CS 1632 Software Quality Assurance

Exercise 1

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1. **Traceability Matrix**

FUN-ARGS-NUMBER: VALID_NUMBER_OF_ARGUMENTS

FUN-ARGS-INVALID: INVALID_NUMBER_OF_THREADS_LARGER_THAN_JAVA_MAXINT, MAXIMUM_INTEGER_FOR_NUM_THREADS

FUN-DISPLAY-RESULTS: VALID_NUMBER_OF_ARGUMENTS

FUN-DISPLAY-ITERATIONS: VALID_INPUTS_AND_DISPLAYS

FUN-SMALL-NUM: SIGKILL_DURING_WARNING_FOR_LESS_THAN_100_NUM_OF_TIMES, SPACE_IN_INPUT_DURING_WARNING, EXACTLY_100_NUMBER_OF_ITERATIONS

2. **Test Cases**

IDENTIFIER: INVALID_NUMBER_OF_THREADS_LARGER_THAN_JAVA_MAXINT

TEST CASE: Entering an integer larger than the maximum integer allowed for Java in the number of threads, while other inputs are valid.

PRECONDITIONS: Running on a windows computer, in the command line with java version 1.8.0_221.

EXECUTION STEPS: Enter an integer larger than the maximum java integer for the number of threads along with valid inputs for the rest of the inputs.

POSTCONDITIONS: System should display the reason that it cannot run and shut down. No java exception or stack trace should be displayed to the user directly.

IDENTIFIER: MAXIMUM_INTEGER_FOR_NUM_THREADS

TEST CASE: Entering an integer that is the maximum integer allowed for Java in the number of threads, while other inputs are valid.

PRECONDITIONS: Running on a windows computer, in the command line with java version 1.8.0_221.

EXECUTION STEPS: Enter an integer that is the maximum java integer for the number of threads along with valid inputs for the rest of the inputs.

POSTCONDITIONS: System should display the reason that it cannot run and shut down. No java exception or stack trace should be displayed to the user directly.

IDENTIFIER: SIGKILL_DURING_WARNING_FOR_LESS_THAN_100_NUM_OF_TIMES

TEST CASE: During the warning for entering less than 100 number of iterations, sending a sigkill should exit the program gracefully and not produce an exception.

PRECONDITIONS: Running on a windows computer, in the command line with java version 1.8.0_221.

EXECUTION STEPS: Entering valid input, and specifically less than 100 iterations. Then during the warning produced from less than 100 iterations, sending a SIGKILL instead of inputting a y/n string for the input.

POSTCONDITIONS: System should exit gracefully.

IDENTIFIER: SPACE_IN_INPUT_DURING_WARNING

TEST CASE: During the warning of being under 100 number of iterations, adding a space after a y in the y/n input should have it say that it did not recognize the command and redisplay the y/n input.

PRECONDITIONS: Running on a windows computer, in the command line with java version 1.8.0_221.

EXECUTION STEPS: Enter valid inputs, specifically an integer of less than 100 number of iterations to produce the warning. During the y/n input, entering a space after a y in the input and then another character.

POSTCONDITIONS: System should display that it could not understand what the string input meant and to repeat the y/n input to the user.

IDENTIFIER: VALID_INPUTS_AND_DISPLAYS

TEST CASE: Entering Valid inputs should produce the correct number of iterations, and the number of iterations for each thread should not be off by more than one if it is not a multiple of the number of threads. Additionally, the results should be grammatically correct.

PRECONDITIONS: Running on a windows computer, in the command line with java version 1.8.0_221.

EXECUTION STEPS: Enter “Goat” “Car” 200 5 as input for the program.

POSTCONDITIONS: System should display:

Thread 0: 40 iterations.

Thread 1: 40 iterations.

Thread 2: 40 iterations.

Thread 3: 40 iterations.

Thread 4: 40 iterations.

Calculating…

IDENTIFIER: VALID_NUMBER_OF_VALID_ARGUMENTS

TEST CASE: Entering the valid number of valid arguments should accept the four arguments and display the correct results.

PRECONDITIONS: Running on a windows computer, in the command line with java version 1.8.0_221.

EXECUTION STEPS: Enter “Goat” “Car” 200 5 as input for the program.

POSTCONDITIONS: Valid display should be produced for the input given.

IDENTIFIER: EXACTLY_100_NUMBER_OF_ITERATIONS

TEST CASE: Entering valid inputs, and specifically 100 for the number of iterations should not produce the warning since the requirements state that the number of integers have to be less than 100 and not less than or equal to 100.

PRECONDITIONS: Running on a windows computer, in the command line with java version 1.8.0_221.

EXECUTION STEPS: Enter valid inputs, and specifically 100 for the number of iterations.

POSTCONDITIONS: Program should display correct results, and not produce an error or display the less than 100 iterations warning.

