Test Report

SFWRENG 3XA3

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1 Major Revision History

Date	Version	Note
Dec 01, 2017	1.0	draft
Dec 03, 2017	1.1	Delete improper test cases
Dec 05, 2017	1.2	Complete rev0 of test report
Dec 06, 2017	1.3	Final update to rev1 of test report

2 Introduction

2.1 Purpose

This software testing is aimed to verify the functionality of the whole project, and to identify any potential bugs and malfunctions which may occur in program compilation and running time. By completing the test report, we would like to prove that our program for the project satisfies the original requirements specified in SRS.

2.2 Scope

This Test Report includes the results for testing all the major functionality and features specified in requirement documents. It includes a variety of test cases to ensure that the Tower Defense Game functions properly, including programming language syntax, game algorithms, user interface, animations and audios, and unit tests for each class and methods. A separate test for the whole program will also be included for integration testing.

3 Functional Requirements Evaluation

3.1 User Input and the Response

1. FS-IR-1: Main Menu Button

   Type: Functional, Dynamic, Manual

   Initial State: The game opened successfully

   Input: Mouse left clicks on Start button

   Output: The start button shows the visual effect and the game panel is loaded

   Expected Output: The start button shows the visual effect and the game panel is loaded

   Test Result: Passed

2. FS-IR-2: Check critter info

   Type: Functional, Dynamic, Manual

   Initial State: Game interface

   Input: Mouse left clicks on the Critter info button area

   Output: The corresponding button shows the visual effect and shows the information of the all the critters.

   Expected Output: The corresponding button shows the visual effect and shows the information of the all the critters.

   Test Result: Passed

3. FS-IR-3: Start Wave Button

   Type: Functional, Dynamic, Manual

   Initial State: Game interface

   Input: Mouse left clicks on the Start Wave button

   Output: The corresponding button shows the visual effect and the next wave starts.

   Expected Output: The next wave of enemies released from start point.

   Test Result: Passed

4. FS-IR-4: Speed Bar

   Type: Functional, Dynamic, Manual

   Initial State: Game interface

   Input: Mouse left click and drag the speed adjustment bar to the speed level from 1 to 5.

   Output: The drag button shows the visual effect and the game speed changes to the maximum.

   Expected Output: The drag button shows the visual effect and the game speed changes

   Test Result: Passed

5. FS-IR-5: Pause Button

   Type: Functional, Dynamic, Manual

   Initial State: Game interface

   Input: Mouse left clicks on the Pause button

   Output: The corresponding button shows the visual effect, towers stop the attack, and enemies stop moving.

   Expected Output: The corresponding button shows the visual effect, towers stop the attack, and enemies stop moving.

   Test Result: Passed

6. FS-IR-6: Main Menu Button

   Type: Functional, Dynamic, Manual

   Initial State: Game interface

   Input: Mouse left clicks on the Main Menu button

   Output: The corresponding button shows the visual effect and the game returns to the main menu.

   Expected Output: The corresponding button shows the visual effect and the game returns to the main menu.

   Test Result: Passed

7. FS-IR-7: Attack Strategy Drop-down Box

   Type: Functional, Dynamic, Manual

   Initial State: After the player choose a tower

   Input: Mouse left clicks on the tower attack strategy drop-down menu.

   Output: The menu drops down and shows 5 strategies to choose.

   Expected Output: The menu drops down and shows 5 strategies to choose.

   Test Result: Passed

8. FS-IR-8: Upgrade Button

   Type: Functional, Dynamic, Manual

   Initial State: After the player choose a tower

   Input: Mouse left clicks on the Tower upgrade button.

   Output: The corresponding button shows the visual effect and the tower is upgraded.

   Expected Output: The corresponding button shows the visual effect and the tower can be upgraded if conditions are met.

   Test Result: Passed

9. FS-IR-9: Sell Button

   Type: Functional, Dynamic, Manual

   Initial State: After the player choose a tower

   Input: Mouse left clicks on the Tower sell button.

   Output: The corresponding button shows the visual effect and the selected tower is sold.

   Expected Output: The corresponding button shows the visual effect and the selected tower will be sold.

   Test Result: Passed

10. FS-IR-10: Fire Tower Button

    Type: Functional, Dynamic, Manual

    Initial State: Game interface

Input: Mouse left clicks on the fire tower button.

