

How do we divide \mathbb{N} in 2? We **divide** \mathbb{N} in 2 **by multiplying** it's elements by 2 and deduct one element to get to see the other half:

$\mathbb{N}/2 \equiv 2n \wedge 2n - 1$. \mathbb{N} is now divided in even and odd numbers.

Any even number can be divided by 2 or a multiple of 2 so that the result will be odd. So, if we can proof the conjecture of Collatz for the odd numbers then also the even numbers are proven.

Let's analyse what is happening when we apply the Collatz sequence to the odd numbers. The first thing we must do is multiply them by 3 and add 1. Next, we must divide those results by 2 because the result is always even.

In other words, we may divide the odd number sequence in two as well. Let's start with the sequence $2n-1$, these are all odd numbers. We can divide that sequence in $4n-1$ and $4n-3$.

Now we apply the Collatz sequence on these odd number sequences:

$3(4n - 3) + 1 = 12n - 8$ we divide 2 times by 2 and we get $3n - 2$

$3(4n - 1) + 1 = 12n - 2$ this is a subset or subsequence of $3n - 2$ so if $4n - 3$ is proven then $4n - 1$ is proven.

Now we can continue the same way dividing the odd number sequences and we will see that there will be always one odd number sequence whose results, after applying the Collatz sequence, are not a subset (the sequence $3n-2$).

What we see next is that there are two sequences, the even number sequence 2^n that multiplies with n and the sequence $(2^{2n}+2)/6$ that is deducted from the even number sequence. The sequence 2^n needs to be divide in 2 as well to eliminate the subsets $(6n-2)$. This leaves us with the sequence 4^n . The common difference between the sequence 4^n and $(2^{2n}+2)/6$ is $(4^n-1)/3$.

Odd number sequence	Produces	2^n	$(2^{2n}+2)/6$	Common difference	$(4^n-1)/3$
$2n-1$	$3n-1$	2	1	1	
$4n-3$	$3n-2$	4	3	1	1
$8n-3$	$6n-2$	8	3	5	
$16n-11$	$3n-2$	16	11	5	5
$32n-11$	$6n-2$	32	11	21	
$64n-43$	$3n-2$	64	43	21	21
$128n-43$	$6n-2$	128	43	85	
$256n-171$	$3n-2$	256	171	85	85
$512n-171$	$6n-2$	512	171	341	
$1024-683$	$3n-2$	1024	683	341	341

When we put that common difference sequence in the Collatz sequence, we get the even number sequence 4^n .

The result for any n in that sequence can be divided by 2 that many times as needed to reach 1 and therefore the Collatz conjecture is true.

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