**Testing Strategies and Test Cases**

For our game MathGenius, we have tested the functionalities of every subsystem that exists across all platforms and interfaces. Below, you can observe a compilation of all of our testing that we have carried out and completed: each table represents the system being tested and each row within the table represents the test case, containing information on the inputs, expected results and actual results.

Testing is an important activity for checking the correctness of system implementations. We need to find out bugs in the system on unit level as well as on the integration or system level of testing. We use black box integration or system level testing approach to validate the system functionality. We have compared various features of both approaches and find out which approach is useful on different stages of testing to find bugs in the softwares. Black box testing is performed when we do not have the source code. We varied our inputs at the start and we found that the interface would not get past input level and input destination even though our level and destination were correct.

For our testing, we implemented white box testing.White box testing ensures that all independent paths within a module have been exercised at least once and all logical decisions verified on their true and false values. All loops are executed at their boundaries and within their operational bounds internal data structures validity.

The following section documents the white box testing of various functionalities of our game.

**Game Starting Scene**

In this test case, we tested the the functionality of the start and exit button of our main title screen.

Title page:

| **Action** | **Expected result** | **Actual result** |
| --- | --- | --- |
| Start button pressed | Login screen displayed | Login screen displayed |
| Exit button pressed | Game closes | Game closes |

**Login Scene**

Next, we tested the functionality of the login page using valid inputs, invalid inputs, and a combination of both. We also tested the buttons on the page, similar to the previous test case.

Entering Credentials:

| **Email** | **Password** | **Expected result** | **Actual result** |
| --- | --- | --- | --- |
| <empty> | <empty> | Empty input | Empty input |
| usertwo@test.com | <empty> | “Please enter password” | “Please enter password” |
| <empty> | 123456 | “Please enter valid username” | “Please enter valid username” |
| usertwo@test.com | 123456 | User enters game | User enters game |

We also tested the buttons on the page, similar to the testing done for our title page..

Login page:

| **Action** | **Expected result** | **Actual result** |
| --- | --- | --- |
| Login button pressed | User enters game | User enters game |
| Return button pressed | User returns to title screen | User returns to title screen |

**Admin Editing Scene**

We tested the various buttons on the admin editing scenes.

Choose whether to edit User or Question:

| **Action** | **Expected result** | **Actual result** |
| --- | --- | --- |
| Edit Users | Opens edit user scene | Opens edit user scene |
| Edit Questions | Opens edit question scene | Opens edit question scene |
| Exit | Exits the admin mode | Exits the admin mode |

Choose World and Question:

| **World** | **Question** | **Expected result** | **Actual result** |
| --- | --- | --- | --- |
| World 1 | Question 1 | Admin would be able to edit question 1 of world 1 | Admin would be able to edit question 1 of world 1 |
| World 1 | Question 2 | Admin would be able to edit question 2 of world 1 | Admin would be able to edit question 2 of world 1 |
| World 1 | Question 3 | Admin would be able to edit question 3 of world 1 | Admin would be able to edit question 3 of world 1 |
| World 2 | Question 1 | Admin would be able to edit question 1 of world 2 | Admin would be able to edit question 1 of world 2 |
| World 2 | Question 2 | Admin would be able to edit question 2 of world 2 | Admin would be able to edit question 2 of world 2 |
| World 2 | Question 3 | Admin would be able to edit question 3 of world 2 | Admin would be able to edit question 3 of world 2 |
| World 3 | Question 1 | Admin would be able to edit question 1 of world 3 | Admin would be able to edit question 1 of world 3 |
| World 3 | Question 2 | Admin would be able to edit question 2 of world 3 | Admin would be able to edit question 2 of world 3 |
| World 3 | Question 3 | Admin would be able to edit question 3 of world 3 | Admin would be able to edit question 3 of world 3 |

In this section, we tested the functionality of the question edit function by checking if using the admin account would allow the admin to change the contents of the question and choices.

Admin edit content of Question:

| **Content Edited** | **Expected result** | **Actual result** |
| --- | --- | --- |
| Question | Admin would be able to change the contents of the question | Admin would be able to change the contents of the question |
| Answer 1 | Admin would be able to change the contents of the first answer option | Admin would be able to change the contents of the first answer option |
| Answer 2 | Admin would be able to change the contents of the second answer option | Admin would be able to change the contents of the second answer option |
| Answer 3 | Admin would be able to change the contents of the third answer option | Admin would be able to change the contents of the third answer option |
| Answer 4 | Admin would be able to change the contents of the fourth answer option | Admin would be able to change the contents of the fourth answer option |

Next, we tested the functionalities of the user edit feature.

Admin edit content of User:

| **Action** | **Expected result** | **Actual result** |
| --- | --- | --- |
| Display | Username and ID of users are displayed | Username and ID of users are displayed |
| Add User button pressed | Prompt to enter username and password displayed | Prompt to enter username and password displayed |
| Register button pressed | New user is added | New user is added |
| Exit button on add user prompt pressed | Cancels adding user action | Cancels adding user action |
| Delete button pressed | Confirmation “Do you really want to delete (username)” button is displayed | Confirmation “Do you really want to delete (username)” button is displayed |
| Refuse button on the delete prompt is pressed | User is not deleted | User is not deleted |
| Yes button on the delete prompt is pressed | User is deleted | User is deleted |

**World Selection Scene**

In this scene, we tested the 4 world buttons to check if it generates and displays the question for that world.

Selecting a World:

| **Action** | **Expected result** | **Actual result** |
| --- | --- | --- |
| World 1 | Enters world 1 and generates and displays a question from world 1 | Enters world 1 and generates and displays a question from world 1 |
| World 2 | Enters world 2 and generates and displays a question from world 2 | Enters world 2 and generates and displays a question from world 2 |
| World 3 | Enters world 3 and generates and displays a question from world 3 | Enters world 3 and generates and displays a question from world 3 |
| World 4 | Enters world 4 and generates and displays a question from world 4 | Enters world 4 and generates and displays a question from world 4 |
| Exit | Exits student mode | Exits student mode |
| Leaderboard | Displays leaderboard scene | Displays leaderboard scene |

**Gameplay Scene**

This section tests the output for correct and incorrect answers to the question.

Selecting answer:

| **Answer** | **Expected result** | **Actual result** |
| --- | --- | --- |
| Correct option | Answer turns green in colour. “Well done, soldier” and the next button will appear | Answer turns green in colour. “Well done, soldier” and the next button will appear |
| Wrong option | Answer turns red in colour | Answer turns red in colour |

**Leaderboard Scene**

Finally, we tested if the leaderboard would be updated when the users completed the game.

Displaying of results:

| **Action** | **Expected result** | **Actual result** |
| --- | --- | --- |
| Display | Username and score of users are displayed according to rank | Username and score of users are displayed according to rank |
| Exit button pressed | Exits the leaderboard | Exits the leaderboard |