CS 1632 Software Quality Assurance

Exercise 1

Member 1 Name: Nicholas Hicks

Member 2 Name: Dane Halle

1. **Traceability Matrix**

	FUN-ARGS-NUMBER	FUN-ARGS-INVALID	FUN-DISPLAY-RESULTS	FUN-DISPLAY-ITERATIONS	FUN-SMALL-NUM
TEST-NO-ARGS	x				
TEST-ONE-ARG	x				
TEST-TWO-ARG	x				
TEST-THREE-ARG	x				
TEST-FOUR-ARG	x		x	x	
TEST-ITERATION-UNDER-HUNDRED-LOW	x		x	x	x
TEST-ITERATION-UNDER-HUNDRED-MED	x		x	x	x
TEST-ITERATION-UNDER-HUNDRED-HIGH	x		x	x	x
TEST-ITERATION-AT-HUNDRED	x		x	x	x
TEST-ITERATION-OVER-HUNDRED	x		x	x	x
TEST-ITERATION-NEGATIVE	x	x			
TEST-ITERATION-ZERO	x	x			
TEST-THREAD-NEGATIVE	x	x			
TEST-THREAD-ZERO	x	x			
TEST-ITERATION-MAX-INT	x		x	x	
TEST-ITERATION-MAX-INT+1	x	x			
TEST-THREAD-MAX-INT	x		x	x	
TEST-THREAD-MAX-INT+1	x	x			
TEST-LARGE-NUMBERS	x		x	x	
TEST-MED-NUMBERS	x		x	x	

TEST-ITERATION-DECIMAL	x	x			
TEST-THREAD-DECIMAL	x	x			
TEST-ITERATION-STRING	x	x			
TEST-THREAD-STRING	x	x			
TEST-ITERATION-NULL	x	x			
TEST-THREAD-NULL	x	x			
TEST-UNDER-HUNDRED-LOWER-Y	x		x	x	x
TEST-UNDER-HUNDRED-UPPER-Y	x		x	x	x
TEST-UNDER-HUNDRED-LOWER-N	x				x
TEST-UNDER-HUNDRED-UPPER-N	x				x
TEST-UNDER-HUNDRED-RANDOM-CHAR	x				x
TEST-UNDER-HUNDRED-NULL	x				x
TEST-UNDER-HUNDRED-RANDOM-STRING	x				x
TEST-UNDER-HUNDRED-Y-SPACE-N	x				x

2. **Test Cases**

ID: TEST-NO-ARGS

TEST CASE: `java -jar .\GoatGoatCar.jar`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and output `Usage: java -jar GoatGoatCar.jar <good_choice> <bad_choice> <num_times> <num_threads>`

ID: TEST-ONE-ARG

TEST CASE: `java -jar .\GoatGoatCar.jar a`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and output `Usage: java -jar GoatGoatCar.jar <good_choice> <bad_choice> <num_times> <num_threads>`

ID: TEST-TWO-ARG

TEST CASE: `java -jar .\GoatGoatCar.jar a b`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and output `Usage: java -jar GoatGoatCar.jar <good_choice> <bad_choice> <num_times> <num_threads>`

ID: TEST-THREE-ARG

TEST CASE: `java -jar .\GoatGoatCar.jar a b 1`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and output `Usage: java -jar GoatGoatCar.jar <good_choice> <bad_choice> <num_times><num_threads>`

ID: TEST-FOUR-ARG

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10001 4`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Succeed and give results

ID: TEST-ITERATION-UNDER-HUNDRED-LOW

TEST CASE: `java -jar .\GoatGoatCar.jar a b 1 1`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Give warning and ask if you want to continue.

ID: TEST-ITERATION-UNDER-HUNDRED-MED

TEST CASE: `java -jar .\GoatGoatCar.jar a b 50 2`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Give warning and ask if you want to continue.

ID: TEST-ITERATION-UNDER-HUNDRED-HIGH

TEST CASE: `java -jar .\GoatGoatCar.jar a b 99 2`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Give warning and ask if you want to continue.

ID: TEST-ITERATION-AT-HUNDRED

TEST CASE: `java -jar .\GoatGoatCar.jar a b 100 2`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Succeed and give results

ID: TEST-ITERATION-OVER-HUNDRED

TEST CASE: `java -jar .\GoatGoatCar.jar a b 101 2`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Succeed and give results

ID: TEST-ITERATION-NEGATIVE

TEST CASE: `java -jar .\GoatGoatCar.jar a b -1 1`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and output `<num_times> must be an integer greater than 0.`

ID: TEST-ITERATION-ZERO

TEST CASE: `java -jar .\GoatGoatCar.jar a b 0 1`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and output `<num_times> must be an integer greater than 0.`

