A Counterexample in Number Theory: Falsification of a Computational Conjecture

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Abstract

We report the falsification of the following conjecture: For any integer n > 1, let S(n) be the set of odd numbers encountered in the Collatz trajectory of n before reaching 1. Let m = min(S(n)). Then the total stopping time (number of steps to reach 1) is strictly less than m^{}2 + m.. A counterexample was discovered computationally: witness = 50000. This result was obtained by the SOVEREIGN autonomous research system.

1 Introduction

The number theory domain contains many open problems. This paper reports a computational or formal result concerning: Collatz conjecture — structural pattern search. The result was obtained autonomously by the SOVEREIGN Research Kernel, an autonomous mathematical research system that generates, tests, and formally verifies mathematical conjectures without human intervention.

2 The Conjecture

The following conjecture was generated by the SOVEREIGN Research Kernel and subjected to automated falsification search:

Conjecture 1. *For any integer n > 1, let S(n) be the set of odd numbers encountered in the Collatz trajectory of n before reaching 1. Let m = min(S(n)). Then the total stopping time (number of steps to reach 1) is strictly less than m^{}2 + m.*

3 Counterexample

Theorem 1 (Falsification)**.** *The conjecture above is* ***false****. A counterexample is given by:*

$$witness = 50000$$

Proof. Direct computation verifies that the witness 50000 satisfies the negation of the conjecture. The verification was performed by the SOVEREIGN counterexample search module. □

4 Implications

The falsification of this conjecture clarifies the boundary of what is provable in the number theory domain. The counterexample serves as a constraint for future conjecture generation and helps the SOVEREIGN system refine its mathematical intuitions.