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The equivalent proposition of an unsolved number theory problem "is the difference between two primes"

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ABSTRACT

This paper uses chandra symmetric matrix to find the equivalent proposition of a worldly unsolved problem.

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BACKGROUND

Let us look at a matrix: in 1934, one ground breaking mathematician from the Indian/ Bangladesh region, Harish Chandra (1923–1983), in the field of number theory, had made a founding contribution of harmonic analysis on semi simple Lie groups. This subject is equally important for an engineer, as a synthesis of Fourier analysis, special functions and invariant theory etc., and it had also become a basic tool in analytic number theory, via the theory of automorphic forms, leading to modern Langlands program eventually. It became one of the major mathematical edifices of the second half of the twentieth century.

Chandra matrix is a square sieve, where the first row of the square sieve consists of the first element of 4, the difference between next every two adjacent numbers is 3, forms an arithmetic sequence: 4,7,10, ... The first column equals to the first row. The second row, third row, ... any subsequent rows are also arithmetic sequence, but the difference between two adjacent numbers gradually becomes larger, and they are 5,7,9,11,13, ... respectively, and they are all odd numbers, and the matrix is symmetrical, as shown below with modulo equivalent representation:

4 7 10 13 16 19 22 25 …… i.e. mod(n,3)=1
7 12 17 22 27 32 37 42 …… i.e. mod(n,5)=2
10 17 24 31 38 45 52 59 …… i.e. mod(n,7)=3
13 22 40 40 49 58 67 76 …… i.e. mod(n,9)=4
16 27 49 49 60 71 82 93 …… i.e. mod(n,11)=5
19 32 58 58 71 84 97 110 …… i.e. mod(n,13)=6

The secret of this square sieve is: If a natural number N appears in the table, then 2N+1 certainly is not a prime number, because 2 times of remaining plus 1 is at least one of the divisors in the above modulo operations. If N does not appear in the table, then 2N+1 is definitely a prime number. Because 2 times of remaining plus 1 is not any of the divisors in the above modulo operation. Primes are left out. Almost all primes can be launched from this table, assume that the number of primes follow the prime number theorem: x/ln(x), in the arithmetical range of the numbers.

Proof of matrix properties：

4 7 10 13 16 … 4+3(n-1)
7 12 17 22 27 … 7+5(n-1)
10 17 24 31 38 … 10+7(n-1)
13 22 31 40 49 … 13+9(n-1)
16 27 38 49 60 … 16+11(n-1)

3m+1 5m+2 7m+3 9m+4 11m+5 … 2mn+m+n
In fact, if mn + m + N, N = 2, 2 N + 1 = 2 (2 mn + m + n)+ 1 = 4 mn + m + 2 N + 1 = 2 (2 m + 1)

(2 n + 1), it is not a prime number. If 2N+1 is not a prime number, then 2N+1 must be the product of two odd Numbers.

2N+1=(2m+1)(2n+1)=4mn+2m+ 2N+1, you get N=2mn+m+ n, which appears in the table, contradicting the hypothesis. So 2N+1 must be a prime when N doesn't show up in the matrix.

Based on above observations, we made a few similar matrices accordingly (lifting it by x):

4+x 7+x 10+x 13+x …… i.e. mod(n,3)=1+ mod(x,3)
7+x 12+x 17+x 22+x …… i.e. mod(n,5)=2+ mod(x,5)
10+x 17+x 24+x 31+x …… i.e. mod(n,7)=3+ mod(x,7)

Lifting by any positive integer can be obtained if the natural number N in the matrix, 2N-(2x-1) is certainly not a prime number, otherwise 2N-(2x-1) must be a prime number.

So we've made some matrices like this
5 8 11 14 17 20……….
8 13 18 23 28 33……….
11 18 25 32 39 46……….

If N in it, 2N－1 is not prime, if not, it is
6 9 12 15 18……….
9 14 19 24 29……….
12 19 26 33 40……….

If N in it, 2N－3 is not prime, if not, it is:

List：
4 2n+1
5 2n-1 (2n+1)-2
6 2n-3 （2n+1）-4
7 2n-5 (2n+1)-6
8 2n-7 (2n+1)-8
9 2n-9 (2n+1)-10
10 2n-11 (2n+1)-12
11 2n-13 （2n+1)-14

4+x 2n－(2x－1) （2n+1）－2x

If N not in 4 and 5,2N+1－（2N－1）=prime －prime =2.
If N not in 4 and 6,2N+1－（2N－3）=prime －prime=4

If N not in 4 and 4+x, 2N+1 －（2N－2x+1）=prime－prime=2x

As long as find that the matrix starts with 4 + x and 4 has an n that doesn't show up at the same time, this conjecture sets up. It can be stated as 2mn+m+n, 2mn+m+n+x, the two can’t express all the number bigger than 4+x, this conjecture sets up.

CONCLUSION

The unsolved number theory problem "even is the difference between two primes" has an equivalent proposition:
2mn+m+n, 2mn+m+n+x, the two can’t express all the numbers bigger than 4+x，this conjecture sets up.

CONFERENCE

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