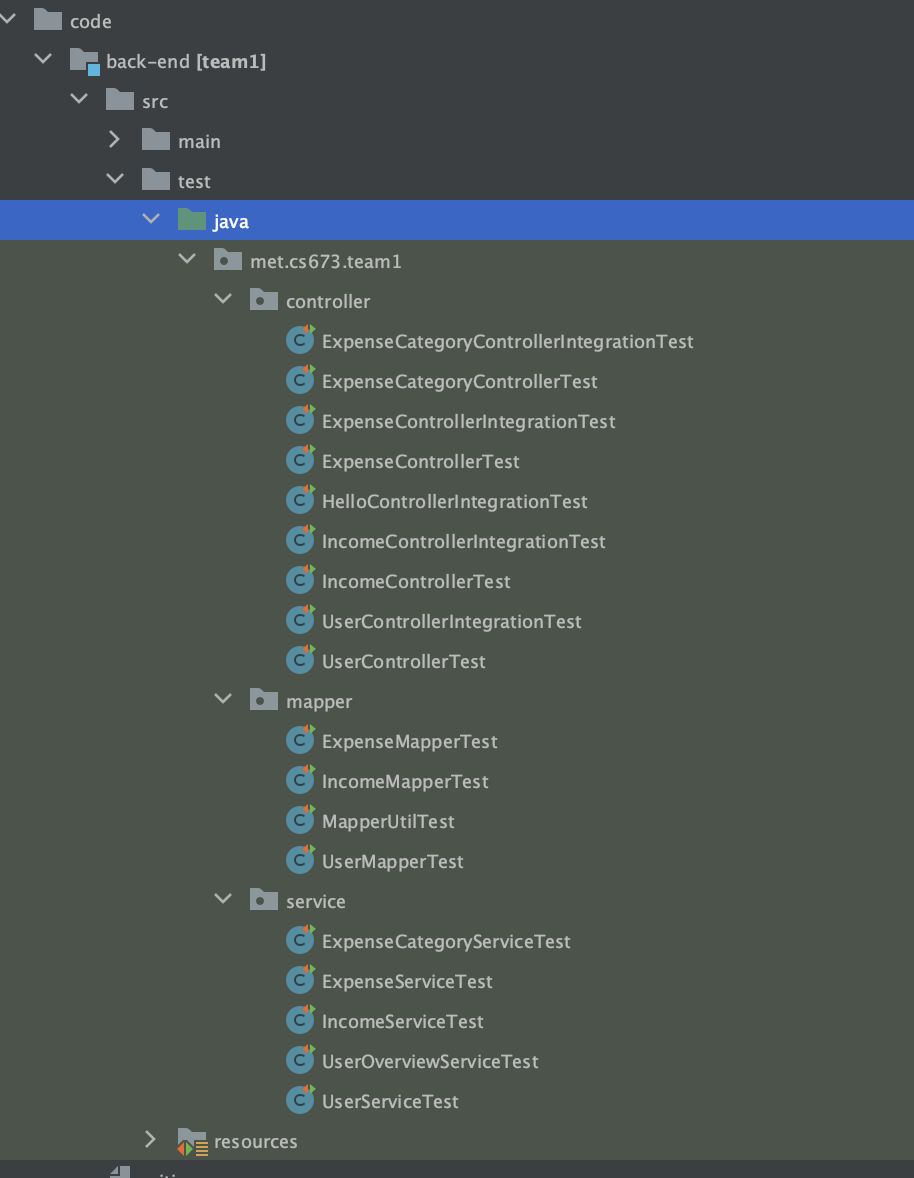
For this iteration we have not written any manual tests. All tests have been automated. Please proceed to the Automated Testing Report section for a testing summary.

# Automated Testing Report (Mali)

Describe briefly the automated testing you have done, including where the test code resides in your code repository, what test frameworks are used, and the screen shots or generated testing report.

