A Result of Even & Prime

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ABSTRACT

Objective:
Goldbach & Euler

Method:
Triangular lattice

Result:
An even \(a\) can be written as \(T(a)\) sums of two prime numbers

\[
T(a) = (((a/2)/2-(a/2)/\ln(a/2)))*(((3*a/4)/2-(3*a/4)/\ln(3*a/4))-(a/2-1)/2-(a/2)/\ln(a/2-1)))*(((a/2)/2-(a/2)/\ln(a/2-1)))*(((3*a/4)/2-(3*a/4)/\ln(3*a/4))-(a/2-1)/2-(a/2)/\ln(a/2-1)))*(((a/4)/2-(a/4)/\ln(a/4))*(((3*a/4)/2-(3*a/4)/\ln(3*a/4))-(a/2-1)/2-(a/2)/\ln(a/2-1)))*(((a/2)/2-(a/2)/\ln(a/2))*(a/2-1)/2-(a/2)/\ln(a/2-1))*(((3*a/4)/2-(3*a/4)/\ln(3*a/4)))+((a/2-1)/2-(a/2-1)/\ln(a/2-1)))*(((a/2)/2-(a/2)/\ln(a/2-1)))*(((3*a/4)/2-(3*a/4)/\ln(3*a/4)))+((a/2-1)/2-(a/2-1)/\ln(a/2-1)+1)/2-(a/2-2)/2-(a/2-2)/\ln(a/2-2))*((a/2-1)/2-(a/2-1)/\ln(a/2-1)+1)/2+a/\ln(a)-a/4
\]

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 false, then any even number greater than 4 can be written as the sum of two prime numbers.

Key words: Goldbach; Euler; even; prime.
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 \( n_1 \) and \( n_2 \).

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 they are denoted as \( a_1 \) and \( a_2 \).

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 \( b_1 \) and \( b_2 \).

Set of odd composite numbers is denoted as \( C \)
\( C=\{c|(2*n_1+1)*(2*n_2+1), \text{n1 is not 0 and n2 is not 0.}\} \)
If one variable belongs to \( C \), then it is denoted as \( c \).
If two variables belong to \( C \), then they are denoted as \( c_1 \) and \( c_2 \).

Set of prime numbers is denoted as \( D \)
If \{1 is also a prime number\} is true,
then \( D=\{d|d \text{ belongs to } B \text{ and } d \text{ does not belong to } C\} \)
If \{1 is also a prime number\} is false,
then \( D=\{d|d \text{ belongs to } B \text{ and } d \text{ does not belong to } C, d \text{ is not 1.}\} \)
If one variable belongs to \( D \), then it is denoted as \( d \).
If two variables belong to \( D \), then they are denoted as \( d_1 \) and \( d_2 \).

1.2 \( N(a) \)
\( a=a/2+a/2, a>0. \)
If \( a/2 \) belongs to \( A \), then \( a=[(a/2-1)-2n]+[(a/2+1)+2n] \)
\( n<(a-2)/4, \text{Card}(n)=a/4. \)
\( (a/2+1)-2n \) is denoted as \( b_L \), \( (a/2+1)+2n \) is denoted as \( b_R \).
If \( a/2 \) belongs to \( B \), then \( a=(a/2-2n)+(a/2+2n) \)
\( n<a/4, \text{Card}(n)=(a+2)/4. \)
\( a/2-2n \) is denoted as \( b_L \), \( a/2+2n=b_2 \) is denoted as \( b_R \).
\( \text{Card}(n) \) is one function of \( a \), it is denoted as \( N(a) \).
\( N(a)=a/4, a>0. \)
Error is denoted as \( O(a) \), \( O(a)=0 \) when \( a>0. \)

1.3 \( e=b_R-b_L \)
Set one increasing positive even sequence, it corresponds to \( \{a|a>0\} \).
Set e on the same side of it incrementally.

Triangular lattice

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

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

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 \( e=|a-g|, a\geq g. \)
e=|(a-1)-1|, a\geq 1.

e=|(a-3)-3|, a\geq 3.

e=|(a-5)-5|, a\geq 5.

\[ \ldots \]

1.5 \( U(a)-T(a)=S(a)-N(a) \)
If bL or bR belongs to C, then color the cell.

