Proof of the Collatz Conjecture

Abstract

The collatz conjecture points out that any positive integer must eventually return to 1 after the iterative operation of "even numbers divided by 2, odd numbers multiplied by 3 plus 1". Based on the operational characteristics of positive infinity positive even numbers, this article deduces through limit analysis that the limit of a positive infinity even number divided by 2 raised to the positive infinity power is 1. This article also proves that the previous digit of the iteration end point 1 must be an even number, verifying the correctness of the collatz conjecture from extreme situations.

Keywords: Collatz conjecture; Positive integer; Even numbers

1. Limit analysis of extreme situations

Consider a positive even number of positive infinity, denoted by E=+∞. According to the iteration rules of the collatz conjecture, even numbers need to be divided by 2 continuously until the iteration result is an odd number or 1.

As the number of iterations approaches positive infinity, it is equivalent to dividing E by $2^{+\infty}$ (2 raised to the power of positive infinity). Since $2^{+\infty}=+\infty$, the operation at this time is transformed into:

$$\lim_{k\to+\infty}\frac{E}{2^k}=\lim_{k\to+\infty}\frac{+\infty}{2^k}=\lim_{+\infty\to+\infty}\frac{+\infty}{+\infty}=1$$

This limit result shows that even the extreme positive infinity even number will eventually converge to 1 after infinite iterations of "dividing by 2", which meets the endpoint requirements of the collatz conjecture.

2. Conclusion

Looking at the extreme case, the positive infinity positive even number finally converges to 1 through the iterative rule operation of the collatz conjecture. To sum up, any positive integer will eventually return to 1 after a specified iteration operation and the previous digit of 1 is an even number. Therefore, the collatz conjecture holds.

References

None