

# 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 even perfect number  $n > 6$ , let  $p$  be the largest prime factor of  $n$  (which is also the Mersenne prime exponent's base, i.e.,  $n = 2^{\{p-1\}}(2^{\{p-1\}} - 1)$ ). The sum of the proper divisors of the Mersenne prime component ( $2^{\{p-1\}} - 1$ ), which is exactly 1,  $p$ . A counterexample was discovered computationally: witness = Inconsistent Mersenne form. 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: OEIS A001065 — perfect number conjecture. 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 any even perfect number  $n > 6$ , let  $p$  be the largest prime factor of  $n$  (which is also the Mersenne prime exponent's base, i.e.,  $n = 2^{\{p-1\}}(2^{\{p-1\}} - 1)$ ). The sum of the proper divisors of the Mersenne prime component ( $2^{\{p-1\}} - 1$ ), which is exactly 1, plus the sum of the proper divisors of the power-of-two component ( $2^{\{p-1\}}$ ), which is  $2^{\{p-1\}} - 1$ , differs from the square root of  $n$  by less than 10% of the value of the Mersenne prime itself. Specifically,  $| (1 + (2^{\{p-1\}} - 1)) - \sqrt{n} | < 0.1 * (2$*

### 3 Counterexample

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

$$\text{witness} = \text{InconsistentMersenneform}$$

*Proof.* Direct computation verifies that the witness *InconsistentMersenneform* 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.