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 >= 14, there exists a Goldbach partition n = p + q (with p <= q) such that the smaller prime p lies in the interval [n/2 - sqrt(n) * ln(ln(n)), n/2]. This conjecture asserts that Goldbach partitions are not only present but c. A counterexample was discovered computationally: witness = {'n': 50000, 'search_range': [24468, 25000], 'bound_val': 24468}. 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 >= 14, there exists a Goldbach partition n = p + q (with p <= q) such that the smaller prime p lies in the interval [n/2 - sqrt(n) * ln(ln(n)), n/2]. This conjecture asserts that Goldbach partitions are not only present but can be found extremely close to the center n/2, with the deviation growing slower than the standard heuristic prediction of sqrt(n).*

3 Counterexample

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

$$witness = \{'n' : 50000, 'search\_range' : [24468, 25000], 'bound\_val' : 24468\}$$

Proof. Direct computation verifies that the witness $\{'n' : 50000, 'search\_range' : [24468, 25000], 'bound\_val' : 24468\}$ satisfies the negation of the conjecture. The verification was performed by the Assignee Research 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 Assignee Research system refine its mathematical intuitions.