# Proof of the Goldbach's Conjecture

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***Abstract*—This article solves the problem using the Formula of Disjoint Sets of Odd Numbers numbers that I proposed**

***Index Terms*—algorithm**

## I. Definition of the Goldbach's Conjecture

Definition: Each even number $(x)$ can be represented as a sum of two primes $(y_o)$.

## II. Algorithm for Proof of the Goldbach's Conjecture

### A. Chains of Odd Numbers

Sequence of even numbers $\{x\}$ is a sequence of chains of odd numbers $y$ of the form $1 \leq y \leq (x-1)$, which are closed by the expression $1+(x-1)$ from the side **A**. These chains are closed by the expression $(x/2)+(x/2)$ from the side **B** if $(x/2)$ is an odd number, otherwise - by the expression $((x/2)-1)+((x/2)+1)$. The addition of mutually directed chain links gives the original even number $x$.
See Fig. 1, Fig. 2, Fig. 3.

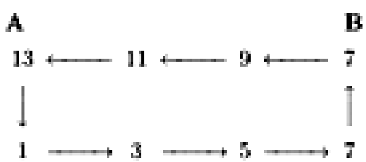


Fig. 1. For the number fourteen

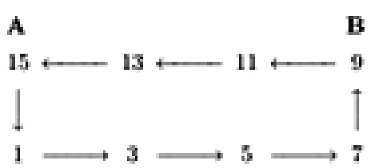


Fig. 2. For the number sixteen

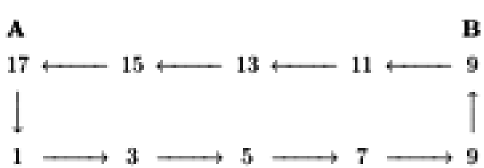


Fig. 3. For the number eighteen

### B. Conclusion 1

Each new even number is a consecutive shift to one larger value in the expressions in the chain $y$ with respect to a smaller value. A new links of the chain $y$ appears when the expression $(x/2)+(x/2)$ appears on the side **B**.

### C. New Definition of the Goldbach's Conjecture

Goldbach's Conjecture means that with each shift in the links of the chain $y$ and the appearance of a new links of the chain there are always mutually directional chain links, where only the primes $(y_o)$.

Half of the smaller values of the chain $y$ are practically unchanged, only gradually added from the side of **B** by smaller values of the opposite half of the chain.
As the value of $x$ increases, the fraction $y_o$ decreases in both halves of the chain $y$, but especially at half the large values.

### D. Formula of Disjoint Sets of Odd Numbers

The entire infinite sequence of odd numbers $\{y\}$ can be represented as disjoint sets.
Let the frequency of appearance of all odd numbers $y$ - 100%.
Then:

$$\Bigg(0{,}0\ldots01\%(1)+33{,}3\ldots3\%(\{3y\})+ + \sum_{n=3}^{n\to\infty} Z_{y_{on}}\Big(\{y_{on}y_n \mid \frac{y_n}{3}\notin\mathbb{N}^*,\ldots \ldots,\frac{y_n}{y_{o(n-1)}}\notin\mathbb{N}^*\}\Big)\Bigg)\to 100\%, \tag{1}$$

where:
$\mathbb{N}^*$ be natural numbers without zero;
the number of digits represented by $(\ldots)$ in the first two terms $\to\infty$;
$n$ is the number of a member of a sequence of odd primes;
$y_n$ is a sequence of odd numbers with the conditions given in the formula;
$y_{o(n-1)}$ is the prime number in sequence of primes just before $y_{on}$;
$Z_{y_{on}}$ is the frequency of appearance of the given set (in %) in the sequence $\{y\}$.

It is easy to see that the first term is $y_o$ in all sets of (1). The first terms of an infinite sequence of all sets are all $y_o \geq 3$.

