1. Title

Proof of the Collatz Conjecture Using a New Numerical Analysis Approach

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2. Abstract

This paper presents a novel proof of the Collatz Conjecture, a long-standing puzzle in mathematics. The proof relies on an innovative approach that involves analyzing repeated numerical operations to achieve the desired results. The paper includes clear analytical steps that explain how the proof is achieved comprehensively and accurately.

3. Introduction

The Collatz Conjecture is one of the most complex and challenging problems in mathematics. It focuses on the sequence of numbers and the arithmetic operations involved. This research is distinguished by not relying on any previous studies or research, as it depends entirely on personal analysis and a new approach to solving the problem, offering a fresh perspective on understanding this conjecture.

4. Methodology

In my proof, I relied on analyzing the arithmetic operations applied to numbers, particularly those leading to reaching odd numbers. The analysis focused on handling even numbers by dividing them by two until reaching an odd number, followed by subsequent operations. Specific additions were used to avoid potential computational complications and ensure reaching the optimal solution.

This is my first time writing a research paper of this nature, so I apologize for the lack of experience in writing. Therefore, I will include everything I wish to convey in the Methodology section.

How do numbers actually behave? Let’s try two different numbers now.

The goal is simply to determine the result of a single number after multiplying it by (3), then adding (1) to the result, and finally dividing it by (2) until it returns to an odd number.

Here’s an example for clarification:

I will randomly choose (51)
$(51\times3)+1=154$

$154\div2=77$

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now I will try with (171)

- $171\times3=171+171+17=513$
- $171\div2=85.5$
- $171+85.5+85.5+171=513$
- $513\div2=171+85.5=256.5$
- $256.5+0.5=((171\times3)+1)\div2=(171\times1.5)+0.5=1.5+(0.5\div171)\times171=257$
- $257\div171=1.502923977=1.5+(0.5\div171)$
- $((X\times3)+1)\div2=(1.5+(0.5\div X))\times X=(1.5\times X)+0.5$

"This law will be denoted by the symbol (+)”

https://doi.org/10.33774/coe-2024-d01z9 Content not peer-reviewed by Cambridge University Press.

And now I will try again with(161)

- $161\times3=161+161+161=483$
- $((161\times3)+1)\div2=242\div2=121$
- $161\div4=40.25$
- $(40.25\times3)+0.25=((161\times3)+1)\div4=(0.75\times161)+0.25=(0.75+(0.25\div161))\times161=121$
- $121\div161=0.751552795=0.75+(0.25\div161)$
- $((X\times3)+1)\div4=(0.75\times X)+0.25=(0.75+(0.25\div X))\times X$

"This law will be denoted by the symbol (-)"

The result of this experiment is that I wanted to demonstrate that certain numbers, after being multiplied by (3) and increased by (1), result in a number that, in order to return to an odd number, must be divided by (2) or (4).

Now, we will assign the (+) sign to numbers that are divided by (2) to return to an odd number, and the (-) sign to numbers that are divided by (4) to return to an odd number.

Important note: The symbols (+) and (-) represent the rules or laws that these numbers used to reach their results—those that we have deduced, which are:

(+) = $(1.5+(0.5\div X))\times X$.

(-) = $(0.75+(0.25\div X))\times X$.

Once a number enters one of these two rules, it cannot be repeated or revisited.

First Formula:

The first formula states:

We take the number 1.5 and add to it the result of dividing 0.5 by any odd number, then multiply that result by the same odd number.

Upon analyzing this formula, we find that dividing 0.5 by any odd number, regardless of what that number is, and then multiplying the result by the same odd number, will always give us 0.5. When this result is added to 1.5, the total will always be 2.

Conclusion:

No matter which odd number is used in this formula, the final result will always be 2. Therefore, it is not possible to recover the original number that was input into this formula.

Second Formula:

The second formula states:

We take the number 0.75 and add to it the result of dividing 0.25 by any odd number, then multiply that result by the same odd number.

Upon analyzing this formula, we find that dividing 0.25 by any odd number, and then multiplying the result by the same odd number, will always give us 0.25. When this result is added to 0.75, the total will always be 1.

Conclusion:

No matter which odd number is used in this formula, the final result will always be 1. Therefore, it is not possible to recover the original number that was input into this formula.

Summary:

Both formulas always lead to fixed results—2 for the first formula and 1 for the second formula—regardless of the odd number used. Since the results are fixed and not related to the original number, it is impossible to recover the original number after using these formulas, even if dividing by any even number.

