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Increment Primes

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Abstract The increment of prime numbers was a clear indication. Increase - the number increases, the addition of something. If the number of prime numbers, figuratively called the "ladder of Gauss-Riemann", the increase may well be likened to the steps, separated from the ladder itself. We prove that the law is obeyed $z_2(i_2 = 2) = 1/2 - 1/2\cos(\pi p(n)/2)$ in the critical line $i_2 = 2$ of the second digit binary number system. This functional model was stable and in other quantities of prime numbers (3000 and 100 000). The critical line is the Riemann column $i_2 = 2$ binary matrix of a prime rate. Not all non-trivial zeros lie on it. There is also a line of frames, the initial rate (yields patterns of symmetry) and left the envelope binary number 1. Cryptographers cannot worry: even on the critical line growth of prime numbers $z_{2j} = 1/2 - 1/2\cos(\pi p_j / 2)$ contain the irrational number $\pi = 3{,}14159...$.

Keywords: *prime numbers, increase, the critical line, the root of 1/2*

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1. Introduction

Gauss, Riemann, and behind them and other mathematicians carried away by the relative power $x/\pi(x)$ of prime numbers with a truncated start, represented in dotted decimal notation. In this case, apparently unconsciously, this figure has been expressed with the logarithm of the irrational basis $e = 2,71...$, and thus the transition from ten degrees to its natural logarithm of false identification has occurred. It is the main error of more than 150 years.

Application $\ln 10$ and false idea that future discharges of the decimal system the number of primes all the time increases to about 2.3, based on the assumption that $\pi(x)$ ~ $|x/\ln x|$. And the reason for this turn in the study of prime numbers has been rather prosaic. As noted in [1]: "Gauss, the greatest of mathematicians discovered the law $\pi(x)$ ~ $|x/\ln x|$ the age of fifteen, studying tables of primes contained in the gift to him a year before the table of logarithms."

We refused to logarithms, went to the binary system. It turned out that the very prime, $a(n) = \{2,3,5,7,11.13.17,...\}$, $n = \{1,2,3,...\}$ is not sufficiently effective measure. To avoid any claims to the proof, we adopt this traditional range.

2. The Increment of Prime Numbers

This new figure was visible and at the same time is mathematically equivalent to a series of prime numbers. Increment - the number increases, the addition of something. If the number of primes $a(n) = \{2,3,5,7,11.13.17,...\}$ long figuratively called the "ladder of Gauss-Riemann", the increase may well be likened to the steps, separated from the carrier farm the base of the stairs. A long and tall ladder physically may well contain two parts - apart from the construction of stairs and a separate farm grounds.

3. Algorithm Building a Number of Prime Numbers

He is widely known, has the form

$$a(n+1) = a(n) + p(n), \qquad (1)$$

where $p(n)$ - the increment of a prime number, n - the order of (number) of a prime number. The very number of primes is given initially, it is determined by the condition of the indivisibility of the other numbers, except on unit and itself (the latter condition, even excessive).

Therefore, growth is always calculated by subtracting

$$p(n) = a(n+1) - a(n). \qquad (2)$$

4. 500 Prime Numbers

In Table 1 shows fragments of the increment of a number of $a(n) = \{2,3,5,...,3571\}$. Among the 500 prime numbers was a maximum increase $p(217) = 34$ for a prime $a(217) = 1327$ with code 100010 in binary.

The fundamental difference of a number of increment of the number of primes is that in the increment (the same number - an abstract measure of the amount), only one column $i_2 = 2$ bit binary numbers is completely filled and critical, and the first class has only zeros for the set $a(n) > 2$. Full filling will continue to infinity, therefore, can be considered a proven fact the appearance of the $p(n) = 2$ at any power $a(n)$.

