University of Sevilla

Higher Technical School of Computer Engineering

**D04 – Student #3 Testing Report**

**Un dibujo de una persona

El contenido generado por IA puede ser incorrecto.**

Degree in Computer Engineering - Software Engineering

Desing and Testing II

Course 2024 – 2025

|  |  |
| --- | --- |
| **Date** | **Version** |
| 24/05/2025 | v2.0 |

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| --- | --- |
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**Repository:** https://github.com/DP2-2025-C1-040/Acme-ANS

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# 1. Revision Table

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| --- | --- | --- | --- |
| Date | Version | Description | Delivery |
| 23/05/2025 | v1.0 | First report’s version | D04 |
| 24/05/2025 | v2.0 | Add comparison between two computers | D04 |

# 2. Execution summary

For this testing document, each of the implementations present in the mandatory requirements of the D04 deliverable have been developed and explained.

Both the system performance and the functional performance of each and every one of the requested functions have been evaluated, in this case, those related to ‘flight assignment’ and ‘activity log’. The methodology provided in Lesson 04, ‘S01 - Formal testing’ and ‘S02 - Performance testing’ was followed.

The system performs robustly in terms of functionality, although there are areas that could use a little attention.

# 3. Introduction

This document is divided into two distinct sections:

1. Functional testing: a list of implemented test cases, grouped by functionality, will be presented. For each one, a description and an indication of how effective it is in detecting errors will be given. For effectiveness, the code coverage and a screenshot of the code will be used to check that all possible decisions have been tested during the execution of the program to avoid the existence of errors.
2. Performance testing: appropriate graphs and a 95% confidence interval will be provided for the time taken for the requests in the tests on two different computers. In addition, after the tests on the different computers, it will be indicated which of these is the most powerful and offers the best performance.

# 4. Functional Testing

Tests cases related to flight assignment:

* Create flight assignment:
  + Description: the restrictions of all the fields of the flight assignment creation form are tested with values related to positive, negative and hacking cases.
  + Escala de tiempo

    El contenido generado por IA puede ser incorrecto.Coverage: 99.7%
  + Texto

    El contenido generado por IA puede ser incorrecto.Effectiveness: coverage is almost 100%, so it is almost perfect. We notice some yellow lines in some cases of null objects, for example ‘crewMember != null’, because in no case this object is going to be null.
* Delete flight assignment:
  + Description: the elimination of a flight assignment is tested, with positive, negative and hacking cases. In addition, its associated activity logs are checked for deletion.
  + Coverage: 63%

Escala de tiempo

El contenido generado por IA puede ser incorrecto.

* + Effectiveness: in this case, the coverage is 63% due to the unbind method and some “object != null”, as in no case this method is entered but it is necessary for the other services.
* List landed flight assignments:
  + Description: the list of landed flight assignments associated with the currently logged-in flight crew member is tested. The different hacking cases are also verified.
  + Coverage: 100%
  + Effectiveness: perfect coverage.
* List programmed flight assignments:
  + Description: the list of programmed flight assignments associated with the currently logged-in flight crew member is tested. The different hacking cases are also verified.
  + Coverage: 100%
  + Effectiveness: perfect coverage.
* Publish flight assignment:
  + Description: the publication of a flight assignment is tested. It is checked that if the leg has already occurred, it cannot be published and the different cases of hacking.
  + Escala de tiempo

    El contenido generado por IA puede ser incorrecto.Coverage: 99.1%

Texto

El contenido generado por IA puede ser incorrecto.

* + Effectiveness: almost perfect coverage with some yellow lines in some cases of null objects.
* Show flight assignment:
  + Description: the display of a flight assignment, with its corresponding flight crew member and associated leg, is tested. In addition, the different hacking cases are tested.
  + Texto, Escala de tiempo

    El contenido generado por IA puede ser incorrecto.Coverage: 98.9%
  + Effectiveness: near-perfect coverage. We notice some yellow lines in some cases of null objects, for example ‘assignment != null’, because in no case this object is going to be null.
* Update flight assignment:
  + Description: the constraints of all fields of a flight assignment update form are tested with values for positive, negative and hacking cases.
  + Escala de tiempo

    El contenido generado por IA puede ser incorrecto.Coverage: 97.1%

Texto

El contenido generado por IA puede ser incorrecto.

* + Effectiveness: near-perfect coverage. Same case as above with null objects.

Texto, Aplicación

El contenido generado por IA puede ser incorrecto.In short, the only red thing that can be seen is the unbind method of the delete service, since it is not executed at any time, as it is impossible to enter this condition. On the other hand, the lines in yellow have already explained the reason for their cause. For all these reasons and for having an average coverage of 93.1% in flight assignment, it is considered that the existence of potential failures or bugs is negligible.

Test cases relating to activity log records:

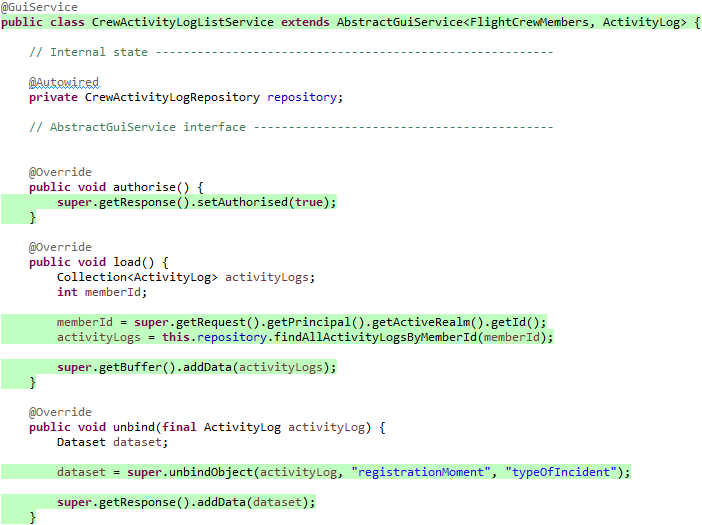
* Create activity log:
  + Description: the restrictions of all the fields of the activity log creation form are tested with values related to positive, negative and hacking cases.
  + Escala de tiempo

    El contenido generado por IA puede ser incorrecto.Coverage: 97.2%

Interfaz de usuario gráfica

El contenido generado por IA puede ser incorrecto.