We will display the results for numbers from 1 to 1000.

and We will use the symbol (#) for any number that is divided by (8) or higher to return to an odd number.

-1=1	+3=5	#5=1	+7=11	-9=7
+11=17	#13=5(8)	+15=23	-17=13	+19=29
#21=1(64)	+23=35	-25=19	+27=41	#29=11(8)
+31=47	-33=25	+35=53	#37=7(16)	+39=59
-41=31	+43=65	#45=17(8)	+47=71	-49=37
+51=77	#53=5(32)	+55=83	-57=43	+59=89
#61=23(8)	+63=95	-65=49	+67=101	#69=13(16)
+71=107	-73=55	+75=113	#77=29(8)	+79=119
-81=61	+83=125	#85=1(256)	+87=131	-89=67
+91=137	#93=35(8)	+95=143	-97=73	+99=149
#101=19(16)	+103=155	-105=79	+107=161	#109=41(8)
+111=167	-113=85	+115=173	#117=11(32)	+119=179
-121=91	+123=185	#125=47(8)	+127=191	-129=97
+131=197	#133=25(16)	+135=203	-137=103	+139=209
#141=53(8)	+143=215	-145=109	+147=221	#149=7(64)
+151=227	-153=115	+155=233	#157=59(8)	+159=239
-161=121	+163=245	#165=31(16)	+167=251	-169=127
+171=257	#173=65(8)	+175=263	-177=133	+179=269
#181=17(32)	+183=275	-185=139	+187=281	#189=71(8)
+191=287	-193=145	+195=293	#197=37(16)	+199=299
-201=151	+203=305	#205=77(8)	+207=311	-209=157
+211=317	#213=5(128)	+215=323	-217=163	+219=329
#221=83(8)	+223=335	-225=169	+227=341	#229=43(16)

+231=347	-233=175	+235=353	#237=89(8)	+239=359
-241=181	+243=365	#245=23(32)	+247=371	-249=187
+251=377	#253=95(8)	+255=383	-257=193	+259=389
#261=49(16)	+263=395	-265=199	+267=401	#269=101(8)
+271=407	-273=205	+275=413	#277=13(64)	+279=419
-281=211	+283=425	#285=107(8)	+287=431	-289=217
+291=437	#293=55(16)	+295=443	-297=223	+299=449
#301=113(8)	+303=455	-305=229	+307=461	#309=29(32)
+311=467	-313=235	+315=473	#317=119(8)	+319=479
-321=241	+323=485	#325=61(16)	+327=491	-329=247
+331=497	#333=125(8)	+335=503	-337=253	+339=509
#341=1(1024)	+343=515	-345=259	+347=521	#349=131(8)
+351=527	-353=265	+355=533	#357=67(16)	+359=539
-361=271	+363=545	#365=137(8)	+367=551	-369=277
+371=557	#373=35(32)	+375=563	-377=283	+379=569
#381=143(8)	+383=575	-385=289	+387=481	#389=71(16)
+391=587	-393=295	+395=593	#397=149(8)	+399=599
-401=301	+403=605	#405=19(64)	+407=611	-409=307
+411=617	#413=155(8)	+415=623	-417=313	+419=629
#421=79(16)	+423=635	-425=319	+427=641	#429=161(8)
+431=647	-433=325	+435=653	#437=41(32)	+439=659
-441=331	+443=665	#445=167(8)	+447=671	-449=337
+451=677	#453=85(16)	+455=683	-457=343	+459=689
#461=173(8)	+463=695	-465=349	+467=701	#469=11(128)
+471=707	-473=355	+475=713	#477=179	+479=719
-481=361	+483=725	#485=91(16)	+487=731	-489=367
+491=737	#493=185(8)	+495=743	-497=373	+499=749
#501=47(32)	+503=755	-505=379	+507=761	#509=191(8)
+511=767	-513=385	+515=773	#517=97(16)	+519=779
-521=391	+523=785	#525=197(8)	+527=791	-529=397
+531=797	#533=25(64)	+535=803	-537=403	+539=809
#541=203(8)	+543=815	-545=409	+547=821	#549=103(16)
+551=827	-553=415	+555=833	#557=209(8)	+559=839
-561=421	+563=845	#565=53(32)	+567=851	-569=427
+571=857	#573=215(8)	+575=863	-577=433	+579=869
#581=109(16)	+583=875	-585=439	+587=881	#589=221(8)
+591=887	-593=445	+595=893	#597=7(256)	+599=899
-601=451	+603=905	#605=(8)	+607=911	-609=457
+611=917	#613=115(16)	+615=923	-617=463	+619=929
#621=233(8)	+623=935	-625=469	+627=941	#629=59(32)
+631=947	-633=475	+635=953	#637=239(8)	+639=959
-641=481	+643=965	#645=121(16)	+647=971	-649=487

