Proof of Goldbach Conjecture

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Abstract
In this paper, the author explores the proof of Goldbach Conjecture.

Objective:
If {1 is also a prime number} is true, then any even number greater than 0 can be written as the sum of two prime numbers.

Method:
Triangular lattice

Result:
An even a can be written as T(a) sums of two prime numbers
T(a)~(((a/2)/2-(a/2)/ln(a/2))*(((a-1)/2-(a-1)/ln(a-1))-((a/2-1)/2-(a/2-1)/ln(a/2-1)))-
((a/2-1)/2-(a/2-1)/ln(a/2-1))*(((a-3)/2-(a-3)/ln(a-3))-((a/2-2)/2-(a/2-2)/ln(a/2-
2))))*(((a/4)/2-(a/4)/ln(a/4))*(((3*a/4)/2-(3*a/4)/ln(3*a/4))-((a/2)/2-
(a/2)/ln(a/2))))/((((a/4)/2-(a/4)/ln(a/4))*(((3*a/4)/2-(3*a/4)/ln(3*a/4))-((a/2)/2-
(a/2)/ln(a/2))))+((((a/2)/2-(a/2)/ln(a/2))-((a/4)/2-(a/4)/ln(a/4)))*((a/2-a/ln(a))-
((3*a/4)/2-(3*a/4)/ln(3*a/4)))))+((a/2-1)/2-(a/2-1)/ln(a/2-1))*((a/2-1)/2-(a/2-1)/ln(a/2-
1)+1)/2-((a/2-2)/2-(a/2-2)/ln(a/2-2))*((a/2-2)/2-(a/2-2)/ln(a/2-2)+1)/2+a/ln(a)-a/4

Conclusions:
If {1 is also a prime number} is true, then any even number greater than 0 can be written as the sum of two prime numbers.
If {1 is also a prime number} is true, then any even number greater than 2 can be written as the sum of two different prime numbers.
If {1 is also a prime number} is false, then any even number greater than 5 can be written as the sum of two different prime numbers.

Key words: Goldbach; Euler.

1 Structure

1.1 Concept

Set of natural numbers is denoted as N, $N=\{n\}$.
If one variable belongs to N, then it is denoted as n.
If two variables belong to N, then they are denoted as n1 and n2.

Set of even numbers is denoted as A, $A=\{a|a=2*n\}$.
If one variable belongs to A, then it is denoted as a.
If two variables belong to A, then are denoted as a1 and a2.

Set of odd numbers is denoted as B, $B=\{b|b=2*n+1\}$.
If one variable belongs to B, then it is denoted as b.
If two variables belong to B, then they are denoted as b1 and b2.

Set of odd composite numbers is denoted as C
$C=\{c|c=(2*n1+1)*(2*n2+1)$, n1 is not 0 and n2 is not 0.}
If one variable belongs to C, then it is denoted as c.
If two variables belong to C, then they are denoted as c1 and c2.

Set of prime numbers is denoted as D
D={d|d belongs to B and d does not belong to C}
If one variable belongs to D, then it is denoted as d.
If two variables belong to D, then they are denoted as d1 and d2.

1.2 N(a)

$a=a/2+a/2$, $a>0$.
If a/2 belongs to A, then $a=[(a/2-1)-2n)]+[(a/2+1)+2n]$
$n<(a-2)/4$, $Card(n)=a/4$.
$(a/2+1)-2n$ is denoted as bL, $(a/2+1)+2n$ is denoted as bR.

If a/2 belongs to B, then $a=(a/2-2n)+(a/2+2n)$
$n<a/4$, $Card(n)=(a+2)/4$.
$a/2-2n$ is denoted as bL, $a/2+2n=b2$ is denoted as bR.
Card(n) is one function of a, it is denoted as N(a).

1.3 e=bR-bL

Set one increasing positive even sequence, it corresponds to $\{a|a>0\}$.
2
4
6
8
…

Set e on the same side of it incrementally.

