**PROFESSOR WUMPUS**

CS 1632 – Deliverable 1:

Test Plan and Traceability Matrix

Group Members:

Anthony Poerio ([adp59@pitt.edu](mailto:adp59@pitt.edu))

Brandon Hedges ([bjh86@pitt.edu](mailto:bjh86@pitt.edu))

**INTRODUCTION**

Artisan asymmetrical bicycle rights, trust fund art party ugh hexagon. Green juice vape live-edge, butcher vaporware wolf tote bag drinking vinegar photo booth celiac subway tile direct trade. Crucifix vegan air plant hoodie man braid, portland disrupt blog pinterest fingerstache austin tacos skateboard street art. Scenester vinyl jianbing, paleo vegan snackwave plaid taxidermy. Tote bag roof party synth gochujang, yuccie succulents bespoke church-key scenester viral. Yuccie master cleanse humblebrag semiotics, vegan typewriter direct trade hoodie raclette skateboard cornhole kinfolk banh mi fap 90's. Next level poutine hella jianbing, gluten-free tbh listicle retro humblebrag cred pickled yuccie bitters bushwick.

Yr normcore master cleanse, fixie asymmetrical bicycle rights salvia tofu. Deep v next level tilde occupy pour-over, slow-carb edison bulb kogi taxidermy direct trade keytar. Lyft four dollar toast direct trade PBR&B, etsy lumbersexual fingerstache neutra post-ironic put a bird on it VHS. Craft beer vinyl 90's jean shorts, +1 meggings plaid VHS gluten-free four loko. Narwhal farm-to-table live-edge, pok pok kombucha asymmetrical four loko wolf cliche meggings craft beer cardigan. Lyft blue bottle literally, migas farm-to-table thundercats craft beer jianbing forage tote bag fam enamel pin irony selfies cornhole. Post-ironic lumbersexual church-key, stumptown food truck edison bulb twee enamel pin humblebrag raw denim fap.

Succulents semiotics street art actually. Street art kombucha VHS cliche iPhone. Authentic raw denim mlkshk, kogi retro intelligentsia synth next level schlitz YOLO biodiesel. Banjo live-edge ennui coloring book ramps bicycle rights fingerstache bushwick. Polaroid woke jean shorts, mumblecore godard sartorial authentic tumblr live-edge cornhole austin photo booth squid. Banjo roof party aesthetic fanny pack jianbing, brooklyn chillwave poke air plant readymade waistcoat butcher tattooed. Raclette put a bird on it pok pok disrupt aesthetic.

Challenges:

* Tedious
* Pain to do by hand
* Would like to automate
* Sometimes need to find a seed that’ll let you do what you want. And can take awhile.

**TEST CASES**

CASE 1**:**

IDENTIFIER: TEST-DISPLAY-ON-WUMPUS-INTERCEPT

TEST CASE: Run the program and intentionally walk into Prof Wumpus’s room to ensure the matrix always displays user’s location at each iteration—even when we are intercepted by Prof Wumpus.

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 1. With seed 1, Professor Wumpus will be placed in the room at ROW=1, COL=4 (indexing from 1).

EXECUTION STEPS: Move EAST 4 times. Press: E, Enter; E, Enter; E, Enter; E, Enter.

POSTCONDITIONS: First: The user’s location is displayed in the matrix at ROW=1, COL=4. Second: Display the message “Prof Wumpus sees you, but you don't have your assignment. YOU LOSE!” Third: Exit program.

CASE 2**:**

IDENTIFIER: TEST-MATRIX-DIMENSIONS

TEST CASE: Ensure the program displays a matrix with dimensions 6x6 (6 rows, 6 columns)

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 1

EXECUTION STEPS: Count the number of COLUMNS in the matrix. Count the number of columns in the matrix, starting at 1.

POSTCONDITIONS: You will finish counting at the number 6.