The frequency of appearance of $Z_{y_{on}}$ (in percent) in the sequence $\{y\}$ is calculated easily:
The frequency of appearance of the set $\{3y\}$ by definition - $Z_3 = 33{,}3\ldots3\%$ (every third term in the sequence $\{y\}$).
The frequency of appearance of the total sum of known sets $\Sigma_3$ in the sequence $\{y\}$:

$$\Sigma_3 = 0{,}0\ldots01\% + 33{,}3\ldots3\% = 33{,}3\ldots4\%. \quad (2)$$

The frequency of appearance of all members of the set $\{3y\}$ from all odd numbers, multiples of $3, R_3 = 100\%$.
Let's calculate $R_5$, the frequency of the appearance of the set $\{5y_5 \mid y_5/3 \notin \mathbb{N}^*\}$ from all odd numbers that are multiples of 5:

$$R_5 = 100\% - 33{,}3\ldots3\% = 66{,}6\ldots67\%, \quad (3)$$

that it is possible to present so:

$$R_5 = 100\% - (\Sigma_3 - 0{,}0\ldots01\%) = 66{,}6\ldots67\%. \quad (4)$$

Let's compute $Z_5$, the frequency of the appearance of the set $\{5y_5 \mid y_5/3 \notin \mathbb{N}^*\}$ in the sequence $\{y\}$:

$$Z_5 = \frac{R_5}{5} \approx 13{,}3\ldots3\%. \quad (5)$$

The frequency of appearance of the total sum of known sets $\Sigma_5$ in the sequence $\{y\}$:

$$\Sigma_5 = \Sigma_3 + Z_5 \approx 46{,}6\ldots67\%. \quad (6)$$

Expressions for $Z_n, \Sigma_n, R_n$ in general form will be:

$$Z_{y_{on}} = \frac{R_{y_{on}}}{y_{on}}, \quad (7)$$

$$\Sigma_{y_{on}} = \Sigma_{y_{o(n-1)}} + Z_{y_{on}}, \quad (8)$$

$$R_{y_{on}} = 100\% - (\Sigma_{y_{o(n-1)}} - 0{,}0\ldots01\%), \quad (9)$$

$$R_{y_{on}} = Z_{y_{on}} y_{on} = Z_{y_{o(n-1)}}(y_{o(n-1)} - 1), \quad (10)$$

$$\frac{Z_{y_{o(n-1)}}}{Z_{y_{on}}} = \frac{y_{on}}{(y_{o(n-1)} - 1)}. \quad (11)$$

### *E. Final Conclusion on Goldbach's Conjecture*

For $y_o = 8999$, the frequency of appearance of the total sum of known sets in the sequence $\{y\}$ $\Sigma_{8999} \approx 87{,}6726\%$, and $Z_{8999} \approx 0{,}0014\%$. Thus, the share of unknown sets, and among them the remainder unknowns $y_{on}$, is reduced to $\sim 12{,}3274\%$ (the share of $y_{on}$, naturally, is even lower).
However, no matter how the $\Sigma_{y_{on}}$ decreases with the growth of the value of $y_{on}$ according to (9) and (10), the total sum of the known sets $\Sigma_{y_{on}}$ will eventually reach, for example, $\Sigma_{y_{on}} \approx 99\%$. This will happen because the entire infinite sequence of odd numbers $\{y\}$ consists of disjoint sets of odd numbers according to (1), but primes whose sets are formed in such a range are high-level numbers with a large number of digits. The share of unknown sets in this range, including those remaining by unknowns of $y_{on}$, is reduced to $\sim 1\%$.
If a prime number $y_{on}$, with $\Sigma_{y_{on}} \approx 99\%$ and $R_{y_{on}} \approx 1\%$, put on the side **B** of the chain $y$ of the next even number $x$, then the frequency of appearance of a $y_o < 1\%$ in half the large values. The highest frequency of appearance of $y_o$ is: the first four values in half the smaller values are $y_o$, the fraction $y_o$ in the first set $\{n100\}$ of the sequence $\{y\}$ reaches $50\%$. The frequency of appearance of $y_o$ becomes significantly less than $50\%$ in half of the smaller values of the chains $y$ of even numbers $x$ with a large number of digits. In such a range of even numbers $x$ , where the frequency of appearance of $y_o < 1\%$ in half of the large values of the chain $y$ and the frequency of appearance of $y_o$ is significantly less than $50\%$ in half of the smaller values of the chain $y$, it is easy to achieve a state where $x \neq y_{o1} + y_{o2}$. This can be achieved by successively shifting the links of the chain $y$ in half of large values and adding odd numbers of the opposite half from the side **B** to half of the smaller values.

Thus, Goldbach's Conjecture is not confirmed.

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## Acknowledgment

## References