2	0																					
4		2																				
6	0		4																			
8		2		6																		
10	0		4		8																	
12		2		6		10																
14	0		4		8		12															
16		2		6		10		14														
18	0		4		8		12		16													
20		2		6		10		14		18												
22	0		4		8		12		16		20											
24		2		6		10		14		18		22										
26	0		4		8		12		16		20		24									
28		2		6		10		14		18		22		26								
30	0		4		8		12		16		20		24		28							
32		2		6		10		14		18		22		26		30						
34	0		4		8		12		16		20		24		28		32					
36		2		6		10		14		18		22		26		30		34				
38	0		4		8		12		16		20		24		28		32		36			
40		2		6		10		14		18		22		26		30		34		38		
42	0		4		8		12		16		20		24		28		32		36		40	
44		2		6		10		14		18		22		26		30		34		38		42

Triangular lattice

2	0																					
4		2																				
6	0		4																			
8		2		6																		
10	0		4		8																	
12		2		6		10																
14	0		4		8		12															
16		2		6		10		14														
18	0		4		8		12		16													
20		2		6		10		14		18												
22	0		4		8		12		16		20											
24		2		6		10		14		18		22										
26	0		4		8		12		16		20		24									
28		2		6		10		14		18		22		26								
30	0		4		8		12		16		20		24		28							
32		2		6		10		14		18		22		26		30						
34	0		4		8		12		16		20		24		28		32					
36		2		6		10		14		18		22		26		30		34				
38	0		4		8		12		16		20		24		28		32		36			
40		2		6		10		14		18		22		26		30		34		38		
42	0		4		8		12		16		20		24		28		32		36		40	
44		2		6		10		14		18		22		26		30		34		38		42

Any cell corresponds to (a, e) and (bL, bR)

	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
2	1,1																					
4		1,3																				
6	3,3		1,5																			
8		3,5		1,7																		
10	5,5		3,7		1,9																	
12		5,7		3,9		1,11																
14	7,7		5,9		3,11		1,13															
16		7,9		5,11		3,13		1,15														
18	9,9		7,11		5,13		3,15		1,17													
20		9,11		7,13		5,15		3,17		1,19												
22	11,11		9,13		7,15		5,17		3,19		1,21											
24		11,13		9,15		7,17		5,19		3,21		1,23										
26	13,13		11,15		9,17		7,19		5,21		3,23		1,25									
28		13,15		11,17		9,19		7,21		5,23		3,25		1,27								
30	15,15		13,17		11,19		9,21		7,23		5,25		3,27		1,29							
32		15,17		13,19		11,21		9,23		7,25		5,27		3,29		1,31						
34	17,17		15,19		13,21		11,23		9,25		7,27		5,29		3,31		1,33					
36		17,19		15,21		13,23		11,25		9,27		7,29		5,31		3,33		1,35				
38	19,19		17,21		15,23		13,25		11,27		9,29		7,31		5,33		3,35		1,37			
40		19,21		17,23		15,25		13,27		11,29		9,31		7,33		5,35		3,37		1,39		
42	21,21		19,23		17,25		15,27		13,29		11,31		9,33		7,35		5,37		3,39		1,41	
44		21,23		19,25		17,27		15,29		13,31		11,33		9,35		7,37		5,39		3,41		1,43

1.4 Analysis

If f belongs to A, then {(a, e)|a=f} is denoted as {L=f}.

2	0																			
4		2																		
6	0		4																	
8		2		6																
10	0		4		8															
12		2		6		10														
14	0		4		8		12													
16		2		6		10		14												
18																				
20		2		6		10		14		18										
22	0		4		8		12		16		20									
24		2		6		10		14		18		22								
26	0		4		8		12		16		20		24							
28		2		6		10		14		18		22		26						
30	0		4		8		12		16		20		24		28					
32		2		6		10		14		18		22		26		30				
34	0		4		8		12		16		20		24		28		32			
36		2		6		10		14		18		22		26		30		34		
38	0		4		8		12		16		20		24		28		32		36	
40		2		6		10		14		18		22		26		30		34		38

If g belongs to B, then G={(bL, bR)|bL=g or bR=g} is denoted as {R=g}.

e is one function of a when g is invariable, any odd composite number in (0, a) corresponds to one cell in {L=a}. Equation is e=|(a-g)-g|, a>g.

e=|(a-1)-1|, a>1.

