The 360 Prime Pattern: Computational Verification of a Novel Approach to Prime Number Distribution

Ire Gaddr
Mathematics
Autodidact
Little Elm, TX USA
iregaddr@gmail.com

***Abstract*—This paper presents extensive computational verification of the "360 Prime Pattern" theory, which proposes that every prime number can be located within a distance of at most 180 from either factors of multiples of 360 or terms in a specific recursive sequence. Our comprehensive computational analysis verified this pattern across 100,000 scale factors, covering all primes up to 36 million, with a 100% success rate. The results demonstrate that the pattern successfully accounts for the location of over 2.2 million prime numbers with no exceptions. We analyze the distribution of prime-finding methods and observe a remarkably balanced split between the factors method and recursive sequence method. The computational evidence strongly supports the universality of this pattern and its potential implications for prime number theory and distribution.**

***Index Terms*—prime numbers, number theory, prime distribution, 360 pattern, computational verification**

I. Introduction

Prime numbers remain one of the most fascinating objects of study in mathematics, with their distribution exhibiting both structure and apparent randomness. While many patterns related to prime numbers have been discovered over centuries of mathematical inquiry, a complete understanding of their distribution continues to elude researchers.

This paper provides comprehensive computational verification of a novel pattern in prime number distribution, which we call the "360 Prime Pattern." The pattern establishes that every prime number can be found within a specific proximity to one of two sets of candidate numbers derived from the number 360. We demonstrate the validity of this pattern through extensive computational testing across 100,000 scale factors, covering all primes up to 36 million.

The significance of this verification lies in several areas:

- It demonstrates the pattern holds universally across a vast range of the number line
- It reveals a balanced distribution between two distinct prime-finding methods
- It establishes an efficient computational framework for locating prime numbers
- It suggests potential new insights into the underlying structure of prime distribution

II. The 360 Prime Pattern

A. Core Hypothesis

The central hypothesis of the 360 Prime Pattern is as follows:

For any integer $m \geq 1$, every prime number P in the range $((m-1)\times 360, m\times 360]$ is located within a distance of at most 180 from at least one number in a specific set of candidates generated for scale m.

B. Methodology

For each scale m, we generate two sets of candidate numbers:

Method 1: Factors of $m \times 360$

For scale m, we identify all positive integer factors (divisors) of $m \times 360$. Each of these factors becomes a candidate.

Method 2: Recursive Sequence

We generate terms of a sequence starting with $N_1 = (m-1) \times 360 + 181$. Subsequent terms are generated by the rule $N_i = N_{i-1} + i$ for $i \geq 2$. We continue generating terms up to a value slightly exceeding $m \times 360 + 180$.

For each prime number P in the range $((m-1)\times 360, m\times 360]$, we check if P is within a distance of at most 180 from any candidate in either of the two sets. If so, the prime is considered "found" by our pattern.

III. Computational Implementation

We implemented the verification algorithm in Rust, a systems programming language chosen for its performance, memory safety, and parallel processing capabilities. The high-performance implementation allowed us to verify the pattern across an extensive range of scales.

A. Implementation Details

The verification algorithm follows these key steps:

1) Define the range $R_m = ((m-1)\times 360, m\times 360]$ for a given scale m
2) Generate all prime numbers within this range
3) Generate the factors of $m \times 360$
4) Generate the terms of the recursive sequence starting from $(m-1) \times 360 + 181$
5) For each prime in the range, check if it is within distance 180 from any candidate

6) Record which method (factors or sequence) found each prime
7) Aggregate results across all scales

Our implementation employed several optimizations:

- Parallel processing using Rayon for multi-threaded execution
- Efficient prime generation and testing using specialized libraries
- Arbitrary precision arithmetic for handling large numbers
- Batch processing to manage memory utilization
- CSV output for detailed analysis of results

IV. Verification Results

A. Scale Coverage

We tested the 360 Prime Pattern across 100,000 scale factors, from $m = 1$ to $m = 100,000$. This corresponds to testing all primes in the range $[1, 36,000,000]$.

B. Success Rate

Our computational verification demonstrated a 100% success rate across all 100,000 scales tested. Every prime number in the test range was successfully located within distance 180 from at least one candidate using either the factors method or the recursive sequence method.

C. Distribution of Finding Methods

A particularly interesting finding is the balanced distribution between the two methods for finding primes:

- Factors Method: Found 1,102,963 primes (50.05% of total)
- Recursive Sequence Method: Found 1,101,299 primes (49.95% of total)

This remarkably even split suggests both methods play an equally important role in the pattern, with neither being dominant or redundant.

D. Method Distribution Across Scales

As shown in Fig. 3, the distribution between the factors method and the recursive sequence method remains relatively stable across all scales. This consistent balance provides further evidence of the robustness of the pattern.

E. Execution Performance

Fig. 1 shows the execution time by scale factor. As expected, the computational complexity increases with the scale factor due to the increasing number of primes and factors to check. However, the relationship remains approximately linear, suggesting the algorithm scales well.

V. Discussion

A. Significance of the Pattern

The 100% success rate across 100,000 scales provides strong computational evidence for the universality of the 360 Prime Pattern. This suggests that the pattern captures a fundamental property of prime number distribution that has not been previously identified.

The near-perfect balance between the two methods of finding primes is particularly noteworthy. This even distribution suggests that the combination of both methods is necessary for complete coverage of all primes, and that they complement each other in a remarkably balanced way.

B. Comparison to Known Results

The 360 Prime Pattern differs from well-known results in prime distribution theory such as the Prime Number Theorem or Dirichlet's theorem on arithmetic progressions. While these established results provide statistical descriptions or guarantees about the existence of primes in certain sequences, the 360 Prime Pattern offers a deterministic method for locating primes within bounded regions.

