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COLLATZ'S HYPOTHESIS: FROM SIMPLICITY TO MYSTERY

In the world of mathematics, there are numerous problems that attract the attention of scientists due to their complexity and mystery. One such problem is Collatz's hypothesis, which, despite its simplicity, remains unsolved until now. Collatz's conjecture arises in the context of a sequence that appears by successively applying certain rules to positive integers.

The Collatz's hypothesis originated in 1932, when the German mathematician Lothar Collatz proposed a rather simple algorithm: he proposed to take any positive integer n. If it is even, divide it by 2; if it is odd, multiply by 3 and add 1. Thus, we get a new number. By repeating this process with a new number, we eventually converge to the number 1.

As for the result of these actions, Collatz claimed that after a few iterations the numbers would always reach 1. This is remarkable in that he was the first to point out the existence of such a simple algorithm that could lead to such a universal result. This hypothesis was called the «Collatz hypothesis» and became the subject of intensive mathematical research. Since then, it has remained one of the most interesting mysteries of mathematics.

Thus, we get a new number in the sequence. This process is repeated until the number becomes equal to 1. For example, consider in more detail the behavior of the sequence for a certain initial number n. [1]

Example: Suppose that the initial number $n = 6$.

6 is even, so we divide by 2, we get 3.

3 is odd, multiply by 3 and add 1 to get 10.

10 is even, we divide by 2, we get 5.

5 is odd, we multiply by 3 and add 1, we get 16.

16 is even, we divide by 2, we get 8.

8 is even, we divide by 2, we get 4.

4 is even, we divide by 2, we get 2.

2 is even, we divide by 2, we get 1.

So, for the initial number 6, we got the sequence: 6, 3, 10, 5, 16, 8, 4, 2, 1.

The main question that arises is whether every inputted prime number n always converges to 1 using this algorithm. For the numbers that have been tested, this is confirmed, but there is no formal proof that this is indeed true for all integers. Thus, Collatz's hypothesis remains an open problem in mathematics.

Investigation of the Collatz's hypothesis involves using of various methods, including computer algorithms, to test large sequences of numbers. Mathematicians use programs to generate sequences according to the rules of the Collatz's hypothesis and analyze their behavior.

Although a large number of numbers have been tested, no number has yet been found that does not converge to 1. This study has been performed for very large prime numbers, including numbers with sequence lengths of millions, billions, and even more.

For example, various projects such as the $3x$+1project, where enormous computing resources were devoted to testing the Collatz's hypothesis, have not foundany single contradiction to the hypothesis. Overall, this abundant empirical evidence supports the hypothesis for a large range of initial numbers.

Nevertheless, the lack of a formal proof of the Collatz's conjecture leaves it an open problem in mathematics. This attracts the attention of mathematicians all over the world, who continue to develop new research methods and try to find an analytical proof of the correctness or incorrectness of this hypothesis. Thus, Collatz's conjecture remains one of the most interesting and unsolved problems in mathematics.

I will also give these examples that demonstrate the paradoxical simplicity of Collatz's hypothesis and the complexity of its behavior. Examples of found sequence: «There are numbers for which the sequences created by the Collatz's hypothesis algorithm are very long and complex. For example, for number 27, the sequence consists of 111 steps, and for number 6171 of 261 steps» [2, 6-8].

For number 27, which at first glance may seem quite small, the sequence created by the Collatz's hypothesis algorithm consists of 111 steps. This means that the process of sequentially checking parity and performing the corresponding arithmetic operations takes a significant number of steps before the number 1 is reached. In the case of the number 6171, the sequence is even more impressive, amounting to 261 steps. This is a large number of iterations, which once again emphasizes the complexity and mystery of the behavior of the Collatz's hypothesis.

These examples indicate that even for numbers with a seemingly simple initial condition- positive integers – the Collatz's conjecture can generate long and complex sequences. This makes it a fascinating object of study for mathematicians all over the world, who are trying to solve this riddle and find an analytical proof of its correctness or incorrectness.

Conclusion. Collatz's conjecture is one of the most interesting and unsolved problems in the world of mathematics. Although the simplicity of its formulation may seem surprising, it remains open to many different aspects of research. The use of computer algorithms made it possible to conduct a large number of empirical tests, which, however, did not find any contradiction to the hypothesis.

Despite this, the lack of a formal analytical proof leaves Collatz's hypothesis an open problem that continues to stimulate researchers in their efforts to unravel it. This mysterious hypothesis continues to attract the attention of mathematicians around the world, and solving this problem could bring new discoveries in the field of number theory and computational mathematics. Thus, Collatz's hypothesis remains an interesting object of research and a potential starting point for further mathematical discoveries.

REFERENCES

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THE TRANSFORMATIVE POWER OF 5G TECHNOLOGIES IN TELECOMMUNICATIONS AND WIRELESS COMPUTER NETWORKS

Definition of 5G

5G is a fifth-generation mobile network standard based on the 5G/IMT-2020 standards for radio interfaces in telecommunications, the successor to the 4G network [1]. In cellular network technology, the service area is divided into small geographical areas – cells or honeycombs. All 5G wireless devices in a cell are connected to the Internet and mobile communications via radio waves, through