Every Number is Actually One: An Investigation of the Collatz Conjecture

Akaash Sanyal

Mathematical Evolutions

Jennifer McCarthy and Jonathan Phillips

Summer Ventures in Science and Mathematics

The University of North Carolina at Charlotte

Abstract

The Collatz Conjecture has puzzled mathematicians for decades, with its tantalizingly simplistic equation. The conjecture states that all numbers will reduce down to one if inputted into a two part recursive equation. The function is as follows:

$$C(x) = \begin{cases} \frac{x}{2} & \text{if } x \text{ is even.} \\ 3x + 1 & \text{if } x \text{ is odd.} \end{cases}$$

In other words, even numbers should be divided by two, and odd numbers should be tripled and then added to one. There have been a number of attempted proofs in the past, but each time some mistake is found, baffling those bold enough to attempt a proof. This paper includes my attempts to prove it, using proof by induction, as well as two computer programs in C++ that I created to aid me in the search for an answer. The latter of the programs deal with binary and if there are any possible solutions or pattern hidden in this layout. Finally, I will delve into the problem of why this conjecture is so difficult to prove.