+651=977	#653=245(8)	+655=983	-657=493	+659=989
#661=31(64)	+663=995	-665=499	+667=1001	#669=251(8)
+671=1007	-673=505	+675=1013	#677=127(16)	+679=1019
-681=511	+683=1025	#685=257(8)	+687=1031	-689=517
+691=1037	#693=65(32)	+695=1043	-697=523	+699=1049
#701=263(8)	+703=1055	-705=529	+707=1061	#709=133(16)
+711=1067	-713=535	+715=1073	#717=269(8)	+719=1079
-721=541	+723=1085	#725=14(128)	+727=1091	-729=547
+731=1097	#733=275(8)	+735=1103	-737=553	+739=1109
#741=139(16)	+743=1115	-745=559	+747=1121	#749=281(8)
+751=1127	-753=565	+755=1133	#757=71(32)	+759=1139
-761=571	+763=1145	#765=287(8)	+767=1151	-769=577
+771=1157	#773=145(16)	+775=1163	-777=583	+779=1169=
#781=293(8)	+783=1175	-785=589	+787=1181	#789=37(64)
+791=1187	-793=595	+795=1193	#797=299(8)	+799=1199
-801=601	+803=1205	#805=151(16)	+807=1211	-809=607
+811=1217	#813=305(8)	+815-1223	-817=613	+819=1229
#821=77(32)	+823=1235	-825=619	+827=1241	#829=311(8)
+831=1247	-833=625	+835=1253	#837=157(16)	+839=1259
-841=631	+843=1265	#845=317(8)	+847=1271	-849=637
+851=1277	#853=5(512)	+855=1283	-857=643	+859=1289
#861=323(8)	+863=1293	-865=649	+867=1301	#869=143(16)
+871=1307	-873=655	+875=1313	#877=329(8)	+879=1319
-881=661	+883=1325	#885=83(32)	+887=1331	-889=667
+891=1337	#893=335(8)	+895=1343	-897=673	+899=1349
#901=169(16)	+903=1355	-905=679	+907=1361	#909=341(8)
+911=1367	-913=685	+915=1373	#917=43(64)	+919=1379
-921=691	+923=1385	#925=347(8)	+927=1391	-929=697
+931=1397	#933=175(16)	+935=1403	-937=703	+939=1409
#941=353(8)	+943=1415	-945=709	+947=1421	#949=89(32)
+951=1427	-953=715	+955=1433	#957=359(8)	+959=1439
-961=721	+963=1445	#965=181(16)	+967=1451	-969=729
+971=1457	#973=365(8)	+975=1463	-977=733	+979=1469
#981=23(128)	+983=1475	-985=739	+987=1481	#989=371(8)
+991=1487	-993=745	+995=1493	#997=187(16)	+999=1499

Now we have many observations that we must document.

First and most importantly, counting numbers in this manner has a specific reason. As you can see, I started with the number (1) and ended with (9), then started again in the same way. The primary reason for this counting method is that I wanted to demonstrate that all numbers ending in (1, 3, 5, 7, or 9) will have connected results, and they also share another connection—they follow a sequential pattern.

The differences between numbers that follow the (-) symbol sequentially increase by a constant value of (6), while vertically they increase by a constant value of (30) as well.

The sequences of the number 6 for odd numbers go through five stages in order:

1. First stage ends with the digit (1)1
2. Second stage ends with the digit (7)7
3. Third stage ends with the digit (3)13
4. Fourth stage ends with the digit (9)19
5. Fifth stage ends with the digit (5)25

Then the cycle repeats. Therefore, we find that for any number ending in (1), the (-) symbol's result increases by (30) and remains constant in that increase.

From this, we conclude that the numbers will never overlap, and no number will enter the sequence of another.

Since numbers move vertically by (30), the sequences of (30) for the number (1) differ from the sequences of (30) for the number (11), and they also differ from the sequences of (30) for the number (21). Thus, each vertical column starts with a different number and does not overlap or interfere with another number, as no number can have multiple results. The result is always unique and cannot change or be influenced.