CASE 3**:**

IDENTIFIER: TEST-INVALID-INPUT-LETTER

TEST CASE: Run the program with invalid letters input parameters

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 1

EXECUTION STEPS:

Pass in the following invalid inputs:

1) “o”

2) “p”

3) “pq”

4) “north”

POSTCONDITIONS: For each invalid input, the Student marker will not move, and the program will output: “Please enter N, S, E, or W”

CASE 4**:**

IDENTIFIER: TEST-INVALID-INPUT-NUMBER

TEST CASE: Run the program with invalid numbers as input parameters

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 1

EXECUTION STEPS:

Pass in the following invalid inputs:

1) “1”

2) “-2”

3) “10”

4) “1000000000”

POSTCONDITIONS: For each invalid input, the Student marker will not move, and the program will output: “Please enter N, S, E, or W”

CASE 5**:**

IDENTIFIER: TEST-VALID-LOWERCASE-INPUT

TEST CASE: Run the program and pass in N,E,S,and W in lowercase form

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 1

EXECUTION STEPS:

Pass in the following invalid inputs:

1) “e”

2) “s”

3) “w”

4) “n”

POSTCONDITIONS: For each input, the student marker will move in the direction specified.

CASE 6**:**

IDENTIFIER: TEST-VALID-LOWERCASE-INPUT-AT-WALLS

TEST CASE: Test that valid lowercase input is accepted when the move itself is invalid because the user would be walking into a wall

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 1

EXECUTION STEPS:

Pass in the following inputs:

1) “n” 🡪 1x

2) “s” 🡪 5x (until bottom left wall is reached)

3) “w” 🡪 1x

4) “e” 🡪 5x (until bottom right wall is reached)

POSTCONDITIONS:

Each time the user attempts to walk into a wall—the program will accept the lowercase input, and respond with the following error message: “There’s a wall there, buddy!”

CASE 7**:**

IDENTIFIER: TEST-ALL-VALID-ROOMS-WITH-UPPERCASE-INPUT

TEST CASE: Run the program and move through the matrix into each valid room, ensuring that the user can enter into all rooms that are valid.

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 1

EXECUTION STEPS:

Pass in the following inputs:

1) “S” 🡪 4x

2) “E” 🡪 1x

3) “N” 🡪 4x

4) “E” 🡪 1x (will encounter TA and move to room at ROW=5, COL=3)

5) “N” 🡪 4x (Wumpus will be 1 room to right, so need to avoid him)

6) “S” 🡪 1x

7) “E” 🡪 1x

8) “S” 🡪 3x

9) “E” 🡪 1x (Find Assignment)

10) “N” 🡪 4x

11) “W” 🡪 1x (Encounter Wumpus)

POSTCONDITIONS:

All moves will be valid, and we will see the S marker move into the room specified. The only time the S marker will NOT move into the room specified is when we encounter the TA at STEP 4, and we are moved into a random room instead. After step 11, the S marker will be in room: ROW=1, COL=4, and we will receive the message: “You turn in your assignment. YOU WIN.” The game will then end.

CASE 8**:**

IDENTIFIER: TEST-ALL-VALID-ROOMS-WITH-LOWERCASE-INPUT

TEST CASE: Run the program and move through the matrix into each valid room, ensuring that the user can enter into all rooms that are valid when lowercase input is used.

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 1

EXECUTION STEPS:

Pass in the following inputs:

1) “s” 🡪 4x

2) “e” 🡪 1x

3) “n” 🡪 4x

4) “e” 🡪 1x (will encounter TA and move to room at ROW=5, COL=3)

5) “n” 🡪 4x (Wumpus will be 1 room to right, so need to avoid him)

6) “s” 🡪 1x

7) “e” 🡪 1x

8) “s” 🡪 3x

9) “e” 🡪 1x (Find Assignment)

10) “n” 🡪 4x

11) “w” 🡪 1x (Encounter Wumpus)

POSTCONDITIONS:

All moves will be valid, and we will see the S marker move into the room specified. The only time the S marker will NOT move into the room specified is when we encounter the TA at STEP 4, and we are moved into a random room instead. After step 11, the S marker will be in room: ROW=1, COL=4, and we will receive the message: “You turn in your assignment. YOU WIN.” The game will then end.

