Collatz

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1 Test design

1.1 Test 1

C0			
n	max_length	max_size	Description
3	1	11	All statements are reached during iteration.

100% C0-coverage is obtained choosing the n, max_len max_size values to respectively 3, 1 and 11. To obtain 100% statement coverage, we need to make sure to enter the while-loop in the function. When choosing the value n = 3, we enter the while-loop, since the n>1-invariant is satisfied. Len needs to be <= max_len, which is satisfied, since len starts is initialized to 0 and max_len is 1. Lastly, max-size 11 satisfies the n < max_size property. When entering the while-loop the n%2-check is evaluated to false, and we continue to our else-branch, where n = 3n+1. This gives us a new n being 10. (We have chosen the maxsize to be 11 because of this. If maxsize was less then 10, Collatz would not go into the while loop again). Now, we enter the loop again, with n being 10. This time, we know that n%2-check is evaluated to true, which executes n = n / 2. Hereafter, we cannot run the while-loop again, since the invariant is no longer satisfied and thereby we return len, and thereby 100% C0 coverage is obtained.

1.2 Task 2

C1, 100% Branch coverage should ensure every potential combination of branch choices. Therefore I will choose inputs that contemplate this. Since in our branch, we have only have boolean &&'s and no boolean OR's , we know that if one is false, all will be false. I would assume it therefore is only necessary to test for two cases: One where the branch evaluates to true, and one where it evaluates to false.

C1			
n	max_length	max_size	Description
0	1	1	Makes sure n > 1 is evaluated to false. Only one of the conditions needs to be evaluated to false for the whole statement to be false, because of the boolean ANDs.
3	1	11	Makes sure the loop is executed, since every condition is true. True

1.3 Task 3

K-bounded Path coverage for k = 2					
Input Values	n > 1	len max_len	n <max_size	n%2 = 0	Description
n = 0, max_len = 1, max_size = 3	false	true	true	false	Evaluates to false, because n = 0
n = 1, max_len = 1, max_size = 3	false	true	true	false	Returns 1, since Collatz has been modified to return 1 when n = 1
n = 2, max_len = 1, max_size = 6	true	true	true	true	Returns 1, since 2%= 0 is evaluated.

All paths have been executed for k = 2 since the condition of n = 0 is checked, which ensures the branch is evaluated to false, n = 1 is checked, which returns 1, since collatz has been modified to return 1 when n = 1 and finally, n = 2 is checked, which ensures that n%2= 0 is evaluated to true, which returns 1.

C0	
val	Description
true	Executes first branch
false	Executes second branch. 100% coverage can only be obtained by the method evaluating both true to false. "val"cannot be both true and false at once. Therefore the minimum number of test cases to ensure it, is two.