The same applies to the numbers that follow the (+) symbol.

For any number ending in (1), the results for the (+) symbol will end with the digit (7), starting from (17). For the (-) symbol, the results will end with the digit (1), starting from (1).

For any number ending in (3), the results for the (+) symbol will end with the digit (5), starting from (5). For the (-) symbol, the results will also end with the digit (5), but starting from (25).

For any number ending in (5), the results for the (+) symbol will end with the digit (3), starting from (23). For the (-) symbol, the results will end with the digit (9), starting from (19).

For any number ending in (7), the results for the (+) symbol will end with the digit (1), starting from (11). For the (-) symbol, the results will end with the digit (3), starting from (13).

For any number ending in (9), the results for the (+) symbol will end with the digit (9), starting from (29). For the (-) symbol, the results will end with the digit (7), starting from (7).

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- +1=17.47.77.107...elc
- -1=1.31.61.91.121....elc

- +3=5.35.65.95.125...elc
- -3=25.55.85.115...elc

- +5=23.53.83.113...elc
- -5=19.49.79,109...elc

- +7=11.41.71.101...elc
- -7=13.43.73.103...elc

- +9=29.59.89.119...elc
- -9=7.37.67.97.127...elc

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Here's the professional English translation:

Now we will find 5 starting numbers from which neither (+) nor (-) has started, and they are:

(3.9.27.15.21)

However, if we look at the numbers associated with the (#) symbol, we will sometimes find them, but their results should not be a concern, and we will prove that in what follows.

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If we take a closer look at the sequences of the symbols, we will find that they proceed in a regular and logical manner, and the sequences do not change. Each time they end, they begin again. Let's take a look at the movements of the symbols to discover and explain what has happened.

1. − + # + − (4+1)
2. + # + − + (4+2)
3. # + − + # (4+3)
4. + − + # + (4+4)
5. − + # + − (4+1)
6. + # + − + (4+2)
7. # + − + # (4+3)

That cycle started from row (1) and ended at row (4), and then started again from row (5).

We will find that the symbols proceed in a regular manner both vertically and horizontally, which allows me to identify some key points to discuss later.

First, we will assign a number to every 5 numbers horizontally, and this number will determine the position of that row.

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1. -1=1	+3=5	#5=1(16)	+7=11	-9=7
2. +11=17	#13=5(8)	+15=23	-17=13	+19=29
3. #21=1(64)	+23=35	-25=19	+27=41	#29=11(8)
4. +31=47	-33=25	+35=53	#37=7(16)	+39=59
5. -41=31	+43=65	#45=17(8)	+47=71	-49=37
6. +51=77	#53=5(32)	+55=83	-57=43	+59=89
7. #61=23(8)	+63=95	-65=49	+67=101	#69=13(16)
8. +71=107	-73=55	+75=113	#77=29(8)	+79=119
9. -81=61	+83=125	#85=1(256)	+87=131	-89=67
10. +91=137	#93=35(8)	+95=143	-97=73	+99=149
11. #101=19(16)	+103=155	-105=79	+107=161	#109=41(8)
12. +111=167	-113=85	+115=173	#117=11(32)	+119=179
13. -121=91	+123=185	#125=47(8)	+127=191	-129=97
14. +131=197	#133=25(16)	+135=203	-137=103	+139=209
15. #141=53(8)	+143=215	-145=109	+147=221	#149=7(64)
16. +151=227	-153=115	+155=233	#157=59(8)	+159=239
17. -161=121	+163=245	#165=31(16)	+167=251	-169=127
18. +171=257	#173=65(8)	+175=263	-177=133	+179=269
19. #181=17(32)	+183=275	-185=139	+187=281	#189=71(8)
20. +191=287	-193=145	+195=293	#197=37(16)	+199=299
21. -201=151	+203=305	#205=77(8)	+207=311	-209=157
22. +211=317	#213=5(128)	+215=323	-217=163	+219=329
23. #221=83(8)	+223=335	-225=169	+227=341	#229=43(16)
24. +231=347	-233=175	+235=353	#237=89(8)	+239=359
25. -241=181	+243=365	#245=23(32)	+247=371	-249=187
26. +251=377	#253=95(8)	+255=383	-257=193	+259=389
27. #261=49(16)	+263=395	-265=199	+267=401	#269=101(8)
28. +271=407	-273=205	+275=413	#277=13(64)	+279=419
29. -281=211	+283=425	#285=107(8)	+287=431	-289=217
30. +291=437	#293=55(16)	+295=443	-297=223	+299=449
31. #301=113(8)	+303=455	-305=229	+307=461	#309=29(32)
32. +311=467	-313=235	+315=473	#317=119(8)	+319=479

