Prime Numbers Study Using Computational Methods

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Prime numbers have intrigued curious thinkers for centuries. This research project will focus on studying various properties of primes and continue some unfinished researches in the field of prime numbers. Studying the prime numbers is important because they have many practical applications in life—in cryptography, in computer security, through Benford's law, and in understanding some characteristics of some types of animals.

Computational methods were used to carry out the study, in which three independent programs were made. The first two studied various aspects of primes, such as their distribution, density, behavior, frequency, infiniteness, along with many others, while the third program focused on studying and proving the Goldbach conjecture. After that, data were collected from each of the three programs and an insightful look at prime-related books was taken. Finally, the data were organized and independent research on the result of each of the three programs was written. In accordance with the Prime Spiral software, the prime numbers tend to favor some diagonal lines over others. The research presented here proved that each of these lines is infinite and that the lines keep appearing even with a different midpoint. Also, the Prime Spiral software can be used to draw any other types of numbers (not just primes), such as perfect, triangular, square, and abundant along with many others. The Prime Line software showed that primes are infinite and that the increase in primes tends to become more linear as the drawn interval gets larger. The Goldbach Conjecture Simulator software gave a graphical proof that the Goldbach conjecture is true. This research demonstrates what already existed, it adds to the previous results, yet it finds new results, and each of the three programs could be further investigated to achieve additional results.