CASE 9**:**

IDENTIFIER: TEST-NORTH-AND-SOUTH-WALLS

TEST CASE: Run the program and intentionally walk into the NORTH and SOUTH walls, ensuring that program indicates to the user that she cannot move outside the bounds of the game-space.

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 5

EXECUTION STEPS:

Pass in the following inputs:

1) “n” 🡪 1x (receive error message)

2) “e” 🡪 1x

3) “n” 🡪 1x (receive error message)

4) “e” 🡪 1x

5) “n” 🡪 1x (receive error message)

7) “e” 🡪 1x

8) “n” 🡪 1x (receive error message)

9) “e” 🡪 1x

10) “n” 🡪 1x (receive error message)

11) “s” 🡪 5x (receive error message on 5th s)

12) “w” 🡪 1x

11) “s” 🡪 1x (receive error message)

12) “w” 🡪 1x

13) “s” 🡪 1x (receive error message)

14) “w” 🡪 1x

13) “s” 🡪 1x (receive error message)

14) “w” 🡪 1x

15) “s” 🡪 1x (receive error message)

POSTCONDITIONS:

Each time the user walks into a wall, the program will output the message “There’s a wall there, buddy!”

CASE 10**:**

IDENTIFIER: TEST-EAST-AND-WEST-WALLS

TEST CASE: Run the program and intentionally walk into the EAST and WEST walls, ensuring that program indicates to the user that she cannot move outside the bounds of the game-space.

PRECONDITIONS: Start the program with the command: java -jar profwumpus.jar 5

EXECUTION STEPS:

Pass in the following inputs:

1) “w” 🡪 1x (receive error message)

2) “s” 🡪 1x

3) “w” 🡪 1x (receive error message)

4) “s” 🡪 1x

5) “w” 🡪 1x (receive error message)

7) “s” 🡪 1x

8) “w” 🡪 1x (receive error message)

9) “s” 🡪 1x

10) “w” 🡪 1x (receive error message)

11) “e” 🡪 5x (receive error message on 5th e)

12) “n” 🡪 1x

11) “e” 🡪 1x (receive error message)

12) “n” 🡪 1x

13) “e” 🡪 1x (receive error message)

14) “n” 🡪 1x

13) “e” 🡪 1x (receive error message)

14) “n” 🡪 1x

15) “e” 🡪 1x (receive error message)

POSTCONDITIONS:

Each time the user walks into a wall, the program will output the message “There’s a wall there, buddy!”

CASE 11**:**

IDENTIFIER: TEST-RANDOM-NUMBER-GENERATOR-WITH-32-BIT-INTEGER

TEST CASE: Run the program and pass it an integer that is >= 32-bits long or less

PRECONDITIONS: None

EXECUTION STEPS: java -jar profwumpus.jar 2147483647

\* This number is (2^31-1)

\* So it can be represented in less than 32-bits, signed

POSTCONDITIONS: The program starts as expected, and the game-space matrix is displayed. The game will output the message “Welcome to Professor Wumpus

Playing with seed 2147483647”

CASE 12**:**

IDENTIFIER: TEST-RANDOM-NUMBER-GENERATOR-WITH-NEGATIVE-32-BIT-INTEGER

TEST CASE: Run the program and pass it a NEGATIVE integer that is >= 32-bits long or less

PRECONDITIONS: None

EXECUTION STEPS: java -jar profwumpus.jar -2147483647

\* This number is ( -(2^31) - 1 )

\* So it can be represented in less than 32-bits, signed

POSTCONDITIONS: The program starts as expected, and the game-space matrix is displayed. The game will output the message “Welcome to Professor Wumpus

Playing with seed -2147483647”

CASE 13**:**

IDENTIFIER: TEST-RUNNING-WITH-SEED-BEYOND-BOUNDS

TEST CASE: Run the program and pass it an invalid seed that is not in the range of 32-bit signed integers.