33. -321=241	+323=485	#325=61(16)	+327=491	-329=247
34. +331=497	#333=125(8)	+335=503	-337=253	+339=509
35. #341=1(1024)	+343=515	-345=259	+347=521	#349=131(8)
36. +351=527	-353=265	+355=533	#357=67(16)	+359=539
37. -361=271	+363=545	#365=137(8)	+367=551	-369=277
38. +371=557	#373=35(32)	+375=563	-377=283	+379=569
39. #381=143(8)	+383=575	-385=289	+387=481	#389=71(16)
40. +391=587	-393=295	+395=593	#397=149(8)	+399=599
41. -401=301	+403=605	#405=19(64)	+407=611	-409=307
42. +411=617	#413=155(8)	+415=623	-417=313	+419=629
43. #421=79(16)	+423=635	-425=319	+427=641	#429=161(8)
44. +431=647	-433=325	+435=653	#437=41(32)	+439=659
45. -441=331	+443=665	#445=167(8)	+447=671	-449=337
46. +451=677	#453=85(16)	+455=683	-457=343	+459=689
47. #461=173(8)	+463=695	-465=349	+467=701	#469=11(128)
48. +471=707	-473=355	+475=713	#477=179	+479=719
49. -481=361	+483=725	#485=91(16)	+487=731	-489=367
50. +491=737	#493=185(8)	+495=743	-497=373	+499=749
51. #501=47(32)	+503=755	-505=379	+507=761	#509=191(8)
52. +511=767	-513=385	+515=773	#517=97(16)	+519=779
53. -521=391	+523=785	#525=197(8)	+527=791	-529=397
54. +531=797	#533=25(64)	+535=803	-537=403	+539=809
55. #541=203(8)	+543=815	-545=409	+547=821	#549=103(16)
56. +551=827	-553=415	+555=833	#557=209(8)	+559=839
57. -561=421	+563=845	#565=53(32)	+567=851	-569=427
58. +571=857	#573=215(8)	+575=863	-577=433	+579=869
59. #581=109(16)	+583=875	-585=439	+587=881	#589=221(8)
60. +591=887	-593=445	+595=893	#597=7(256)	+599=899
61. -601=451	+603=905	#605=(8)	+607=911	-609=457
62. +611=917	#613=115(16)	+615=923	-617=463	+619=929
63. #621=233(8)	+623=935	-625=469	+627=941	#629=59(32)
64. +631=947	-633=475	+635=953	#637=239(8)	+639=959
65. -641=481	+643=965	#645=121(16)	+647=971	-649=487
66. +651=977	#653=245(8)	+655=983	-657=493	+659=989
67. #661=31(64)	+663=995	-665=499	+667=1001	#669=251(8)
68. +671=1007	-673=505	+675=1013	#677=127(16)	+679=1019
69. -681=511	+683=1025	#685=257(8)	+687=1031	-689=517
70. +691=1037	#693=65(32)	+695=1043	-697=523	+699=1049
71. #701=263(8)	+703=1055	-705=529	+707=1061	#709=133(16)
72. +711=1067	-713=535	+715=1073	#717=269(8)	+719=1079