2	0																					
4		2																				
6	0		4																			
8		2		6																		
10	0		4		8																	
12		2		6		10																
14	0		4		8		12															
16		2		6		10		14														
18	0		4		8		12		16													
20		2		6		10		14		18												
22	0		4		8		12		16		20											
24		2		6		10		14		18		22										
26	0		4		8		12		16		20		24									
28		2		6		10		14		18		22		26								
30	0		4		8		12		16		20		24		28							
32		2		6		10		14		18		22		26		30						
34	0		4		8		12		16		20		24		28		32					
36		2		6		10		14		18		22		26		30		34				
38	0		4		8		12		16		20		24		28		32		36			
40		2		6		10		14		18		22		26		30		34		38		
42	0		4		8		12		16		20		24		28		32		36		40	
44		2		6		10		14		18		22		26		30		34		38		42

e=|(a-3)-3|, a>3.

2	0																					
4		2																				
6	0		4																			
8		2		6																		
10	0		4		8																	
12		2		6		10																
14	0		4		8		12															
16		2		6		10		14														
18	0		4		8		12		16													
20		2		6		10		14		18												
22	0		4		8		12		16		20											
24		2		6		10		14		18		22										
26	0		4		8		12		16		20		24									
28		2		6		10		14		18		22		26								
30	0		4		8		12		16		20		24		28							
32		2		6		10		14		18		22		26		30						
34	0		4		8		12		16		20		24		28		32					
36		2		6		10		14		18		22		26		30		34				
38	0		4		8		12		16		20		24		28		32		36			
40		2		6		10		14		18		22		26		30		34		38		
42	0		4		8		12		16		20		24		28		32		36		40	
44		2		6		10		14		18		22		26		30		34		38		42

e=|(a-5)-5|, a>5.

2	0																					
4		2																				
6	0		4																			
8		2		6																		
10	0		4		8																	
12		2		6		10																
14	0		4		8		12															
16		2		6		10		14														
18	0		4		8		12		16													
20		2		6		10		14		18												
22	0		4		8		12		16		20											
24		2		6		10		14		18		22										
26	0		4		8		12		16		20		24									
28		2		6		10		14		18		22		26								
30	0		4		8		12		16		20		24		28							
32		2		6		10		14		18		22		26		30						
34	0		4		8		12		16		20		24		28		32					
36		2		6		10		14		18		22		26		30		34				
38	0		4		8		12		16		20		24		28		32		36			
40		2		6		10		14		18		22		26		30		34		38		
42	0		4		8		12		16		20		24		28		32		36		40	
44		2		6		10		14		18		22		26		30		34		38		42

…

1.5 U(a)-T(a)=S(a)-N(a)

If bL or bR belongs to C, then color the cell.

2	0																					
4		2																				
6	0		4																			
8		2		6																		
10	0		4		8																	
12		2		6		10																
14	0		4		8		12															
16		2		6		10		14														
18			4		8		12		16													
20		2		6		10		14		18												
22	0		4		8		12		16		20											
24		2				10		14		18		22										
26	0		4		8		12		16		20		24									
28		2		6		10		14		18		22		26								
30			4		8				16		20		24		28							
32		2		6		10		14		18		22		26		30						
34	0		4		8		12				20		24		28		32					
36		2				10		14				22		26		30		34				
38	0		4		8		12		16		20		24		28		32		36			
40		2		6				14		18		22		26		30		34		38		
42			4		8				16		20				28		32		36		40	
44		2		6		10		14		18		22				30		34		38		42

If bL and bR belong to C, then color it black.

The number of prime numbers in (0, a] is denoted as I(a), I(a)~a/ln(a).
The number of odd composite numbers in (0, a] is denoted as S(a), S(a)~a/2-a/ln(a).
The number of black cells in {L=a} is denoted as U(a), the number of colored non black cells in {L=a} is denoted as V(a).
The number of colorless cells in {L=a} is denoted as T(a)
Objective is denoted as {Any T(a)>0, a>0.}
V(a)+T(a)+U(a)=N(a), V(a)=S(a)-2*U(a).

