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**Testability Matrix**

FUN-BASIC-CALC: BASIC-CALC-TEST

FUN-DISPLAY-RESULTS: DISPLAY-RESULTS-TEST

FUN-ARGS-NUM: INVALID-NUM-TEST

FUN-ARGS-INVALID: INVALID-NUM-TIMES-ARGS-TEST, INVALID-NUM-THREADS-TEST

FUN-SMALL-NUM: VALID-SMALL-NUM-TEST

**Test Cases**

IDENTIFIER: BASIC-CALC-TEST

TEST CASE: Pass the system valid arguments

PRECODITIONS: User has a valid GoatGoatCar.jar file, user has terminal open to the directory containing the jar file

EXECTUTION STEPS: run program on input “java –jar GoatGoatCar.jar Car Goat 1000 15”

POSTCONDITIONS: The program correctly calculates the percentage of switching and staying while running 1000 iterations over 15 threads.

IDENTIFIER: DISPLAY-RESULTS-TEST

TEST CASE: Ensures the output is correct for valid arguments.

PRECODITIONS: User has a valid GoatGoatCar.jar file, user has terminal open to the directory containing the jar file.

EXECTUTION STEPS: run program on input “java –jar GoatGoatCar.jar Car Goat 1000 15”

POSTCONDITIONS: The program displays the percentages of staying and switching winning Car and Goat, with three decimal precision, printing “Goat” and “Car” as labels for the correct result (Car for good and Goat for bad).

IDENTIFIER: INVALID-NUM -TEST

TEST CASE: Run the program with zero arguments

PRECODITIONS: User has a valid GoatGoatCar.jar file, user has terminal open to the directory containing the jar file.

EXECTUTION STEPS: run the program with the input “java –jar GoatGoatCar.jar”

POSTCONDITIONS: The program displays usage information (java -jar GoatGoatCar.jar <good\_choice> <bad\_choice> <num\_times> <num\_threads>), then terminates.

IDENTIFIER: INVALID-NUM-TIMES-ARGS-TEST

TEST CASE: Run the program passing -5 as the number of times.

PRECODITIONS: User has a valid GoatGoatCar.jar file, user has terminal open to the directory containing the jar file.

EXECTUTION STEPS: run the program on input “java –jar GoatGoatCar.jar Car Goat -5 10”

POSTCONDITIONS: The program shall display an internal error message saying that the value for number of times must be greater than 0, then shut down.

IDENTIFIER: INVALID-NUM-THREADS-TEST

TEST CASE: Run the program passing in “h” as the number of threads.

PRECODITIONS: User has a valid GoatGoatCar.jar file, user has terminal open to the directory containing the jar file.

EXECTUTION STEPS: run the program on input “java –jar GoatGoatCar.jar Car Goat 1000 h”

POSTCONDITIONS: The program shall display an internal error message saying that the value for number of threads must be an integer, then shut down.

IDENTIFIER: VALID-SMALL-NUM-TEST

TEST CASE: Run the program passing in 100 for the number of times.

PRECODITIONS: User has a valid GoatGoatCar.jar file, user has terminal open to the directory containing the jar file.

EXECTUTION STEPS: Run the program on input “java –jar GoatGoatCar.jar Car Goat 100 10”

POSTCONDITIONS: The program should not issue a warning that the value is too low, and should instead continue as normal.

**Defects**

SUMMARY: The program should explain the reason why it cannot run, but it crashes with a Java error.

DESCRPITION: The program does not catch the invalid input of a string as the number of threads.

REPRODUCTION STEPS: Run the input “java –jar GoatGoatCar.jar Car Goat 1000 h”

EXPECTED BEHAVIOR: An explanation why the program is unable to run.

OBSERVED BEHAVIOR: The program crashes with a NumberFormatException from the JVM.

SUMMARY: The program does not correctly check the small number edge case of input 100

DESCRPITION: The program issues a recommendation that the minimum number of times is 100 on input 100. It should only issue that warning on values less than 100.

REPRODUCTION STEPS: Run the program on input “java –jar GoatGoatCar.jar Car Goat 100 15”

EXPECTED BEHAVIOR: The program should run normally.

OBSERVED BEHAVIOR: The program issues the recommendation that the minimum number of times should be 100, then asks if the user would like to continue.