PRECONDITIONS: Run the program with the command:

java -jar profwumpus.jar 2147483648 (Seed one greater than the range of 32-bit signed integers)

EXECUTION STEPS: java -jar profwumpus.jar 2147483648

POSTCONDITIONS: The program starts as expected, and the game-space matrix is displayed. The game will output the message “Welcome to Professor Wumpus

Playing with seed” (random seed displayed on each iteration).

CASE 14**:**

IDENTIFIER: TEST-RUNNING-WITH-FLOATING-POINT-SEED

TEST CASE: Run the program and pass it an invalid seed that is a floating point integer and not a seed.

PRECONDITIONS: Run the program with the command:

java -jar profwumpus.jar 0.5 (Seed with floating point number)

EXECUTION STEPS: java -jar profwumpus.jar 0.5

POSTCONDITIONS: The program starts as expected, and the game-space matrix is displayed. The game will output the message “Welcome to Professor Wumpus

Playing with seed” (random seed displayed on each iteration).

CASE 15**:**

IDENTIFIER: TEST-RANDOMNESS-OF-TA-MOVEMENTS

TEST CASE: Run the program 3 times and record the output. Compare the outputs for the TA’S movements against the other outputs to ensure that the output is not the same or too similar.

PRECONDITIONS: Run the program with the command: java -jar profwumpus.jar

EXECUTION STEPS:

1)Run program with command: java -jar profwumpus.jar

2) “s”

3) “n”

4) “s”

5) “n”

6) “s”

7) “n”

8) “s”

9) “n”

10) “s”

12) Record output from console

13) Ctrl-c to terminate program

14) Run program with command: java -jar profwumpus.jar

15) “s”

16) “n”

17) “s”

18) “n”

19) “s”

20) “n”

21) “s”

22) “n”

23) “s”

24) Record output from console

25) Ctrl-c to terminate program

26) Run program with command: java -jar profwumpus.jar

27) “s”

28) “n”

29) “s”

30) “n”

31) “s”

32) “n”

33) “s”

34) “n”

35) “s”

36) Record output from console

37) Ctrl-c to terminate program

38) Compare output data

POSTCONDITIONS: In each iteration of the program the TA bumps into random walls in random orders and the output of the TA’S movements from each instance of the program do not display the same TA movements.

CASE 16**:**

IDENTIFIER: TEST-DOES-WUMPUS-MOVE

TEST CASE: Seed the program with a specific number to ensure Professor Wumpus’s starting point is known.

PRECONDITIONS:

EXECUTION STEPS:

POSTCONDITIONS:

CASE 17**:**

IDENTIFIER:

TEST CASE:

PRECONDITIONS:

EXECUTION STEPS:

POSTCONDITIONS:

CASE 18**:**

IDENTIFIER:

TEST CASE:

PRECONDITIONS:

EXECUTION STEPS:

POSTCONDITIONS:

CASE 19**:**

IDENTIFIER:

TEST CASE:

PRECONDITIONS:

EXECUTION STEPS:

POSTCONDITIONS:

CASE 20**:**

IDENTIFIER:

TEST CASE:

PRECONDITIONS:

EXECUTION STEPS:

POSTCONDITIONS:

CASE 21**:**

IDENTIFIER:

TEST CASE:

PRECONDITIONS:

EXECUTION STEPS:

POSTCONDITIONS:

CASE 22**:**

IDENTIFIER:

TEST CASE:

PRECONDITIONS:

EXECUTION STEPS:

POSTCONDITIONS:

