

THE MARVELLOUS PROOF OF THE COLLATZ CONJECTURE

LESZEK W. GULA

ABSTRACT. The proper proof of the Collatz Conjecture

I. INTRODUCTION

The Collatz conjecture is a conjecture in mathematics named after Lothar Collatz, who first proposed it in 1937. The conjecture is also known as the $3c_0 + 1$ conjecture, the Ulam conjecture (after Stanisław Ulam), Kakutani's problem (after Shizuo Kakutani), the Thwaites conjecture (after Sir Bryan Thwaites), Hasse's algorithm (after Helmut Hasse), or the Syracuse problem; the sequence of numbers involved is referred to as the hailstone sequence or hailstone numbers (because the values are usually subject to multiple descents and ascents like hailstones in a cloud), or as wondrous numbers. Paul Erdős said about the Collatz conjecture: "Mathematics may not be ready for such problems." He also offered \$500 for its solution. In 1972, J. H. Conway proved that a natural generalization of the Collatz problem is algorithmically undecidable. [1]

II. THE COLLATZ CONJECTURE

Conjecture 1. *Let $c \in \{3, 5, 7, \dots\} \setminus \{5, 5 + 2^4, 21 + 2^6, 85 + 2^8, 341 + 2^{10}, \dots\}$. If $(c \times 3 + 1) / 2$ is even, divide it by 2. If $(c \times 3 + 1) / 2$ is odd, multiply it by 3 and add 1 to obtain $3k + 1$. Repeat the process indefinitely. This process will eventually reach the number 1, regardless of which odd positive integer is chosen initially. This is the Collatz Conjecture (CC).*

Definition 1. *Let asap common element = ace : $\text{ace}(\mathbb{A}, \mathbb{B}) = a$, where $a \in \mathbb{A}$ and $a \in \mathbb{B}$. This is a definition.*

Proof. From the CC we get the followin algorithm :

$$[3] \Rightarrow \mathbb{C}_3 = [10, 5, 16, 8, 4, 2, 1],$$

$$[7] \Rightarrow \mathbb{C}_7 = [22, 11, 34, 17, 52, 26, 13, 40, \dots, 10, \dots, 1], \text{ ace}(\mathbb{C}_7, \mathbb{C}_3) = 10,$$

$$[9] \Rightarrow \mathbb{C}_9 = [28, 14, 7, 22, 11, 34, 17, \dots, 1], \text{ ace}(\mathbb{C}_9, \mathbb{C}_7) = 22,$$

$$\text{ace}([11], \mathbb{C}_7) = 11,$$

$$\text{ace}([13], \mathbb{C}_7) = 13,$$

$$[15] \Rightarrow \mathbb{C}_{15} = [46, 23, 70, 35, 106, 53, 160, \dots, 40, \dots, 1], \text{ ace}(\mathbb{C}_{15}, \mathbb{C}_7) = 40,$$

$$\text{ace}([17], \mathbb{C}_9) = 17,$$

$$[19] \Rightarrow \mathbb{C}_{19} = [58, 29, 88, 44, 22, \dots, 1], \text{ ace}(\mathbb{C}_{19}, \mathbb{C}_7) = 22,$$

Date: 01.05.2014 – 05.06.2014.

1991 Mathematics Subject Classification. Primary: 11D85, Secondary: General 00.

Key words and phrases. Algebra of sets.

$\text{ace}([23], \mathbb{C}_{15}) = 23,$
 $[25] \Rightarrow \mathbb{C}_{25} = [76, 38, 19, \dots, 1], \text{ace}(\mathbb{C}_{25}, [19]) = 19,$
 $[27] \Rightarrow$
 $\mathbb{C}_{27} = [82, 41, 124, 62, 31, 94, 47, 142, 71, 214, 107, 322, 161, 484, 242, 121, 364, 182, 91,$
 $274, 137, 412, 206, 103, 310, 155, 466, 233, 700, 350, 175, 526, 263, 790, 395, 1186, 593,$
 $1780, 890, 445, 1336, 668, 334, 167, 502, 251, 754, 377, 1132, 566, 283, 850, 425, 1276,$
 $638, 319, 958, 429, 1438, 719, 2158, 1079, 3238, 1619, 4858, 2429, 7288, 3644, 1822, \mathbf{911},$
 $2734, 1367, 4102, 2051, 6154, 3077, 9232, 4616, 2308, 1154, 577, 1732, 866, 433, 1300,$
 $650, 325, 976, 488, 244, 122, 61, 184, 92, 46, 23, 70, 35, 106, 53, 160, \dots, 1],$
 $\text{ace}(\mathbb{C}_{29}, \mathbb{C}_{19}) = 29,$
 $\text{ace}([31], \mathbb{C}_{27}) = 31,$
 $[33] \Rightarrow \mathbb{C}_{33} = [100, 50, 25, \dots, 1], \text{ace}(\mathbb{C}_{33}, [25]) = 25,$
 $\text{ace}([35], \mathbb{C}_{15}) = 35,$
 $[37] \Rightarrow \mathbb{C}_{37} = [112, 56, 28, \dots, 1], \text{ace}(\mathbb{C}_{37}, \mathbb{C}_9) = 28,$
 $[39] \Rightarrow \mathbb{C}_{39} = [118, 59, 178, 89, 268, 134, 67, 202, 101, 304, 152, 76, \dots, 1],$
 $\text{ace}(\mathbb{C}_{39}, \mathbb{C}_{25}) = 76,$
 $\text{ace}([41], \mathbb{C}_{27}) = 41,$
 $[43] \Rightarrow \mathbb{C}_{43} = [130, 65, 196, 98, 49, 148, 74, 37, \dots, 1], \text{ace}(\mathbb{C}_{43}, [37]) = 37,$
 $[45] \Rightarrow \mathbb{C}_{45} = [136, 68, 34, \dots, 1], \text{ace}(\mathbb{C}_{45}, \mathbb{C}_9) = 34,$
 $\text{ace}([47], \mathbb{C}_{27}) = 47,$
 $[49] \Rightarrow \mathbb{C}_{49} = [148, 74, 37, \dots, 1], \text{ace}(\mathbb{C}_{49}, [37]) = 37, \dots . \text{ This is the proof. } \quad \square$

REFERENCES

- [1] http://en.wikipedia.org/wiki/Collatz_conjecture

LUBLIN-POLAND
E-mail address: lwgula@wp.pl