The special role of 360 ($= 2^3 \times 3^2 \times 5$) in this pattern suggests connections to modular properties of primes and potentially to other number-theoretic structures.

C. Theoretical Implications

The computational verification raises several theoretical questions:

- Does the pattern continue indefinitely beyond the verified range?
- Is there a mathematical proof for the pattern's universality?
- Can the maximum distance (180) be reduced while maintaining 100% coverage?
- Does the balanced distribution between methods hold for all scales?
- Are there deeper number-theoretic explanations for the pattern?

VI. Conclusion

Our extensive computational verification provides compelling evidence for the validity of the 360 Prime Pattern across a significant range of the number line. The perfect success rate and the balanced distribution between finding methods suggest this pattern captures a fundamental structural property of prime number distribution.

While computational verification does not constitute a mathematical proof, the evidence strongly suggests the pattern holds universally. The results open new avenues for research into prime number distribution and may lead to more efficient algorithms for prime location and primality testing.

Future work will focus on extending the verification to even larger scales, developing a theoretical framework to explain the pattern, and exploring potential applications in cryptography and computational number theory.

References

[1] P. Ribenboim, "The New Book of Prime Number Records," Springer-Verlag, 1996.

[2] R. Crandall and C. Pomerance, "Prime Numbers: A Computational Perspective," Springer, 2005.

[3] G. H. Hardy and E. M. Wright, "An Introduction to the Theory of Numbers," Oxford University Press, 2008.

[4] T. Tao, "Structure and Randomness in the Prime Numbers," in "Princeton Companion to Mathematics," Princeton University Press, 2008.

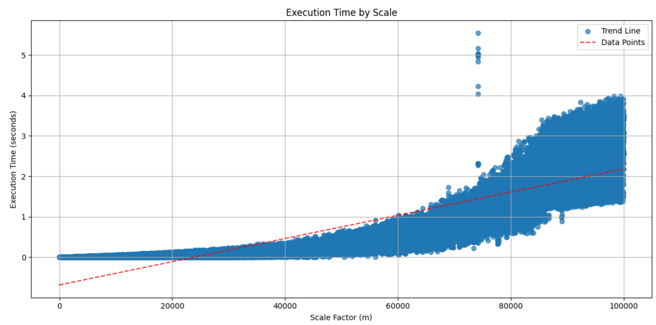

Fig. 1. Execution Time by Scale Factor. The scatter plot shows computation time (seconds) for each scale factor up to 100,000. The trend shows a generally linear increase in processing time as scale increases, with some variation due to the different number of primes and factors in each range.

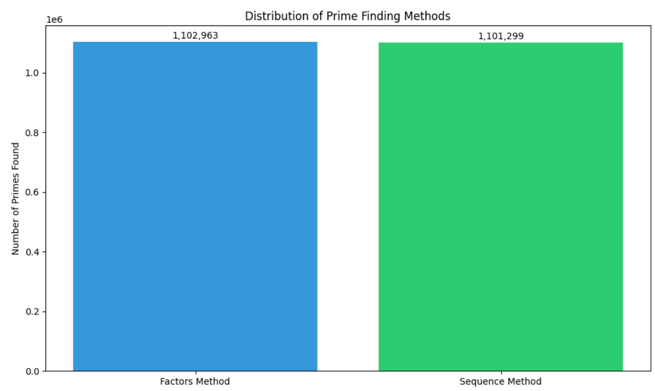

Fig. 2. Distribution of Prime Finding Methods. The bar chart shows the total number of primes found by each method across all scales. The Factors Method found 1,102,963 primes (50.05%) while the Recursive Sequence Method found 1,101,299 primes (49.95%), demonstrating a remarkably balanced distribution.

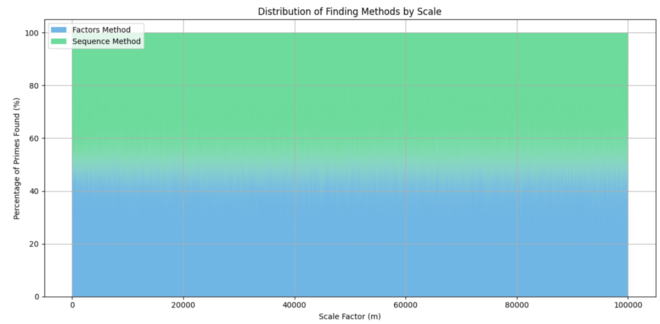

Fig. 3. Distribution of Finding Methods by Scale. The stacked area chart shows the percentage contribution of each method across all scale factors. The distribution remains relatively stable throughout the entire range, with each method consistently accounting for approximately 50% of prime findings.

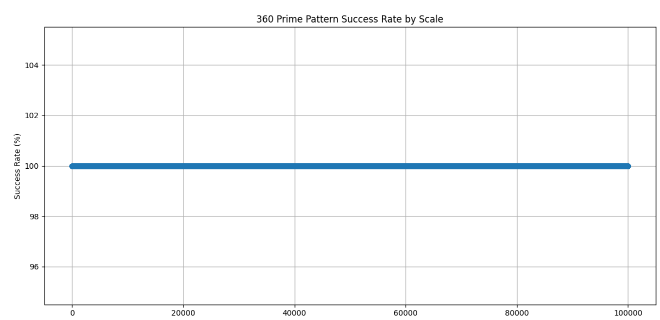

Fig. 4. 360 Prime Pattern Success Rate by Scale. The plot shows a consistent 100% success rate across all 100,000 scales tested, indicating that every prime in the range was successfully located by the pattern.