**TRACEABILITY MATRIX**

|  |  |  |
| --- | --- | --- |
| TEST CASE | REQUIREMENT | PASS/FAIL |
| Case 1: TEST-DISPLAY-ON-WUMPUS-INTERCEPT | 1. The game shall consist of a 6 by 6 matrix of rooms, which shall be displayed to the player at each iteration, along with the location of the Student (indicated as an S). | **FAIL. This is an EDGE CASE. DEFECT-1** |
| Case 2: TEST-MATRIX-DIMSIONS | 1. The game shall consist of a 6 by 6 matrix of rooms, which shall be displayed to the player at each iteration, along with the location of the Student (indicated as an S). | **FAIL. DEFECT-2** |
| Case 3: TEST-INVALID-INPUT-LETTER | 2. At each iteration, the player shall be able to input the direction they wish the Student to move (N for North, S for South, E for East or W for West). There are no other options. If a player enters any command other than N, S, E, or W, or their lowercase equivalents, the game shall display "Please enter N, S, E, or W". | **PASS** |
| Case 4: TEST-INVALID-INPUT-NUMBER | 2. At each iteration, the player shall be able to input the direction they wish the Student to move (N for North, S for South, E for East or W for West). There are no other options. If a player enters any command other than N, S, E, or W, or their lowercase equivalents, the game shall display "Please enter N, S, E, or W". | **PASS** |
| Case 5: TEST-VALID-LOWERCASE-INPUT | 3. All user input shall be case-insensitive. For example, typing either "N" or "n" shall take the Student to the room to the North (if it exists). | **PASS** |
| Case 6: TEST-VALID-LOWERCASE-AT-WALLS | **3. All user input shall be case-insensitive. For example, typing either "N" or "n" shall take the Student to the room to the North (if it exists).** | **FAIL. DEFECT-3** |
| Case 7: TEST-ALL-VALID-ROOMS-WITH-UPPERCASE-INPUT | 4. If a room exists in the direction they have indicated, the Student shall move to that room and a new iteration shall commence. | **FAIL. DEFECT-1** |
| Case 8: TEST-ALL-VALID-ROOMS-WITH-UPPERCASE-INPUT | 4. If a room exists in the direction they have indicated, the Student shall move to that room and a new iteration shall commence. | **FAIL. DEFECT-1** |
| Case 9: TEST-NORTH-AND-SOUTH-WALLS | 5. If a room does not exist, the game shall indicate to the user that they cannot move in that direction. | **PASS** |
| Case 10: TEST-EAST-AND-WEST-WALLS | 5. If a room does not exist, the game shall indicate to the user that they cannot move in that direction. | **FAIL. DEFECT-3** |
| Case 11: TEST-RANDOM-NUMBER-GENERATOR-WITH-32-BIT-INTEGER | 6. The game shall accept a 32-bit signed integer seed for the random number generator. This should be entered as an argument for the program on the command line. | **PASS** |
| Case 12: TEST-RANDOM-NUMBER-GENERATOR-WITH-NEGATIVE-32-BIT-INTEGER | 6. The game shall accept a 32-bit signed integer seed for the random number generator. This should be entered as an argument for the program on the command line. | **PASS** |
| Case 13: TEST-RUNNING-WITH-SEED-BEYOND-BOUNDS | **7. If an invalid value is entered for the seed, the system shall ignore it and assume that no argument was passed in (that is, it will act as though no seed were entered).** | **FAIL. DEFECT-4** |
| Case 14:TEST-RUNNING-WITH-FLOATING-POINT-SEED | **7. If an invalid value is entered for the seed, the system shall ignore it and assume that no argument was passed in (that is, it will act as though no seed were entered).** | **FAIL. DEFECT-4** |
| 15:TEST-RANDOMNESS-OF-TA-MOVEMENTS | **8. The TA shall move a random direction at each iteration. If the TA attempts to move to a room which does not exist, the user shall be informed that they hear the TA bump into a wall. Professor Wumpus shall not move.** | **Pass** |
| 16 |  |  |
| 17 |  |  |
| 18 |  |  |
| 19 |  |  |
| 20 |  |  |
| 21 |  |  |
| 22 |  |  |

**DEFECTS FOUND**

DEFECT 1**:**

SUMMARY: Matrix Display NOT updated when Student is intercepted by Prof Wumpus

DESCRIPTION: When a user walks into Professor Wumpus, the location is not updated before ending the game. -- MINOR

REPRODUCTION STEPS: 1) Start the program with the command: java -jar profwumpus.jar 1. 2) Move EAST 4 times. Press: E, Enter; E, Enter; E, Enter; E, Enter.