2 Prove
W={(bL, bR)|bL belongs to(0, a/2], bR belongs to [a/2, a).}
Card(bL, bR) is denoted as W(a), W(a)=N(a)^2.

2	0										
4		2									
6	0		4								
8		2		6							
10	0		4		8						
12		2		6		10					
14	0		4		8		12				
16		2		6		10		14			
18	0		4		8		12		16		
20		2		6		10		14		18	
22	0		4		8		12		16		20
24		2		6		10		14		18	
26	0		4		8		12		16		20
28		2		6		10		14		18	
30	0		4		8		12		16		20
32		2		6		10		14		18	

2	0											
4		2										
6	0		4									
8		2		6								
10	0		4		8							
12		2		6		10						
14	0		4		8		12					
16		2		6		10		14				
18	0		4		8		12		16			
20		2		6		10		14		18		
22	0		4		8		12		16		20	
24		2		6		10		14		18		22
26	0		4		8		12		16		20	
28		2		6		10		14		18		22
30	0		4		8		12		16		20	
32		2		6		10		14		18		22
34	0		4		8		12		16		20	

If bL and bR belong to C, then the cell is denoted as (cL, cR).
X={(cL, cR)|cL and cR belong to (0, a/2-1].};
Card(cL, cR) is denoted as X(a), X(a)=S(a/2-1)*(S(a/2-1)+1)/2.
Y={(cL, cR)|cL belongs to (0, a/2] and cR belongs to [a/2, a-1].};
Card(cL, cR) is denoted as Y(a), Y(a)=S(a/2)*(S(a-1)-S(a/2-1)).
Z={(cL, cR)|cL and cR belong to Y, bL+bR belongs to (0, a].};
Card(cL, cR) is denoted as Z(a), Z(a)=H(a)*Y(a).

2.1 H(a)~H(a-2)
Maximum error is denoted as Or(a), Or(a)~0 when a>a0.
M={(cL, cR)|cL+cR belongs to (0, a]}, Card(cL, cR) is denoted as M(a).
M(a)=X(a)+Y(a), U(a)=M(a)-M(a-2).
Let U(a)=S(a)-N(a), H(a)~(S(a)-N(a)-X(a)+X(a-2))/(Y(a)-Y(a-2)).
H(a)~(a/4-a/ln(a)-((a/2-1)/2-(a/2-1)/ln(a/2-1))*((a/2-1)/2-(a/2-1)/ln(a/2-1)+1)/2+((a/2-2)/2-(a/2-2)/ln(a/2-2))*((a/2-2)/2-(a/2-2)/ln(a/2-2)+1)/2)/(((a/2)/2-(a/2)/ln(a/2))*(((a-1)/2-(a-1)/ln(a-1))-((a/2-1)/2-(a/2-1)/ln(a/2-1)))-((a/2-1)/2-(a/2-1)/ln(a/2-1))*(((a-3)/2-(a-3)/ln(a-3))-((a/2-2)/2-(a/2-2)/ln(a/2-2))))
Let U(a)=S(a)-N(a)+1, H(a)~(S(a)-N(a)+1-X(a)+X(a-2))/(Y(a)-Y(a-2)).
Let U(a)=S(a)-N(a)+2, H(a)~(S(a)-N(a)+2-X(a)+X(a-2))/(Y(a)-Y(a-2)).

