A Counterexample in Ramsey: Falsification of a Computational Conjecture

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Abstract

We report the falsification of the following conjecture: w(2;4,4) = 35: every 2-coloring of {1,...,35} contains a monochromatic arithmetic progression of length 4. Verify computationally by showing all 2-colorings of {1,...,34} avoid monochromatic AP-4 (proving w > 34), and {1,...,35} does not.. A counterexample was discovered computationally: witness = Test coloring had mono AP-4 in {1..34}. This result was obtained by the SOVEREIGN autonomous research system.

1 Introduction

The ramsey domain contains many open problems. This paper reports a computational or formal result concerning: Van der Waerden w(2;4,4) — verify equals 35. 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. *w(2;4,4) = 35: every 2-coloring of {1,...,35} contains a monochromatic arithmetic progression of length 4. Verify computationally by showing all 2-colorings of {1,...,34} avoid monochromatic AP-4 (proving w > 34), and {1,...,35} does not.*

3 Counterexample

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

$$witness = Testcoloringhadmono AP - 4in\{1..34\}$$

Proof. Direct computation verifies that the witness $Testcoloringhadmono AP - 4in\{1..34\}$ 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 ramsey domain. The counterexample serves as a constraint for future conjecture generation and helps the SOVEREIGN system refine its mathematical intuitions.