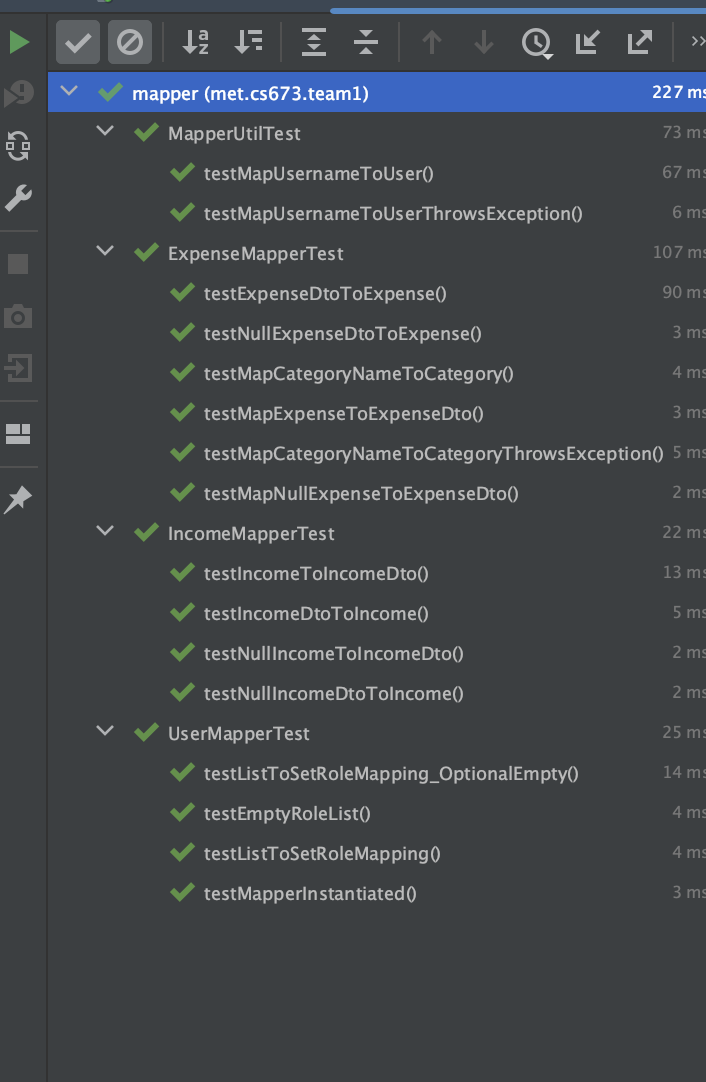
For Iteration 2, we have written Unit and Integration tests for our back end code. Unit tests were written by the developers with JUnit5 and Mockito. Integration tests were written by the QA leader with JUnit5, Mockito, and Mock MVC.

The Unit and Integration Tests reside in the following folder:

