Collatz Conjecture Proof (Work in Progress)

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1 Preface

$$0 \in \mathbb{N} \tag{1}$$

$$a \operatorname{mod}_k b := a - b \left\lfloor \frac{a}{b} \right\rfloor + k \tag{2}$$

$$a \bmod b := a \ \operatorname{mod}_0 \ b \tag{3}$$

2 Proof

Proof. let $n, m, k, p \ \in \mathbb{N},\ f(x) = \begin{cases} 3x+1,\ x \bmod 2 \equiv 1 \\ \frac{x}{2},\ x \bmod 2 \equiv 0 \\ \text{undef, otherwise} \ \ (x \notin \mathbb{Z}) \end{cases}$

$\log_2 x \in \mathbb{N} \iff 1$ is reached after $\log_2 x$ iterations.

$3^p n \neq 2^k \forall n \neq 2^m$. Therefore multiplying by 3 has no effect on the ability to reach 2^n and neither does dividing by 2. $3n + 1 \stackrel{?}{=} 2^k \wedge 3n + 2 \stackrel{?}{=} 2^k \therefore$ adding does have an effect.

$|\mathbb{N}| = \infty = \left|2^{\mathbb{N}}\right|$ (there are infinite 2^ns).

One of the 2^ns will always be reached because iterating through f will add 1 every time it is odd. ∎

3 Footnotes

This will only prove for $x \in \mathbb{N}$.

The formulas for f or mod have to change for $x \in \mathbb{I}, \mathbb{C}$

ie: $3i \bmod 2 = i \notin \{1, 0\}$.

The conjecture does not hold $\forall x \in -\mathbb{N}$ because $x = -5$ loops.