2.2 H(a)~J(a)/(J(a)+K(a))
Maximum error is denoted as Oe(a), Oe(a)~(W(a)-(J(a)+K(a)))/W(a)~1/2.
J={(cL, cR)|cL belongs to (0, a/4] and cR belongs to (a/2, 3*a/4]};
Card(cL, cR) is denoted as J(a), J(a)=S(a/4)*(S(3*a/4)-S(a/2)).
K={(cL, cR)|cL belongs to (a/4, a/2] and cR belongs to (3*a/4, a]};
Card(cL, cR) is denoted as K(a), K(a)=(S(a/2)-S(a/4))*(S(a)-S(3*a/4)).
J(a)/(J(a)+K(a))~(((a/4)/2-(a/4)/ln(a/4))*(((3*a/4)/2-(3*a/4)/ln(3*a/4))-((a/2)/2-(a/2)/ln(a/2))))/((((a/4)/2-(a/4)/ln(a/4))*(((3*a/4)/2-(3*a/4)/ln(3*a/4))-((a/2)/2-(a/2)/ln(a/2))))+((((a/2)/2-(a/2)/ln(a/2))-((a/4)/2-(a/4)/ln(a/4)))*((a/2-a/ln(a))-((3*a/4)/2-(3*a/4)/ln(3*a/4)))))

2.3 H(a)~(J(a)+p1+p2)/(J(a)+K(a)+p1+p2+q1+q2)
Maximum error is denoted as O2(a), O2(a)~1/4.
P1={(cL, cR)|cL belongs to (0, a/8] and cR belongs to (3*a/4, 7*a/8]};
Card(cL, cR) is denoted as p1, p1=S(a/8)*(S(7*a/8)-S(3*a/4)).
P2={(cL, cR)|cL belongs to (a/4, 3*a/8] and cR belongs to (a/2, 5*a/8]};
Card(cL, cR) is denoted as p2, p2=(S(3*a/8)-S(a/4))*(S(5*a/8)-S(a/2)).
Q1={(cL, cR)|cL belongs to (a/8, a/4] and cR belongs to (7*a/8, a]};
Card(cL, cR) is denoted as q1, q1=(S(a/4)-S(a/8))*(S(a)-S(7*a/8)).
Q2={(cL, cR)|cL belongs to (3*a/8, a/2] and cR belongs to (5*a/8, 3*a/4]};
Card(cL, cR) is denoted as q2, q2=(S(a/2)-S(3*a/8))*(S(3*a/4)-S(5*a/8)).

2.4 H(a)~(J(a)+p1+…+p6)/(J(a)+K(a)+p1+…+p6+q1+…+q6)
Maximum error is denoted as O6(a), O6(a)~1/8.
P3={(cL, cR)|cL belongs to (0, a/16] and cR belongs to (7*a/8, 15*a/16]};
Card(cL, cR) is denoted as p3, p3=S(a/16)*(S(15*a/16)-S(7*a/8)).
P4={(cL, cR)|cL belongs to (a/8, 3*a/16] and cR belongs to (3*a/4, 13*a/16]};
Card(cL, cR) is denoted as p4, p4=(S(3*a/16)-S(a/8))*(S(13*a/16)-S(3*a/4)).
P5={(cL, cR)|cL belongs to (a/4, 5*a/16] and cR belongs to (5*a/8, 11*a/16]};
Card(cL, cR) is denoted as p5, p5=(S(5*a/16)-S(a/4))*(S(11*a/16)-S(5*a/8)).

P6={(cL, cR)|cL belongs to (3*a/8, 7*a/16] and cR belongs to (a/2, 9*a/16]};
Card(cL, cR) is denoted as p6, p6=(S(7*a/16)-S(3*a/8))*(S(9*a/16)-S(a/2)).
Q3={(cL, cR)|cL belongs to (a/16, a/8] and cR belongs to (15*a/16, a]};
Card(cL, cR) is denoted as q3, q3=(S(a/8)-S(a/16))*(S(a)-S(15*a/16)).
Q4={(cL, cR)|cL belongs to (3*a/16, a/4] and cR belongs to (13*a/16, 7*a/8]};
Card(cL, cR) is denoted as q4, q4=(S(a/4)-S(3*a/16))*(S(7*a/8)-S(13*a/16)).
Q5={(cL, cR)|cL belongs to (5*a/16, 3*a/8] and cR belongs to (11*a/16, 3*a/4]};
Card(cL, cR) is denoted as q5, q5=(S(3*a/8)-S(5*a/16))*(S(3*a/4)-S(11*a/16)).
Q6={(cL, cR)|cL belongs to (7**a/16, a/2] and cR belongs to (9*a/16, 5*a/8]};
Card(cL, cR) is denoted as q6, q6=(S(a/2)-S(7*a/16))*(S(5*a/8)-S(9*a/16)).

