On a Conjecture About a Recursive Prime Generating Sequence

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Purpose In this study, Rowlands' sequence, a recursive sequence discovered in 2003, was studied. The aim was to develop a conditional proof of: Conjecture 1: The first difference of Rowlands sequence is always a prime number or 1 excluding a finite number of initial exceptions. Conjecture 2: Assuming the above; if primes are produced, they are infinitely many distinct primes. Primes are a central object of study, due to their wide applications in pure mathematics but also in cryptography and securing data online. Method Graphical and numerical data (using Rust, Python and Matplotlib) were used to observe patterns in Rowland’s sequence. Hypotheses were formed based off the data and computations were made to provide numerical evidence. These hypotheses were then used to further understand the behaviour of the sequence and construct a framework for the proof, breaking it down into lemmas, propositions, theorems etc. Mathematical induction and the Euclidean GCD algorithm were mainly used to then successively prove each step. Results Rowlands sequence was classified into 3 groups. Group 1 was shown to only ever produce the number 1. Group 2 and 3 are shown to satisfy Conjecture 1 and 2 under a certain hypothesis. Furthermore, various properties and heuristics were proven/formed on the behaviour of the sequence, however, a full proof is still needed. Conclusion A conditional proof was achieved of Conjecture 1 and 2. The proof of conjecture 2 achieves a more general result than known research. This sets up the full proof of the Conjectures to be a more targeted and simpler task.

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