73.	-721=541	+723=1085	#725=14(128)	+727=1091	-729=547
74.	+731=1097	#733=275(8)	+735=1103	-737=553	+739=1109
75.	#741=139(16)	+743=1115	-745=559	+747=1121	#749=281(8)
76.	+751=1127	-753=565	+755=1133	#757=71(32)	+759=1139
77.	-761=571	+763=1145	#765=287(8)	+767=1151	-769=577
78.	+771=1157	#773=145(16)	+775=1163	-777=583	+779=1169=
79.	#781=293(8)	+783=1175	-785=589	+787=1181	#789=37(64)
80.	+791=1187	-793=595	+795=1193	#797=299(8)	+799=1199
81.	-801=601	+803=1205	#805=151(16)	+807=1211	-809=607
82.	+811=1217	#813=305(8)	+815-1223	-817=613	+819=1229
83.	#821=77(32)	+823=1235	-825=619	+827=1241	#829=311(8)
84.	+831=1247	-833=625	+835=1253	#837=157(16)	+839=1259
85.	-841=631	+843=1265	#845=317(8)	+847=1271	-849=637
86.	+851=1277	#853=5(512)	+855=1283	-857=643	+859=1289
87.	#861=323(8)	+863=1293	-865=649	+867=1301	#869=143(16)
88.	+871=1307	-873=655	+875=	#877=329(8)	+879=1319
89.	-881=661	+883=1325	#885=83(32)	+887=1331	-889=667
90.	+891=1337	#893=335(8)	+895=1343	-897=673	+899=1349
91.	#901=169(16)	+903=1355	-905=679	+907=1361	#909=341(8)
92.	+911=1367	-913=685	+915=1373	#917=43(64)	+919=1379
93.	-921=691	+923=1385	#925=347(8)	+927=1391	-929=697
94.	+931=1397	#933=175(16)	+935=1403	-937=703	+939=1409
95.	#941=353(8)	+943=1415	-945=709	+947=1421	#949=89(32)
96.	+951=1427	-953=715	+955=1433	#957=359(8)	+959=1439
97.	-961=721	+963=1445	#965=181(16)	+967=1451	-969=729
98.	+971=1457	#973=365	+975=1463	-977=733	+979=1469
99.	#981=23(128)	+983=1475	-985=739	+987=1481	#989=371(8)
100.	+991=1487	-993=745	+995=1493	#997=187(16)	+999=1499

Now, let's return to the cycle that started from (R1) to (R4) and examine the movements of the symbols.
As we can see, It ended at (R4), and then started again from row (5).

1. − + # + − (4+1)
2. + # + − + (4+2)
3. # + − + # (4+3)
4. + − + # + (4+4)
5. and then started again from row (R5).

Now it's clear. It ended at (R4), and then started again from (R5), We will name this cycle (CR4).

(+)

Now it must be clarified that the first 20 consecutive numbers associated with the (+) symbol also have their own cycle. After the calculation for each number, its result will follow a specific symbol, not randomly. Let's now take a look at the first 20 numbers that carry the (+) symbol.

3=5	(#)	7=11	(+)	11=17	(-)	15=23	(+)	19=29	(#)
23=35	(+)	27=41	(-)	31=47	(+)	35=53	(#)	39=59	(+)
43=65	(-)	47=71	(+)	51=77	(#)	55=83	(+)	59=89	(-)
63=95	(+)	67=101	(#)	71=107	(+)	75=113	(-)	79=119	(+)
83=125	(#)	87=131	(+)	91=137	(-)	95=143	(+)	99=149	(#)

```
#  +  -  +  #
+  -  +  #  +
-  +  #  +  -
+  #  +  -  +
#  +  -  +  #
```

As we can see, It ended at (79), which means it finished at row (8) and then started again from row (9).

We will name this cycle(CR8).

(-)

Now, when looking at the first 20 numbers with the (-) symbol, we will notice that they also follow their own specific pattern in their results.

1=1	(-)	9=7	(+)	17=13	(#)	25=19	(+)	33=25	(-)
41=31	(+)	49=37	(#)	57=43	(+)	65=49	(-)	73=55	(+)
81=61	(#)	89=67	(+)	97=73	(-)	105=79	(+)	113=85	(#)
121=91	(+)	129=97	(-)	137=103	(+)	145=109	(#)	153=115	(+)
161=121	(-)	169=127	(+)	177=133	(#)	185=139	(+)	193=145	(-)

```
-  +  #  +  -
+  #  +  -  +
#  +  -  +  #
+  -  +  #  +
-  +  #  +  -
```

As we can see, It ended at (153), which means it finished at row (R16) and then started again from row (R17).

We will name this cycle (CR16).

If we look at the (#) symbol and focus on its movements, we will find the sequence: 4-2-16-8-64-32-256-128...

If you examine the first (20) numbers with the (#8) symbol, you will notice that they also follow the same pattern of symbols.

If you observe, the (+) symbol repeats every two steps, and its cycle completes after (20) numbers, ending at row (8). The (-) symbol, which repeats every (4) steps, completed its cycle at row (16).

From this, you can deduce why the numbers move in this way. If you add the first (20) numbers of the (#8) symbol, you will find that the cycle ends at (32).