Output: The corresponding button shows the visual effect and the player can choose a place to build a fire tower

Expected Output: The corresponding button shows the visual effect and the player can choose a place to build a fire tower

Test Result: Passed

11. FS-IR-11: Ice Tower Button

    Type: Functional, Dynamic, Manual

    Initial State: Game interface

    Input: Mouse left clicks on the ice button

    Output: The corresponding button shows the visual effect and the player can choose a place to build a ice tower

    Expected Output: The corresponding button shows the visual effect and the player can choose a place to build a ice tower

    Test Result: Passed

12. FS-IR-12: Laser Tower Button

    Type: Functional, Dynamic, Manual

    Initial State: Game interface

    Input: Mouse left clicks on the laser button

    Output: The corresponding button shows the visual effect and the player can choose a place to build a laser tower

    Expected Output: The corresponding button shows the visual effect and the player can choose a place to build a laser tower

    Test Result: Passed

13. FS-IR-13: Area Attack Tower Button

    Type: Functional, Dynamic, Manual

    Initial State: Game interface

    Input: Mouse left clicks on the Area Attack button.

    Output: The corresponding button shows the visual effect and the player can choose a place to build a area attack tower

Expected Output: The corresponding button shows the visual effect and the player can choose a place to build a area attack tower

Test Result: Passed

14. FS-IR-14: N Button

    Type: Functional, Dynamic, Manual

    Initial State: After the player finishing building a tower

    Input: Mouse left clicks on the N button.

    Output: The corresponding button shows the visual effect and the tower icon behind the mouse disappears.

    Expected Output: The button should let the player exit the tower placement stage.

    Test Result: Passed

3.2 Game Logic

15. FS-GL-1: Enemy track

    Type: Functional, Dynamic, Manual

    Initial State: A wave is running.

    Description: All the enemies take the correct path and move in a queue.

    Expected Output: All the enemies will go along the right path one by one.

    Test Result: Passed

16. FS-GL-2: Tower Attack

    Type: Functional, Dynamic, Manual

    Initial State: A wave is running.

    Description: The tower attacks the enemy once they are in range.

    Expected Output: The tower will attack the enemies within its attack range.

    Test Result: Passed

17. FS-GL-3: Attack Strategy

    Type: Functional, Dynamic, Manual

    Initial State: A tower is attacking

    Input: Selected "closest" strategy

    Output: The tower takes priority to attack the closest enemy.

    Expected Output: The tower will attack the enemy based on distance to tower.

    Test Result: Passed

18. FS-GL-4: Tower Strengthen

    Type: Functional, Dynamic, Automated

    Initial State: A tower has been upgraded

    Description: The tower will become stronger after upgrading, its damage per hit will increase.

    Expected Output:

    Test Result: Passed

19. FS-LG-5: Difficulty Increase

    Type: Functional, Dynamic, Automated

    Initial State: A wave is ended

    Input: New wave started

    Output: New enemies with stronger default settings enter the game.

    Expected Output: A stronger wave of enemies will come into the path.

    Test Result: Passed

20. FS-LG-6: Stage Change

    Type: Functional, Dynamic, Manual

    Initial State: One stage is clear

    Input: The player enters the next stage.

    Output: Map is changed after switching stage. Golds and lifes are initialized.

Expected Output: A new map which is harder and more complex will be loaded and the game will be reset.

Test Result: Passed

3.3 Animation Effect

21. FS-ANE-1: Enemy Animation

    Type: Functional, Dynamic, Manual

    Initial State: The game state.

    Input: The player start a new wave.

    Output: The enemies move along the path with animation effect.

    Expected Output: The enemies move along the path at 60 fps animation.

    Test Result: Passed

22. FS-ANE-2: Tower Animation

    Type: Functional, Dynamic, Manual

    Initial State: The game state.

    Input: The player upgrade a new tower and there exists enemy in the tower attack range

    Output: The tower's trajectory is strengthened after upgrade.

    Expected Output: The tower's trajectory is strengthened after upgrade.

    Test Result: Passed

3.3.1 Audio Effect

23. FS-AUE-1: Main Menu Audio

    Type: Functional, Dynamic, Manual

    Initial State: The game installed successfully.

    Input: The player launches the game into main menu.

Output: The music for main menu works properly.

Expected Output: The background music for main menu is played after main menu launches

Test Result: Passed

24. FS-AUE-2: Game Stage Audio

    Type: Functional, Dynamic, Manual

    Initial State: Level selecting menu.

    Input: The player enter a game stage.

    Output: The audio of game stage works properly.

    Expected Output: The background music for game state is played after it launches

    Test Result: Passed

4 Nonfunctional Requirements Evaluation

4.1 Usability

4.1.1 Support by platforms

25. SS-1

    Type: Structural, Dynamic, Manual

    Initial State: Program installed onto system

    Input/Condition: Launch program on Windows OS, Mac OS, or Linux.