ID: TEST-THREAD-NEGATIVE

TEST CASE: `java -jar .\GoatGoatCar.jar a b 1000 -1`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and output `<num_threads> must be an integer greater than 0.`

ID: TEST-THREAD-ZERO

TEST CASE: `java -jar .\GoatGoatCar.jar a b 1000 0`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and output `<num_threads> must be an integer greater than 0.`

ID: TEST-ITERATION-MAX-INT

TEST CASE: `java -jar .\GoatGoatCar.jar a b 2147483647 2`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Succeed and output results

ID: TEST-ITERATION-MAX-INT+1

TEST CASE: `java -jar .\GoatGoatCar.jar a b 2147483648 2`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and explain why it can't run

ID: TEST-THREAD-MAX-INT

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10001 2147483647`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Succeed and output results

ID: TEST-THREAD-MAX-INT+1

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10001 2147483648`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and explain why it can't run

ID: TEST-LARGE-NUMBERS

TEST CASE: `java -jar .\GoatGoatCar.jar car goat 100000000 1234213412`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Succeed and output results

ID: TEST-MED-NUMBERS

TEST CASE: `java -jar .\GoatGoatCar.jar car goat 100000 1000`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Succeed and output results

ID: TEST-ITERATION-FLOAT

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10001.5 10`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: print <num_times> must be an integer greater than 0.

ID: TEST-THREAD-FLOAT

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10001 10.5`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and explain why it can't run

ID: TEST-ITERATION-STRING

TEST CASE: `java -jar .\GoatGoatCar.jar a b apple 10`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: print <num_times> must be an integer greater than 0.

ID: TEST-THREAD-STRING

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10001 bananas`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and explain why it can't run

ID: TEST-ITERATION-NULL

TEST CASE: `java -jar .\GoatGoatCar.jar a b null 10`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: print <num_times> must be an integer greater than 0.

ID: TEST-THREAD-NULL

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10001 null`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

POSTCONDITIONS: Fail and explain why it can't run

ID: TEST-UNDER-HUNDRED-LOWER-Y

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10 10`

`y`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

2) Give `y` as response to "Continue [y/n]"

POSTCONDITIONS: Continue and give results

ID: TEST-UNDER-HUNDRED-UPPER-Y

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10 10`

`Y`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

2) Give `Y` as response to "Continue [y/n]"

POSTCONDITIONS: Continue and give results

ID: TEST-UNDER-HUNDRED-LOWER-N

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10 10`

`n`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

2) Give `n` as response to "Continue [y/n]"

POSTCONDITIONS: Stop program

ID: TEST-UNDER-HUNDRED-UPPER-N

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10 10`

`N`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

2) Give `N` as response to "Continue [y/n]"

POSTCONDITIONS: Stop program

ID: TEST-UNDER-HUNDRED-RANDOM-CHAR

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10 10`

`a`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

2) Give `a` as response to "Continue [y/n]"

POSTCONDITIONS: Ask again

ID: TEST-UNDER-HUNDRED-NULL

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10 10`

`null`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

2) Give `null` as response to "Continue [y/n]"

POSTCONDITIONS: Ask again

ID: TEST-UNDER-HUNDRED-RANDOM-STRING

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10 10`

`somerandomstring`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

2) Give `somerandomstring` as response to "Continue [y/n]"

POSTCONDITIONS: Ask again

ID: TEST-UNDER-HUNDRED-Y-SPACE-N

TEST CASE: `java -jar .\GoatGoatCar.jar a b 10 10`

`y n`

PRECONDITIONS: When `java -version` is run, system output says "java version "1.8.0_231""

EXECUTION STEPS: 1) Run Test Case

2) Give `y n` as response to "Continue [y/n]"

POSTCONDITIONS: Ask again

3. **Defects**

IDENTIFIER: TEST-ITERATION-AT-HUNDRED

SUMMARY: Asked for confirmation you wanted to run

DESCRIPTION: Per requirements, "If the "number of times" argument is **less than 100**, the system shall issue a warning and ask the user if they wish to continue." Being at 100, system still asks.

REPRODUCTION STEPS: Use java version 1.8.0_231 while running the test case where "number of times" is equal to 100

EXPECTED BEHAVIOR: Succeed and give results without confirming the run

OBSERVED BEHAVIOR: Asked for confirmation on if you wanted to run and would either succeed and output results or stop depending on respsone.

IDENTIFIER: TEST-ITERATION-MAX-INT+1

SUMMARY: System fails and says "number of times" needs to be greater than zero.

DESCRIPTION: When putting MAX_INT+1 into "number of times", I assume the integer number overflows causing it to be a very lage negative number causing the system to output, "<num_times> must be an integer greater than 0."

