Collatz conjecture proof and discovery of the Collatz constant

Author Bae Joon young

Email mazack123@naver.com

From south Korea

Abstract

The Collatz conjecture was raised by Lothar Collatz in 1937.

This remains an unproven conundrum so far.

The text seeks to prove that this conundrum is solvable.

Introduction

Collatz conjecture explained

When a random number is n

If n is even, divide by 2

If n is odd, multiply by 3 and add 1

If this process is repeated for any number, it is assumed that 1,2,4 will be an infinitely looping sequence, and the least convergent number will be 1.

Ex)

If n is 3 then

3 – 10 – 5 – 16 – 8 – 4 – 2 – 1 - 4 – 2 – 1 - .....

If n is 8 then

8 – 4 – 2 – 1 – 4 – 2 – 1 - ....

Collatz speculated that repeating this process would result in all numbers converging to 1.

So far, mathematics has not been able to prove whether the Collatz conjecture is correct or wrong.

The reason is that the number is infinite and it is impossible to generalize by substituting an infinite number into the Colltaz conjecture.

However, this author found the following rules.

Start sequence	diverge
6n+1	6n+4
6n+2	6n+1,6n+4
6n+3	6n+4
6n+4	6n+2,6n+5
6n+5	6n+4
6n+6	6n+3,6n+6

Substituting Collatz conjecture into any number diverges from the sequence of 6n+1 ~ 6n+6,

Cycle through the rows of the sequence and arrive at the first row of the sequence.

Again, group this into a sequence of 12n+1 ~ 12n+12

The sum of all the shifted values of the rows of the sequence from substituting Collatz conjecture to any number is

An arbitrary number has a regular value depending on the row to which it belongs, which is defined as Collatz constant.

And we found that when we add the starting row of the sequence with the Collatz constant, we get the row that arrived.

The Collatz constant is an important key to generalizing the Collatz conjecture.

Collatz constant Description

The rows of the sequence are marked N

The sequence is in the range of 12n+1 ~ 12n+12

The sum of the values moved by the rows of the sequence of numbers by substituting Collatz conjecture is defined as C ollatz constant, which is denoted as C.

Collatz conjecture Sequence	row(N)	Shift value
3	1	
10	1	0
5	1	0
16	2	1
8	1	-1
4	1	0
2	1	0
1	1	0
Sum of rows moved(C)		0

Shift value

0 if equal to the number of previous rows

If it grows compared to the number of previous rows, the number that grows is expressed as a positive number.

If it becomes smaller compared to the number in the previous row, the number of smaller numbers is expressed as a negative number.

3 is the number in row 1 and the Collatz constant in row 1 is 0

Collatz constant decrements by -1 for every row increment

In the first row, the Collatz constant have 0

In the second row, the Collatz constant will have -1

In the third row, the Collatz constant have -2

Each row will have a Collatz constant

This means that the Collatz constant is applicable to the law of induction.

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Below is a table to help you understand.

The row of the sequence is marked N

When Collatz conjecture was substituted, the sum of the values moved by the row was denoted as C

	6n+1	6n+2	6n+3	6n+4	6n+5	6n+6	6n+1	6n+2	6n+3	6n+4	6n+5	6n+6	
N	12n+1	12n+2	12n+3	12n+4	12n+5	12n+6	12n+7	12n+8	12n+9	12n+10	12n+11	12n+12	C
1	1	2	3	4	5	6	7	8	9	10	11	12	0
2	13	14	15	16	17	18	19	20	21	22	23	24	-1
3	25	26	27	28	29	30	31	32	33	34	35	36	-2
4	37	38	39	40	41	42	43	44	45	46	47	48	-3
5	49	50	51	52	53	54	55	56	57	58	59	60	-4
6	61	62	63	64	65	66	67	68	69	70	71	72	-5
7	73	74	75	76	77	78	79	80	81	82	83	84	-6
8	85	86	87	88	89	90	91	92	93	94	95	96	-7
9	97	98	99	100	101	102	103	104	105	106	107	108	-8
10	109	110	111	112	113	114	115	116	117	118	119	120	-9
11	121	122	123	124	125	126	127	128	129	130	131	132	-10
12	133	134	135	136	137	138	139	140	141	142	143	144	-11
13	145	146	147	148	149	150	151	152	153	154	155	156	-12
14	157	158	159	160	161	162	163	164	165	166	167	168	-13
15	169	170	171	172	173	174	175	176	177	178	179	180	-14
16	181	182	183	184	185	186	187	188	189	190	191	192	-15
17	193	194	195	196	197	198	199	200	201	202	203	204	-16
18	205	206	207	208	209	210	211	212	213	214	215	216	-17
19	217	218	219	220	221	222	223	224	225	226	227	228	-18

Collatz constant theorem

The rows of the sequence are marked with N

Collatz constant is written as C

C is the sum of the rows in which the sequence has moved, which is equal to the value of –(N-1)

C=Sum of rows moved=-(N-1)

C=-(N-1)

proof

In the range of $12n+1 \sim 12n+12$

The sum of the value of the starting row and the Collatz constant is the value of the row that arrives

The formula for finding the row arriving from the starting row is

$N+C=$Value of the row that arrived

$N+C=N-(N-1)=N-N+1=1$

$N+C=N-(N-1)=1$

$N+C=1$

In the range of $12n+1 \sim 12n+12$, the sum of each N and C is always 1.

It is proved that all rows converge to the first row

The number of first rows converges to 1.

It is proved that all numbers converge to 1