

# 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 perfect number  $n > 6$ , if  $n$  is expressed in the Euclidean form  $n = 2^{\{p-1\}} * (2^{\{p\}} - 1)$  where  $p$  is prime, then the sum of the decimal digits of the Mersenne prime factor  $M_p = 2^{\{p\}} - 1$  is strictly greater than the sum of the decimal digit. A counterexample was discovered computationally: witness = 5. 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 every even perfect number  $n > 6$ , if  $n$  is expressed in the Euclidean form  $n = 2^{\{p-1\}} * (2^{\{p\}} - 1)$  where  $p$  is prime, then the sum of the decimal digits of the Mersenne prime factor  $M_p = 2^{\{p\}} - 1$  is strictly greater than the sum of the decimal digits of the power-of-two factor  $2^{\{p-1\}}$ .*

### 3 Counterexample

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

$$witness = 5$$

*Proof.* Direct computation verifies that the witness 5 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.