

A Counterexample in Number Theory: Falsification of a Computational Conjecture

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Abstract

We report the falsification of the following conjecture: For every even integer $n \geq 10,000$, there exists a Goldbach partition $n = p + q$ (where p and q are prime) such that both p and q lie within the interval $[n/2 - \sqrt{n}, n/2 + \sqrt{n}]$ AND at least one of the primes p or q has a decimal representation. A counterexample was discovered computationally: witness = 50000. This result was obtained by Assignee Research.

1 Introduction

The number theory domain contains many open problems. This paper reports a computational or formal result concerning: Goldbach conjecture — computational extension. The result was obtained autonomously by Assignee Research, 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 Assignee Research and subjected to automated falsification search:

Conjecture 1. *For every even integer $n \geq 10,000$, there exists a Goldbach partition $n = p + q$ (where p and q are prime) such that both p and q lie within the interval $[n/2 - \sqrt{n}, n/2 + \sqrt{n}]$ AND at least one of the primes p or q has a decimal representation that contains the digit sequence of $n/2$ as a substring.*

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 Assignee Research counterexample search module. \square

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 Assignee Research system refine its mathematical intuitions.