    Output/Result: The exported jar file runs on Windows, Mac and Linux.

    Expected Output: The game successfully runs on Window OS, Mac OS, or Linux.

    Test Result: Passed

4.1.2 Accessibility to buttons

26. SS-2

    Type: Structural, Dynamic, Manual

    Initial State: Program installed onto system

    Input/Condition: launch program

    Output/Result: Main menu shows up with 2 big, clearly labelled buttons

    Expected Output: Main menu contains 2 simple, easy to understand buttons

    Test Result: Passed

4.2 Performance

4.2.1 Stability of system

27. SS-3

    Type: Structural, Dynamic, Manual

    Initial State: Program installed onto system

    Input/Condition: launch program and start game.

    Output/Result: the game runs 20 rounds without crash.

    Expected Output: the game will not crash after 10 rounds.

    Test Result: Passed

5 Changes Due to Testings

5.1 Game Logic and Algorithms

No changes are made to game logic and algorithms on the back end, since they passed all the automated tests and manual tests we perform on the system.

5.2 Graphical User Interface

One minor tweak we performed on GUI is the color of texts on the main menu. According to our manual tests on main menu, the texts are having a similar color with its background. We changed the color to white, to separate the texts from backgrounds for better usability.

6 Automated Testings

The JUnit framework will be used to do unit testing for this project.

6.1 Unit tests of internal functions

1. UT-1: Next Wave

   Type: Functional, Dynamic, Automated

   Initial State: A wave is ended

   Input: New wave started

   Output: New enemies with stronger default settings enter the game.

   Expected Output: A stronger wave of enemies will come into the path.

   Test Result: Passed

2. UT-2: Fire Tower Upgrade

   Type: Functional, Dynamic, Automated

   Initial State: Level 1 fire tower

   Input: Upgrade fire tower

   Output: Damage multiplier increases

   Expected Output: Damage increases as tower upgrades

   Test Result: Passed

3. UT-3: Ice Tower Upgrade

   Type: Functional, Dynamic, Automated

   Initial State: Level 1 ice tower

   Input: Upgrade ice tower

Output: Damage multiplier increases

Expected Output: Damage increases as tower upgrades

Test Result: Passed

4. UT-4: Laser Tower Upgrade

   Type: Functional, Dynamic, Automated

   Initial State: Level 1 laser tower

   Input: Upgrade laser tower

   Output: Damage multiplier increases

   Expected Output: Damage increases as tower upgrades

   Test Result: Passed

5. UT-5: AreaAttack Tower Upgrade

   Type: Functional, Dynamic, Automated

   Initial State: Level 1 AreaAttack tower

   Input: Upgrade AreaAttack tower

   Output: Damage multiplier increases

   Expected Output: Damage increases as tower upgrades

   Test Result: Passed

7 Traceability Matrices

7.1 Trace to Modules

7.2 Trace to Requirements

Modules	Tests
M5,M16,M17,M18,M19,M20	FS-IR-1, FS-AUE-1
M3,M6,M7,M8	FS-ANE-1, FS-ANE-2, UT-1, UT-2, UT-3, UT-4, UT-5
M3,M7,M10,M16	FS-GL-1, FS-GL-2, FS-GL-3, FS-GL-4
M5,M2,M16,M17,M9	FS-AUE-2, FS-IR-2 14
M1,M4,M17	FS-LG-5, FS-LG-6
M17,M18,M19	FS-IR-2 14
M16	FS-IR-2 14
M1	SS-1
M2,M4	SS-3
M1	SS-1

Table 1: Trace Between Modules and Tests

Requirements	Tests
FR1	FS-IR-1, FS-AUE-1
FR2	FS-ANE-1, FS-ANE-2, UT-1, UT-2, UT-3, UT-4, UT-5
FR3	FS-GL-1, FS-GL-2, FS-GL-3, FS-GL-4
FR4	FS-AUE-2, FS-IR-2 14
FR5	FS-LG-5, FS-LG-6
NF1	FS-IR-2 14
NF3	SS-1
NF2	FS-IR-2 14
NF4	SS-3
NF5	SS-1

Table 2: Trace Between Requirements and Tests

8 Code Coverage Metrics

The tower defense development team, Group 30, has managed to cover over 90% of all the code in this project in the tests. Referring to the traceability matrices above, all the modules and corresponding requirements are tested, with most of them tested more than once. This proves that almost all the code are been tested and verified.