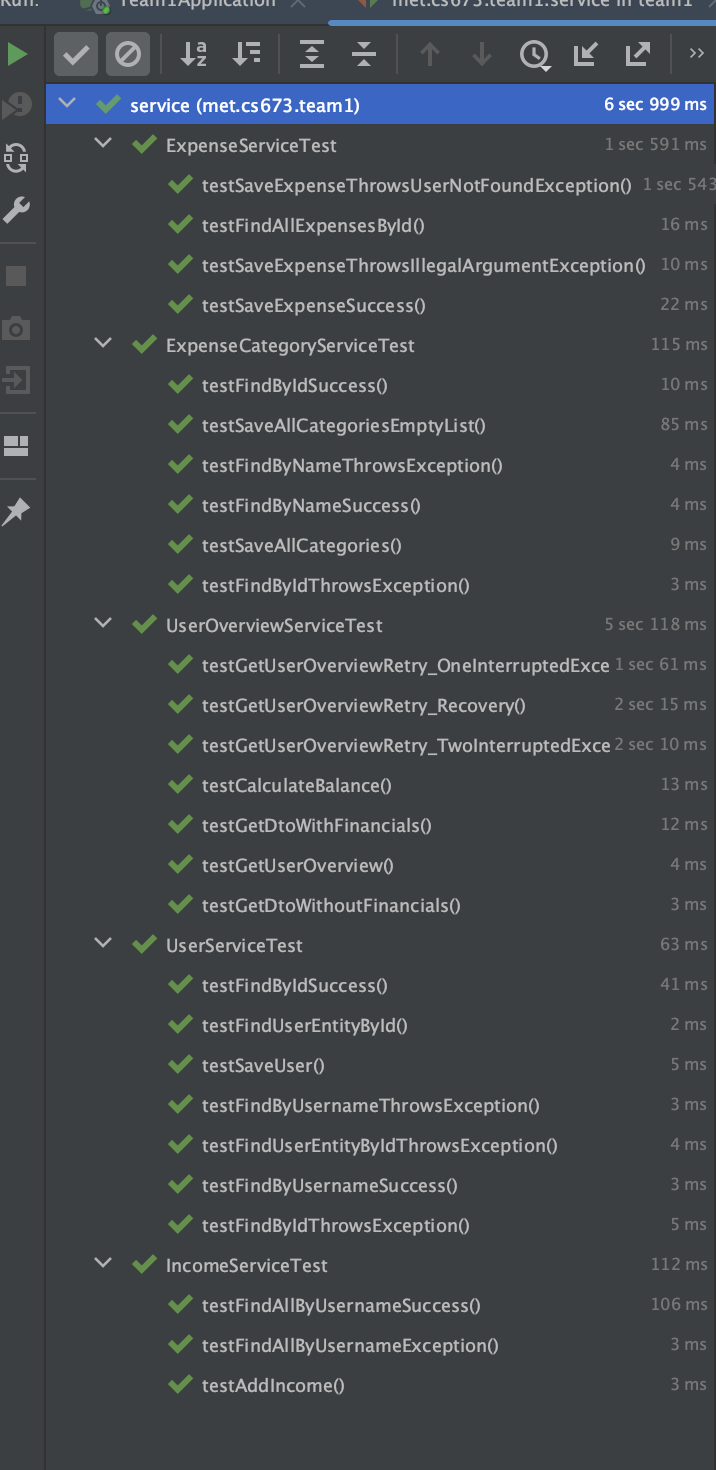


**Testing Reports:**

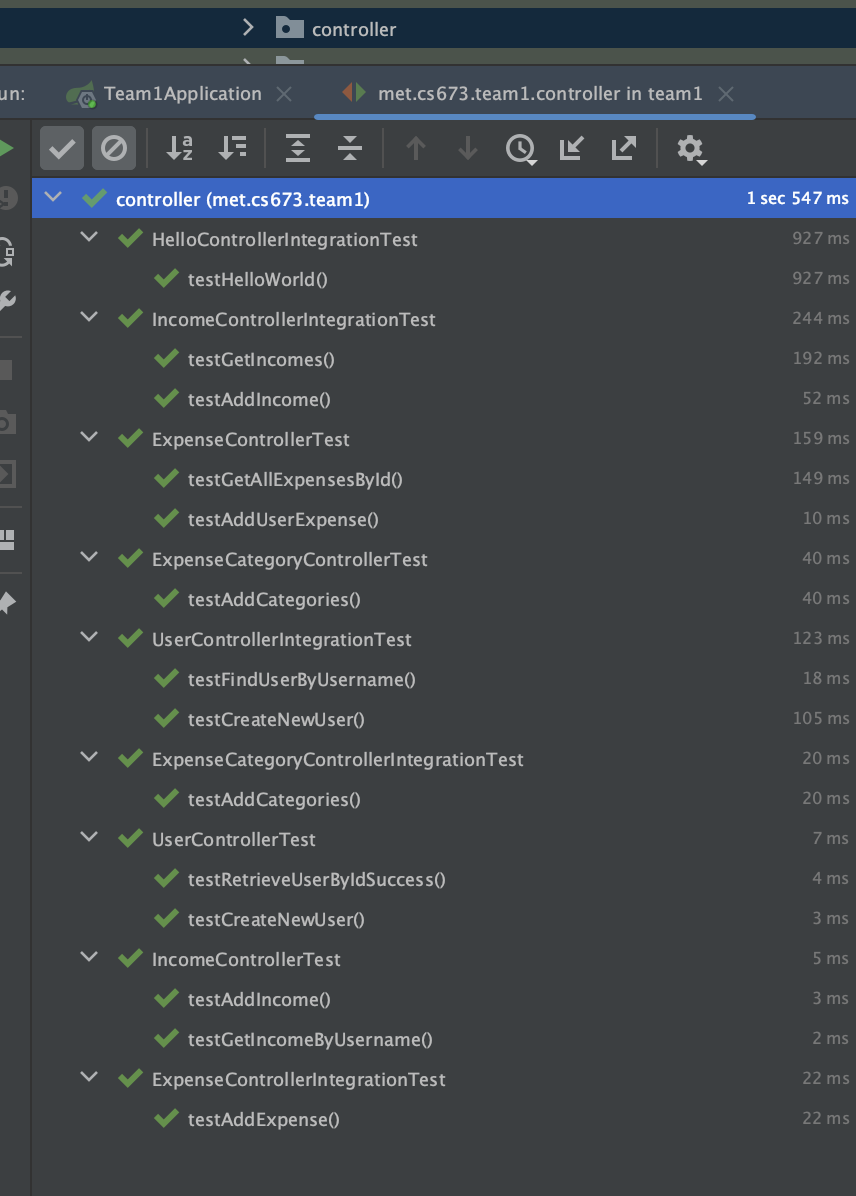
Mapper Tests (16/16 ✅)



Service Tests (27/27 ✅)



Controller Tests (14/14 ✅ )



# Testing Metrics (Mali)

In this section, you shall report any metrics used for the evaluation, e.g. # of test cases, test coverage, defects rate, etc.

Testing Metrics Definitions

| Metric Name | Description |
| --- | --- |
| Test Count | The number of test cases |
| Test Coverage | The percentage of code or functionalities covered by test cases. |
| Defect Density (KLOC) | The number of defects per thousand lines of code. |
| Execution Rate | The number of test cases executed in a given time frame. |
| Test Case Effectiveness | The number of defects measured by test cases. |
| Test Case Pass Rate | The percentage of test cases passed by a testing cycle. |
| Defect Escape Rate | The number of defects found post-production compared to the number of defects identified by QA |
| Test Automation Coverage | The percentage of tests that have been automated |

Testing Metrics Report

| Testing Metrics Summary | | | |
| --- | --- | --- | --- |
| Metric | Classes | | |
|  | Controllers (5) | Services (5) | Mappers (4) |
| Test Count (tests) | 14 | 27 | 16 |
| Test Coverage (tests/classes) | 5/5 | 5/5 | 4/4 |
| Test Coverage (tests/methods) | 7/11 | 18/18 | 15/15 |
| Defect Density (defect/1000codeLines) | 0 | 0 | 0 |
| Avg Execution Rate (ms) | 110.5 | 259.22 | 14.12 |
| Execution Rate (ms) | 1547 | 6999 | 227 |
| Test Case Effectiveness (defects/class) | 0 | 0 | 0 |
| Test Case Pass Rate | 100% | 100% | 100% |
| Defect Escape Rate | N/A | N/A | N/A |
| Test Automation Coverage | 100% | 100% | 100% |

# References

* Cucumber (<https://cucumber.io/>)
* Cucumber set-up in IntelliJ (<https://www.jetbrains.com/help/idea/enabling-cucumber-support-in-project.html#add-cucumber-library> )

# Glossary