If bL and bR belong to C, then color it black.
The number of prime numbers in \((0, a]\) is denoted as \(I(a)\), \(I(a)\sim a/\ln(a)\).
The number of odd composite numbers in \((0, a]\) is denoted as \(S(a)\), \(S(a)\sim a/2 - a/\ln(a)\).
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 \(T(a)\)
\[V(a) + T(a) + U(a) = N(a), \quad V(a) = S(a) - 2*U(a).\]

1.6 Algebra
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.
Objective is denoted as \{Any \(T(a)>0, a>0.\}\}
If \{1 is also a prime number\} is false, then any even number greater than 5 can be written as the sum of two prime numbers.
Objective is denoted as \{Any \(T(a)>1, a>5.\}\}

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

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

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

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

\text{Q2=\{(cL, cR)\mid cL \text{ belongs to } (3*a/8, a/2] \text{ and } cR \text{ belongs to } (5*a/8, 3*a/4]\};
\text{Card}(cL, cR) \text{ is denoted as } q2, q2=(S(a/2)-S(3*a/8))*(S(3*a/4)-S(5*a/8)).

2.2.2 \text{H(a)}~(J(a)+p1+\ldots+p6)/(J(a)+K(a)+p1+\ldots+p6+q1+\ldots+q6), a>24.
\text{Maximum error is denoted as } O6(a), O6(a)~1/8.

\text{P3=\{(cL, cR)\mid cL \text{ belongs to } (0, a/16] \text{ and } cR \text{ belongs to } (7*a/8, 15*a/16]\};
\text{Card}(cL, cR) \text{ is denoted as } p3, p3=S(a/16)*(S(15*a/16)-S(7*a/8)).

\text{P4=\{(cL, cR)\mid cL \text{ belongs to } (a/8, 3*a/16] \text{ and } cR \text{ belongs to } (3*a/4, 13*a/16]\};
\text{Card}(cL, cR) \text{ is denoted as } p4, p4=(S(3*a/16)-S(a/8))*(S(13*a/16)-S(3*a/4)).

\text{P5=\{(cL, cR)\mid cL \text{ belongs to } (a/4, 5*a/16] \text{ and } cR \text{ belongs to } (5*a/8, 11*a/16]\};
\text{Card}(cL, cR) \text{ is denoted as } p5, p5=(S(5*a/16)-S(a/4))*(S(11*a/16)-S(5*a/8)).

\text{P6=\{(cL, cR)\mid cL \text{ belongs to } (3*a/16, a/4] \text{ and } cR \text{ belongs to } (a/2, 9*a/16]\};
\text{Card}(cL, cR) \text{ is denoted as } p6, p6=(S(a/2)-S(3*a/16))*(S(9*a/16)-S(a/2)).

\text{Q3=\{(cL, cR)\mid cL \text{ belongs to } (a/16, a/8] \text{ and } cR \text{ belongs to } (15*a/16, a]\};
\text{Card}(cL, cR) \text{ is denoted as } q3, q3=(S(a/8)-S(a/16))*(S(a)-S(15*a/16)).

\text{Q4=\{(cL, cR)\mid cL \text{ belongs to } (3*a/16, a/4] \text{ and } cR \text{ belongs to } (13*a/16, 7*a/8]\};
\text{Card}(cL, cR) \text{ is denoted as } q4, q4=(S(a/4)-S(3*a/16))*(S(7*a/8)-S(13*a/16)).

\text{Q5=\{(cL, cR)\mid cL \text{ belongs to } (5*a/16, 3*a/8] \text{ and } cR \text{ belongs to } (11*a/16, 3*a/4]\};
\text{Card}(cL, cR) \text{ is denoted as } q5, q5=(S(3*a/8)-S(5*a/16))*(S(3*a/4)-S(11*a/16)).

\text{Q6=\{(cL, cR)\mid cL \text{ belongs to } (7*a/16, a/2] \text{ and } cR \text{ belongs to } (9*a/16, 5*a/8]\};
\text{Card}(cL, cR) \text{ is denoted as } q6, q6=(S(9*a/16)-S(7*a/16))*(S(5*a/8)-S(9*a/16)).

2.2.3 \text{H(a)}~(J(a)+p1+\ldots+p\alpha)/(J(a)+K(a)+p1+\ldots+p\alpha+q1+\ldots+q\alpha), a<\alpha N(a).
\text{Maximum error is denoted as } O\alpha(a), O\alpha(a)~1/\alpha+2.
\alpha=2^{\beta-2}, \beta \text{ belongs to } N \text{ and } \beta>0.
\text{Let } \beta=[ln(a/4)/ln(2)], O\alpha(a)~0 \text{ when } a>a0.

\text{H(a)}~(J(a)+p1+\ldots+p14)/(J(a)+K(a)+p1+\ldots+p14+q1+\ldots+q14)
\text{Maximum error is denoted as } O14(a), O14(a)~1/16.

