PROOF OF COLLATZ CONJECTURE.

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1 Introduction.

The Collatz Conjecture states that, given any natural number n, we will always reach the number 1 by applaying the following function f to n as many time as necessary- If f(n) is even, divide n by 2, and if f(n) is odd, multiply n by 3 and add 1.

The method used is to have found a counterexample, it is, a value for wich the Conjecture does not hold.

2 Demonstration.

Let the number $2^n - 1$ where n is a natural number, and $2^n - 1$ is an odd natural number.

Then:

$3(2^n - 1) + 1 = 3(2^n) - 2$,a number divisible by 2.

Dividing by 2 we obtain the number:

$3\left(2^{n-1}\right) - 1$,wich is an odd number.

Then:

$3\left(32^{n-1} - 1\right) + 1 = 3^2 2^{n-1} - 2$, a number divisible by 2.

Dividing by 2 we obtain de number:

$3^2\left(2^{n-2}\right) - 1$, wich is an odd number.

Performing this operation n times we obtain the even number:

$3^n - 1$.

On the other hand, maiking

$n = 2t - 1$ we obtain:

$3(2t - 1) + 1 = 6n - 2 = 2(3t - 1)$

Let $t = 3^4$

$2\left(3^5 - 1\right) = 484$

$\frac{484}{2} = 242. \Longrightarrow \frac{242}{2} = 121$

$2(3x121 - 1) = 724 \Longrightarrow \frac{724}{2^2}. = 181$

$2(3x181 - 1) = 1084 \Longrightarrow \frac{1084}{2^2} = 271$

$2(3x271 - 1) = 1624. \Rightarrow \frac{1624}{2^3} = 203.$

$2(3x203 - 1) = 608. \Rightarrow \frac{608}{2^5} = 19.$

$2(3x19 - 1) = 112. \Rightarrow \frac{112}{2^4} = 7$

$2\,(3x7-1)=40.\Rightarrow\frac{40}{2^3}=5$
$2\,(3x5-1)=28.\Rightarrow\frac{28}{2}=7$
$2\,(3x7-1)=20\Rightarrow\frac{20}{2^2}=5$
The orbit is periodic.

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