2.5 O126(a)<1/64 when a>a0
H(a)~(J(a)+p1+…+p14)/(J(a)+K(a)+p1+…+p14+q1+…+q14)
Maximum error is denoted as O14(a), O14(a)~1/16.
H(a)~(J(a)+p1+…+p30)/(J(a)+K(a)+p1+…+p30+q1+…+q30)
Maximum error is denoted as O30(a), O30(a)~1/32.
H(a)~(J(a)+p1+…+p62)/(J(a)+K(a)+p1+…+p62+q1+…+q62)
Maximum error is denoted as O62(a), O62(a)~1/64.
H(a)~(J(a)+p1+…+p126)/(J(a)+K(a)+p1+…+p126+q1+…+q126)
Maximum error is denoted as O126(a), O126(a)<1/64 when a>a0.

2.6 Conclusions
S(a)=Ch*(a/2-a/ln(a)), Ch~1 when a>a0.
Error of S(a)~a/2-a/ln(a) is denoted as O(a), O(a)~0 when a>a0.

When a>a1, (J(a)+p1+…+p126)/(J(a)+K(a)+p1+…+p126+q1+…+q126)-(S(a)-N(a)-X(a)+X(a-2))/(Y(a)-Y(a-2))>1/64.
And endorse when a belongs to (0, a1]
Conclusion: If {1 is also a prime number} is true, then any even number greater than 0 can be written as the sum of two prime numbers.

When a>a2, (J(a)+p1+…+p126)/(J(a)+K(a)+p1+…+p126+q1+…+q126)-(S(a)-N(a)+1-X(a)+X(a-2))/(Y(a)-Y(a-2))>1/64.
And endorse when a belongs to (2, a2]
Conclusion: If {1 is also a prime number} is true, then any even number greater than 2 can be written as the sum of two different prime numbers.

When a>a3, (J(a)+p1+…+p126)/(J(a)+K(a)+p1+…+p126+q1+…+q126)-(S(a)-N(a)+2-X(a)+X(a-2))/(Y(a)-Y(a-2))>1/64.
And endorse when a belongs to (5, a2]
Conclusion: If {1 is also a prime number} is false, then any even number greater than 5 can be written as the sum of two different prime numbers.

2.7 T(a)

J(a)/(J(a)+K(a))~(J(a)+P(a))/(J(a)+K(a)+P(a)+Q(a))

T(a)~(Y(a)-Y(a-2))*J(a)/(J(a)+K(a))+X(a)-X(a-2)-S(a)+N(a)

T(a)~(((a/2)/2-(a/2)/ln(a/2))*(((a-1)/2-(a-1)/ln(a-1))-((a/2-1)/2-(a/2-1)/ln(a/2-1)))-((a/2-1)/2-(a/2-1)/ln(a/2-1))*(((a-3)/2-(a-3)/ln(a-3))-((a/2-2)/2-(a/2-2)/ln(a/2-2))))*(((a/4)/2-(a/4)/ln(a/4))*(((3*a/4)/2-(3*a/4)/ln(3*a/4))-((a/2)/2-(a/2)/ln(a/2))))/((((a/4)/2-(a/4)/ln(a/4))*(((3*a/4)/2-(3*a/4)/ln(3*a/4))-((a/2)/2-(a/2)/ln(a/2))))+((((a/2)/2-(a/2)/ln(a/2))-((a/4)/2-(a/4)/ln(a/4)))*((a/2-a/ln(a))-((3*a/4)/2-(3*a/4)/ln(3*a/4)))))+((a/2-1)/2-(a/2-1)/ln(a/2-1))*((a/2-1)/2-(a/2-1)/ln(a/2-1)+1)/2-((a/2-2)/2-(a/2-2)/ln(a/2-2))*((a/2-2)/2-(a/2-2)/ln(a/2-2)+1)/2+a/ln(a)-a/4