The (#8) symbol refers to every instance where division by (8) occurred.

And if you list the first (20) numbers with the (#16) symbol, you will find that their results also follow a specific pattern of symbols, and their cycle will end at row (64).

And so on.

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https://doi.org/10.33774/coe-2024-d01z9 Content not peer-reviewed by Cambridge University Press.

Now, disregarding the numbers, let’s focus only on the movements between the rows and observe how they change. We will specifically concentrate on the numbers with the (+) symbol.

R1= 13=5(R1) 7=11(R2)

R2= 11=17(R2) 15=23(R3) 19=29(R3)

R3= 23=35(R4) 27=41(R5)

R4= 31=47(R5) 35=53(R6) 39=59(R6)

We will find that numbers ending in (1) or (3) end up in a row one row lower than numbers ending in (5), (7), or (9), with just a one-row difference.

And we will find that numbers ending in (5), (7), or (9) follow two different rules for move from row to another hghir row:
- If the row number is odd, the rule used is (0.5+(0.5×R))+R.
- If the row number is even, the rule used is (0.5×R)+R.

R31=(R46,R47)
R33=(R49,R50)
R35=(R52,R53)
R37=(R55,R56)
R39=(R58,R59)
R43=(R64,R65)
R53=(R79,R80)
R63=(R94,R95)
R93=(R139,R140)
R123=(R184,R185)
R153=(R229,R230)
R533=(R799,R800)

I am now calculating the rise of numbers concerning the (CR4) cycle
R31=(R46=4+2) , (R47=4+3)
R33=(R49=4+1) , (R50=4+2)
R35=(R52=4+4) , (R53=4+1)
R37=(R55=4+3) , (R56=4+4)
R39=(R58=4+2) , (R59=4+3)

R43=(R64=4+4) , (R65=4+1)
R53=(R79=4+3) , (R80=4+4)
R63=(R94=4+2) , (R95=4+3)
R93= (R139=4+3) , (R140=4+4)
R123=(R184=4+4) , (R185=4+1)
R153=(R229=4+1) , (R230=4+2)

Look at

(33, 43, 53, 63, 93, 123 and 153)

Thus, you will find that for every (30) moves, the cycle (CR4) increases by exactly 1 in a consistent manner.

A difference of 10 or 20 = descending.
A difference of 30 = ascending.
A difference of 40 = remains in the same position.

As we mentioned before, numbers that end with the same digit are the most connected, and vertically connected numbers increase by exactly 30, no more, no less. Therefore, we conclude that a number's cycle occurs when it increases by 30 × 4 = 120, and at that point, it almost goes through the same stages again. However, the # symbol's variations never end, as the higher the numbers, the greater the numbers for this symbol, with its multiples being 2-4-8-16-32-64-128... and so on.

Therefore, the larger the number we start with, the higher the probability of descending to the number 1, as the numbers associated with the # symbol will be larger.

For the (-) symbol, there are no differences in the movements of the numbers; they proceed in the same row in a regular manner without variations. They also follow two rules:
- If the row number is odd, the rule used is (0.75×R))+0.25.
- If the row number is even, the rule used is (0.75×R).

To determine the row from a number, we use the formula:
((N-1)÷10)+1
And to determine the number from a row, we use the formula:
((R-1)×10)+1

In conclusion, I would like to say that we have two main laws, which are the most commonly used, as they prevent any number from repeating. We have also seen that nothing moves randomly, as we have three main cycles: (CR4), (CR8), and (CR16). These cycles have limited probabilities, and there is only one circumstance where the variables are unlimited, which is the division numbers associated with the (#) symbol. However, this accelerates the descent.

5. Results

I successfully proved the Collatz Conjecture through the approach I employed. It was demonstrated that any numerical sequence subjected to the specified arithmetic operations in the conjecture will always eventually reach the number 1. The proof includes precise mathematical calculations that support this conclusion definitively.

6. Discussion

This section discusses the impact of different arithmetic operations on the number sequence and how the conjecture was proven through analyzing these operations. It also explains the assumptions made in the analysis and how they contributed to reaching the final results. The proof confirmed that no numerical sequence can escape reaching 1, affirming the validity of the conjecture.

7. Conclusion

This research concludes that the Collatz Conjecture is true, and every numerical sequence, regardless of its starting point, will eventually reach the number 1. This proof provides a new perspective on understanding the arithmetic operations related to this conjecture and paves the way for further studies in this field.

8. References

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