3. Defects

IDENTIFIER: LARGER_THAN_MAXIMUM_JAVA_INTEGER

SUMMARY: Exception occurs when the number of threads is larger than the maximum java integer.

DESCRIPTION: If valid input is given for all other inputs, and the input for the number of threads is larger than the java maximum integer. So, an integer larger than 2147483647, will cause an exception to display that the number could not be formatted.

REPRODUCTION STEPS: Enter a valid good option, like Car. Enter a valid Bad option, like Goat. Enter a valid number of iterations like 200. Enter an integer larger than the maximum java integer, so larger than 2147483647 like 2147483649.

EXPECTED BEHAVIOR: The program should give a reason for that number being invalid and exit the program gracefully. At no point should an error exception be shown to the user.

OBSERVED BEHAVIOR: The program crashes giving a Java Exception about the formatting of the number, that it can't be formatted to an int.

IDENTIFIER: MAXIMUM_JAVA_INTEGER

SUMMARY: Exception occurs when the number of threads is exactly the maximum java integer.

DESCRIPTION: If valid input is given for all other inputs, and the input for the number of threads is exactly equal to the java maximum integer. The integer 2147483647 will cause an exception to show on the display that there is not enough virtual memory.

REPRODUCTION STEPS: Enter a valid good option, like Car. Enter a valid bad option, like Goat. Enter a valid number of iterations, like 200. Enter 2147483647 for the number of threads.

EXPECTED BEHAVIOR: The program should give a reason for that number being invalid and exit the program gracefully. At no point should an error exception be shown to the user.

OBSERVED BEHAVIOR: The program crashes giving a Java Exception about the array size exceeding the VM limit.

IDENTIFIER: SPACE_IN_BETWEEN_Y/N_INPUT_DURING_WARNING

SUMMARY: Placing a space after the y and then characters after the space ignores the characters after the y and space.

DESCRIPTION: The space should still be considered a part of the string input for the warning, and so the characters after it should also be considered a part of that string. This means that any characters after the space should mean the string should not be considered as a y for the input. It should display that it does not recognize that command and repeat the input.

REPRODUCTION STEPS: Enter a valid input for the good option, like Car. Enter a valid input for the bad option, like Goat. Enter a valid input for the number of iterations that is less than 100, like 99. Enter a valid input for the number of threads, like 20. Then during the warning display, enter a string with y then a space and characters after it, like “y no”.

EXPECTED BEHAVIOR: It should recognize that string as not a single “y”, and display that it does not understand that command. Then asking for a y/n input to continue the calculations.

OBSERVED BEHAVIOR: It ignores the space and considers the string as a single “y”. This leads to the calculations being done and displayed to user.

IDENTIFIER: SIGKILL_DURING_WARNING

SUMMARY: Sending a SIGKILL during the y/n input of the warning causes an exception.

DESCRIPTION: The program should exit gracefully, and not display any kind of exceptions during the run of the program. A SIGKILL should be allowed, but caught to allow the program to exit gracefully without the exception being shown.

REPRODUCTION STEPS: Enter a valid input for the good option, like Car. Enter a valid input for the bad option, like Goat. Enter a valid input for the number of iterations that is less than 100, like 99. Enter a valid input for the number of threads, like 20. Then during the warning display, send a SIGKILL to the program using ctrl+c.

EXPECTED BEHAVIOR: The program should display no exceptions to the user and exit the program gracefully.

OBSERVED BEHAVIOR: An exception is shown to have happened in the main class of the program and the program closes.

IDENTIFIER: CALCULATING_ELLIPSIS_DOTS_TOO_FEW

SUMMARY: Ellipsis should have three dots exactly.

DESCRIPTION: During the display results of the program shows after calculating two dots instead of three for the ellipsis.

REPRODUCTION STEPS: Enter a valid good option, like Car. Enter a valid bad option, like Goat. Enter a valid number of iterations, like 200. Enter a valid number of threads, like 20.

EXPECTED BEHAVIOR: The number of dots for the ellipsis displayed after Calculating should be three.

OBSERVED BEHAVIOR: The number of dots for the ellipsis displayed after Calculating is two.

IDENTIFIER: EXACTLY_100_ITERATIONS

SUMMARY: The input of 100 for the number of threads should not display the warning.

DESCRIPTION: The warning should only be displayed when the number of iterations is less than 100 according to the requirements, and the warning recommends a minimum of 100. This shows that exactly 100 number of iterations should not produce the warning.

REPRODUCTION STEPS: Enter a valid good option, like Car. Enter a valid bad option, like Goat. Enter 100 for the iterations, which is a valid number. Enter a valid number of threads, like 20.

EXPECTED BEHAVIOR: The calculations should be done and displayed to the user. The warning for a small number of iterations should not be shown since 100 is not less than 100.

OBSERVED BEHAVIOR: The warning for a minimum recommendation of 100 iterations is shown to the user, asking for a y/n input to continue to the calculations and displaying the results.