* + Effectiveness: near-perfect coverage due to some null objects.
* Delete activity log:
  + Description: the elimination of a flight assignment is tested, with positive, negative and hacking cases.
  + Escala de tiempo

    El contenido generado por IA puede ser incorrecto.Coverage: 73.4%
  + Effectiveness: coverage is around 74% due to the unbind method, as in the delete flight assignment. This is not a cause for concern as the unbind method is the same as in other services and is already proven to work correctly in those services.
* List activity logs:
  + Description: the list of activity logs associated with the currently logged-in flight crew member is tested. The different hacking cases are also verified.
  + Coverage: 100%
  + Effectiveness: perfect coverage.
* Publish activity log:
  + Description: the publication of a activity log is tested. It is checked that if the associated flight assignment is not published, the activity log cannot be published and the different cases of hacking.
  + Escala de tiempo

    El contenido generado por IA puede ser incorrecto.Coverage: 97.6%

Interfaz de usuario gráfica, Texto, Aplicación

El contenido generado por IA puede ser incorrecto.

* + Effectiveness: near-perfect coverage due to some null objects.
* Show activity log:
  + Description: the display of a activity log, with its corresponding flight assignment, is tested. In addition, the different hacking cases are tested.
  + Texto

    El contenido generado por IA puede ser incorrecto.Coverage: 97.6%
  + Effectiveness: near-perfect coverage due to some null objects.
* Update activity log:
  + Description: the constraints of all fields of a activity log update form are tested with values for positive, negative and hacking cases.
  + Escala de tiempo

    El contenido generado por IA puede ser incorrecto.Coverage: 97.1%

Interfaz de usuario gráfica

El contenido generado por IA puede ser incorrecto.

* + Effectiveness: coverage almost perfect due to some null objects.

Interfaz de usuario gráfica, Texto, Aplicación, Chat o mensaje de texto

El contenido generado por IA puede ser incorrecto.In short, the only red thing that can be seen is the unbind method of the delete service, since it is not executed at any time, as it is impossible to enter this condition. On the other hand, the lines in yellow have already explained the reason for their cause. For all these reasons and for having an average coverage of 93.4% in activity log, it is considered that the existence of potential failures or bugs is negligible.

# 5. Performance testing

After performing the set of tests for the appropriate functionalities, all the steps shown in ‘S02 - Performance testing’ have been carried out, obtaining the following results:

Aplicación, Tabla

El contenido generado por IA puede ser incorrecto.

As can be seen in the images above, the average time taken by the system to perform a request is approximately 25.1 ms, i.e. 0.025 seconds, which is quite fast.

Furthermore, the bar chart clearly shows that the requests that take the longest time are those that handle a larger amount of data and validations, specifically those related to the creation, deletion and publication of an activity log. This is partly due to the fact that several validations of both the ActivityLog class and the associated FlightAssignment class must be checked.

Interfaz de usuario gráfica, Aplicación, Tabla, Excel

El contenido generado por IA puede ser incorrecto.Although the performance tests without indexes met the established requirements (with an average of 25 ms), it was decided to add indexes on the most queried fields. The appropriate comparisons are made of the different values obtained in each test and we obtain:

The indexes reduced the average to 13 ms (48% faster), which improves the stability of the system and prepares it for higher data volume scenarios.

Tabla

El contenido generado por IA puede ser incorrecto.To determine whether the average times before and after the changes can be considered the same or not, a z-test was performed with the following results:

Given this two-tailed p-value result (≈0), we can conclude that, being in the interval between [0, 0.05), the changes made have been fruitful and have helped to improve performance.

Tabla

El contenido generado por IA puede ser incorrecto.The performance of the system will now be compared on two different computers. The first computer will be the one on which all the above tests have been performed and the second will be another team member's computer. Here are the results:

Tabla, Excel

El contenido generado por IA puede ser incorrecto.We can see the difference in results.

As can be seen, the value of the two-tail p-value is almost 0, a value far away from alpha.

# 6. Conclusions

After creating this testing report, it has been concluded that this phase of the project lifecycle is vital. Verifying that all developed functions work correctly and are thoroughly checked to minimise errors or failures, as well as ensuring that performance is optimised as much as possible, are fundamental aspects for the client. A thoroughly tested system allows the end-user to use it quickly and intuitively, avoiding problems that can detract from their experience.

In addition, a meticulous testing process contributes to customer satisfaction and product reputation, ensuring that quality and efficiency expectations are consistently met.

# 7. Bibliography

* 06 Annexes - Material provided in the subject Design and Testing II by the University of Seville.
* L04 - S01 - Formal testing - Material provided in the subject Design and Testing II by the University of Seville.
* L04 - S02 - Performance testing - Material provided in the subject Design and Testing II by the University of Seville.