EXPECTED BEHAVIOR: First: The user’s location is displayed in the matrix at ROW=1, COL=4. Second: Display the message “Prof Wumpus sees you, but you don't have your assignment. YOU LOSE!” Third: Exit program.

OBSERVED BEHAVIOR: The user’s location is NOT updated, and Student remains in the matrix at ROW=1, COL=3—even though s/he has moved into room [1,4]. The correct message displays, and program exits.

DEFECT 2**:**

SUMMARY: Matrix is not 6x6

DESCRIPTION: The Matrix has dimensions 5x5, but the requirements specify that dimensions must be 6x6 -- MAJOR

REPRODUCTION STEPS: 1) Start the program with the command: java -jar profwumpus.jar 1. 2) Count the number of rows and columns that appear on the screen, starting at 1.

EXPECTED BEHAVIOR: There will be 6 rows and 6 columns.

OBSERVED BEHAVIOR: There are 5 rows and 5 columns

DEFECT 3**:**

SUMMARY: Program crashes when trying to walk into bottom right EAST wall

DESCRIPTION: The program crashes when the user tries to walk into the EAST side of the bottom right wall of the game-space matrix, using the lowercase input character “e”.

REPRODUCTION STEPS:

Start the program with the command: java -jar profwumpus.jar 1.

Pass in the following inputs:

1) “n” 🡪 1x

2) “s” 🡪 5x (until bottom left wall is reached)

3) “w” 🡪 1x

4) “e” 🡪 5x (until bottom right wall is reached)

EXPECTED BEHAVIOR: Each time the user attempts to walk into a wall—the program will accept the lowercase input, and respond with the following error message: “That’s a wall there, buddy!”

OBSERVED BEHAVIOR: When the user attempts to walk into the bottom right wall, using the input “e”, the program crashes and outputs the following error message:

Exception in thread "main" java.lang.ArrayIndexOutOfBoundsException: 5

at ProfWumpus.moveStudent(ProfWumpus.java:51)

at ProfWumpus.playGame(ProfWumpus.java:335)

at ProfWumpus.main(ProfWumpus.java:362)

DEFECT 4**:**

SUMMARY: Program crashes when an invalid seed is passed in as an argument.

DESCRIPTION: The requirements specify that if an invalid seed is entered that it should be ignored and the program should run normally.

REPRODUCTION STEPS: 1) Start the program with the command: java -jar profwumpus.jar 2147483648 OR java -jar profwumpus.jar 0.5

EXPECTED BEHAVIOR: The seed will be ignored and the program will run normally.

OBSERVED BEHAVIOR: When 2147483648 is entered as the seed the program prints “Welcome to Professor Wumpus” then throws an exception and prints the stack trace “Exception in thread "main" java.lang.NumberFormatException: For input string: "2147483648"

at java.lang.NumberFormatException.forInputString(Unknown Source)

at java.lang.Integer.parseInt(Unknown Source)

at java.lang.Integer.parseInt(Unknown Source)

at ProfWumpus.main(ProfWumpus.java:358)”

When 0.5 is entered as the seed the program prints “Welcome to Professor Wumpus” then throws an exception and prints the stack trace “Exception in thread "main" java.lang.NumberFormatException: For input string: "0.5"

at java.lang.NumberFormatException.forInputString(Unknown Source)

at java.lang.Integer.parseInt(Unknown Source)

at java.lang.Integer.parseInt(Unknown Source)

at ProfWumpus.main(ProfWumpus.java:358)”