\text{H(a)}~(J(a)+p1+\ldots+p30)/(J(a)+K(a)+p1+\ldots+p30+q1+\ldots+q30)
\text{Maximum error is denoted as } O30(a), O30(a)~1/32.

\text{H(a)}~(J(a)+p1+\ldots+p62)/(J(a)+K(a)+p1+\ldots+p62+q1+\ldots+q62)
\text{Maximum error is denoted as } O62(a), O62(a)~1/64.

\text{H(a)}~(J(a)+p1+\ldots+p126)/(J(a)+K(a)+p1+\ldots+p126+q1+\ldots+q126)
\text{Maximum error is denoted as } O126(a), O126(a)~1/128.

2.3 Conclusions
\text{S(a)}=Ch*(a/2-a/ln(a)), Ch~1 \text{ when } a>a0.
\text{Error of } S(a)~a/2-a/ln(a) \text{ is denoted as } Oe(a), Oe(a)~0 \text{ when } a>a0.
(1) \text{H(a)}~(J(a)+p1+\ldots+p\alpha)/(J(a)+K(a)+p1+\ldots+p\alpha+q1+\ldots+q\alpha), a=2^{[ln(a/4)/ln(2)]-2}.
(2) If $T(a)=0$, then $H(a) - (S(a) - N(a) - X(a) + X(a-2)) / (Y(a) - Y(a-2))$

But,

$$J(a) + p_1 + ... + p_\alpha / (J(a) + K(a) + p_1 + ... + p_\alpha + q_1 + ... + q_\alpha) > (a/4 - a/\ln(a) - ((a/2) - (a/2-1)) / \ln(a/2)) * ((a/2) - (a/2-1)) / \ln(a/2) + 1) / 2 + ((a/2) - (a/2-1)) / \ln(a/2)$$

So, $T(a) > 0$ when $a > a_1$.

Error analysis endorse $a_1(\min) = 0$, appendix.

Any $T(a) > 0$, $a > 0$.

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

(3) If $T(a)=1$, then $H(a) - (S(a) - N(a) + 1 - X(a) + X(a-2)) / (Y(a) - Y(a-2))$

But,

$$J(a) + p_1 + ... + p_\alpha / (J(a) + K(a) + p_1 + ... + p_\alpha + q_1 + ... + q_\alpha) > (a/4 - a/\ln(a) + 1 - ((a/2) - (a/2-1)) / \ln(a/2)) * ((a/2) - (a/2-1)) / \ln(a/2) + 1) / 2 + ((a/2) - (a/2-1)) / \ln(a/2)$$

So, $T(a) > 1$ when $a > a_2$.

Error analysis endorse $a_2(\min) = 4$, appendix.

Any $T(a) > 1$, $a > 4$.

Conclusion: If $\{1 \text{ is also a prime number}\}$ is false, then any even number greater than 4 can be written as the sum of two prime numbers.

2.4 $T(a)$

According to prime number density formula,

$$J(a) / (J(a) + K(a)) \sim (J(a) + p_1 + ... + p_\alpha) / (J(a) + K(a) + p_1 + ... + p_\alpha + q_1 + ... + q_\alpha)$$

And, $T(a) - (Y(a) - Y(a-2)) * J(a) / (J(a) + K(a)) + \alpha(\alpha-2) - S(a) - N(a)$. 

$$T(a) \sim ((a/2) - (a/2)) / \ln(a/2) * (((a-1) - (a-1)) / \ln(a-1) - ((a-2) - (a-2)) / \ln(a-2)) - ((a/2) - (a/2)) / \ln(a-2) * (((a-3) - (a-3)) / \ln(a-3) - ((a-2) - (a-2)) / \ln(a-2)) * (((a/4) - (a/4)) / \ln(a/4) - (((3*a/4) - (3*a/4)) / \ln(3*a/4) - ((a/2) - (a/2)) / \ln(a/2)))) - (((4*a/4) / \ln(a/4)) - (((3*a/4) - (3*a/4)) / \ln(3*a/4) - ((a/2) - (a/2)) / \ln(a/2)))) - (((a/4) - (a/4)) / \ln(a/4))$$

So, $T(a) > 1$ when $a > a_2$.

Error analysis endorse $a_2(\min) = 4$, appendix.

Any $T(a) > 1$, $a > 4$.

Conclusion: If $\{1 \text{ is also a prime number}\}$ is false, then any even number greater than 4 can be written as the sum of two prime numbers.