N1a Collatx Tivenan

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1 Conjectures

1. Of a given length number n $\geq$3, the three greatest values of the sequence which lengths that are n or less than, are always even.

The reasoning behind this proof was at the smallest length at the odd number which is found, 6 for the number 5 $(5, 16, 8, 4, 2, 1)$. there are three even integers that have the same length but are greater than 5. I look at more examples and found the same true. For example length 7 has numbers, (64,32,16) length 8 has numbers (128,64,32) and length 9 (256,128,64). My examples do not proove this true rather show a trend and a possibility.

2. In the collatz conjecture for every input of, 2^a where a is an integers. The number of terms in the sequence are equal to a*n+1 an odd number of terms in the collatz conjecture. some fixed a and some integer n.

3. For a given length of terms in the collatz conjecture, the greatest even integer will always be greater than the greatest odd integer with the given length.

I found the numbers 2^n to be extremely huge but don't produce a lot of terms to reach to one in fact only n+1 times. Compare to odd integers smaller numbers take a longer time to reach 1. This would lead to the conclusion of a given length, it is much more likely to have a huge 2^n number rather than a smaller odd number. This is obviously not a proof I would have to show mathematically the exponential increase of 2^n compare to odd numbers, and compare this too there length in the collatz conjecture.

2 Proof

Proof. Let $a \in \mathbb{Z}$ where 2^a is the first term in the collatz sequence. Then from the collatz conjecture,

$$\frac{2^a}{2} = 2^{a-1} \text{ 2nd term,}$$
$$\frac{2^a}{2} = 2^{a-2} \text{ 3rd term,}$$
$$\frac{2^a}{2} = 2^{a-3} \text{ 4th term,}$$

In order to get to one, we must divide 2 into 2^a by a times.

$$\frac{2^a}{2^a} = 1 \text{ ath term,}$$

Since we include 2^a as our first element we say that sequence has $a + 1$ terms in the Collatz conjecture.

$\square$