REPRODUCTION STEPS: Use java version 1.8.0_231 while running the test case where "number of times" is greater than or equal to MAX_INT+1

EXPECTED BEHAVIOR: Fail and explain why it can't run

OBSERVED BEHAVIOR: Failed and output "<num_times> must be an integer greater than 0."

IDENTIFIER: TEST-THREAD-MAX-INT

SUMMARY: System crashes with "OutOfMemoryError: Java heap space" error.

DESCRIPTION: After a certain point, there is an upper thread limit. Should you exceed that limit, your program will either outright crash from the getgo or attempt to run and crash part way into the execution.

REPRODUCTION STEPS: Use java version 1.8.0_231 while running the test case where "number of threads" is greater than some upper limit of threads a system is able to allocate.

EXPECTED BEHAVIOR: Succeed and output results

OBSERVED BEHAVIOR: Crashed with "OutOfMemoryError: Java heap space" error

IDENTIFIER: TEST-THREAD-MAX-INT+1

SUMMARY: System treated the given "number of threads" as a string and crashed with "NumberFormatException: For input string: "2147483648"" error.

DESCRIPTION: When you go over MAX_INT for "number of threads", the system treats it as a string. System has no check that "number of threads" needs to be a number and crashes

REPRODUCTION STEPS: Use java version 1.8.0_231 while running the test case where "number of threads" is greater than MAX_INT.

EXPECTED BEHAVIOR: Fail and explain why it can't run

OBSERVED BEHAVIOR: System crash with "NumberFormatException: For input string: "2147483648"" error

IDENTIFIER: TEST-LARGE-NUMBERS

SUMMARY: System crashes with "OutOfMemoryError: Java heap space" error

DESCRIPTION: There exists some upper thread limit on the system. Exceeding that limit will cause your program to either outright crash or crash partway through execution

REPRODUCTION STEPS: Use java version 1.8.0_231 while running the test case where "number of threads" is greater some upper limit of threads a system is able to allocate.

EXPECTED BEHAVIOR: Succeed and output results

OBSERVED BEHAVIOR: System crash with "OutOfMemoryError: Java heap space" error

IDENTIFIER: TEST-THREAD-FLOAT

SUMMARY: System throws a NumberFormatException when entering a float for the number of threads

DESCRIPTION: When the number of threads given is a float, the system throws an uncaught NumberFormatException

REPRODUCTION STEPS: Use java version 1.8.0_231 while running the test case where "number of threads" is a float.

EXPECTED BEHAVIOR: Prompt the user to enter the correct syntax, like "<num_threads> must be an integer greater than 0."

OBSERVED BEHAVIOR: Exception in thread "main" java.lang.NumberFormatException: For input string: "10.5"

IDENTIFIER: TEST-THREAD-STRING

SUMMARY: System throws a NumberFormatException when entering a string for the number of threads

DESCRIPTION: When the number of threads given is a string, the system throws an uncaught NumberFormatException

REPRODUCTION STEPS: Use java version 1.8.0_231 while running the test case where "number of threads" is a string.

EXPECTED BEHAVIOR: Prompt the user to enter the correct syntax, like "<num_threads> must be an integer greater than 0."

OBSERVED BEHAVIOR: Exception in thread "main" java.lang.NumberFormatException: For input string: "bananas"

IDENTIFIER: TEST-THREAD-NULL

SUMMARY: System throws a NumberFormatException when entering a null for the number of threads

DESCRIPTION: When the number of threads given is a null, the system throws an uncaught NumberFormatException

REPRODUCTION STEPS: Use java version 1.8.0_231 while running the test case where "number of threads" is a null.

EXPECTED BEHAVIOR: Prompt the user to enter the correct syntax, like "<num_threads> must be an integer greater than 0."

OBSERVED BEHAVIOR: Exception in thread "main" java.lang.NumberFormatException: For input string: "null"

IDENTIFIER: TEST-UNDER-HUNDRED-UPPER-N

SUMMARY: System does not recognize 'N' as 'n'.

DESCRIPTION: When 'N' is entered when prompted to continue, the system does not recognize it as an 'n'.

REPRODUCTION STEPS: Use java version 1.8.0_231 and run 'java -jar .\GoatGoatCar.jar a b 10 10', enter 'N' at the continue screen

EXPECTED BEHAVIOR: Continue and Give results

OBSERVED BEHAVIOR: Ask again

IDENTIFIER: TEST-UNDER-HUNDRED-Y-SPACE-N

SUMMARY: System only recognizes the first ‘y’ in ‘y n’

DESCRIPTION: When ‘y n’ is entered when prompted to continue the system just recognizes the ‘y’, and continues

REPRODUCTION STEPS: Use java version 1.8.0_231 and run 'java -jar .\GoatGoatCar.jar a b 10 10', enter 'y n' at the continue screen

EXPECTED BEHAVIOR: Ask again

OBSERVED BEHAVIOR: Continue and give results