Table 1. A number of primes increase in 10th and binary number systems

Order n prime	Prime $a(n)$	The increment $p(n)$ of a prime	The category of number i_2 of binary system					
			6	5	4	3	2	1
			Part of the increase $p_{i_2}(n) = 2^{i_2 - 1}$					
			32	16	8	4	2	1
1	2	1						1
2	3	2	trivial zeros				1	0
3	5	2					1	0
4	7	4				1	0	0
5	11	2					1	0
6	13	4				1	0	0
7	17	2					1	0
8	19	4				1	0	0
9	23	6				1	1	0
10	29	2					1	0
11	31	6				1	1	0
12	37	4				1	0	0
13	41	2					1	0
14	43	4				1	0	0
15	47	6				1	1	0
16	53	6				1	1	0
17	59	2					1	0
18	61	6				1	1	0
19	67	4				1	0	0
20	71	2					1	0
21	73	6				1	1	0
22	79	4				1	0	0
23	83	6				1	1	0
24	89	8			1	0	0	0
25	97	4				1	0	0
26	101	2					1	0
27	103	4				1	0	0
28	107	2					1	0
29	109	4				1	0	0
30	113	14			1	1	1	0
...	...	...	...	...	...	...	...	...
495	3539	2					1	0
496	3541	6				1	1	0
497	3547	10			1	0	1	0
498	3557	2					1	0
499	3559	12			1	1	0	0

5. Mathematical Landscape

To construct (Figure 1) we take the example $i_2 = 1, 2, 3, 4, 5$ and delete those rows in which the five columns contains at least one trivial zero.

An indicator is a binary number z_2 in the field of real numbers (0, 1).

6. Critical Line

The first line in Table 1 will automatically fall out of the set. After that, at any length series of prime numbers the first column $i_2 = 1$ is zero. Then each value increment from right to left starting from zero and ends with the unit. And for the unit as a wave broken lines are only trivial zeros. All non-trivial zeros are arranged in any row between 1 (left) and 0 (first column on the right). Then ***Riemann's critical line*** in a vertical column $i_2 = 2$. But it is clear that not all non-trivial zeros lie on the critical line. They are available in other binary digits, interspersed with trivial zeros.

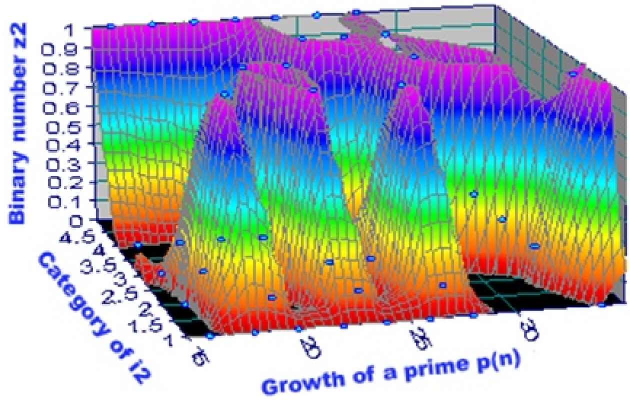

Figure 1. The landscape of increment in the number of 500 prime numbers

7. Critical Start of the Series

In Table 2 shows the three critical primes.

Table 2. Gain critical primes at the beginning of a series

Order n	Prime $a(n)$	Increment $p(n)$	Digit number i_2					
			6	5	4	3	2	1
			part of the increase					
			32	16	8	4	2	1
-1	0	1						0
0	1	1	trivial zeros					1
1	2	1						1

Together with Table 1 critical prime numbers give a full range of prime numbers, which this article is not considered. To accept it, you must: a) to recognize as simple that number which shares only on unit (zero/zero indefinite); b) change the order in a number $N = \{0, 1, 2, 3, 4, \ldots\}$; c) gain 1 is a border in the uncritical range includes non-critical prime $P = \{3, 5, 7, \ldots\}$.

Further detailed analysis of the increment will fulfill a number of non-critical primes.

8. Effect of Discharge i_2

In the software environment of Excel sum over the columns in Table 1 (excluding the first line) and get the number of units $\sum z_2$ in the ranks of the binary system.

Model should give the relative values that allow comparison between different series of increment of prime numbers. After the identification of bio-law [2] was to teach the following conclusions:

- the share of units (Figure 2) lines of the binary matrix of increment of prime numbers

$$\nu(1) = \sum z_2 / 498 = 0,61623(i_2 - 1)^{0,28783} \exp(-0,029314(i_2 - 1)^{3,22295}); \quad (3)$$

- the proportion of zeros in (Figure 2) lines of the binary matrix of increment of prime numbers

$$\nu(0) = (498 - \sum z_2) / 498 = 1 - 0,61623(i_2 - 1)^{0,28783} \exp(-0,029314(i_2 - 1)^{3,22295}). \quad (4)$$

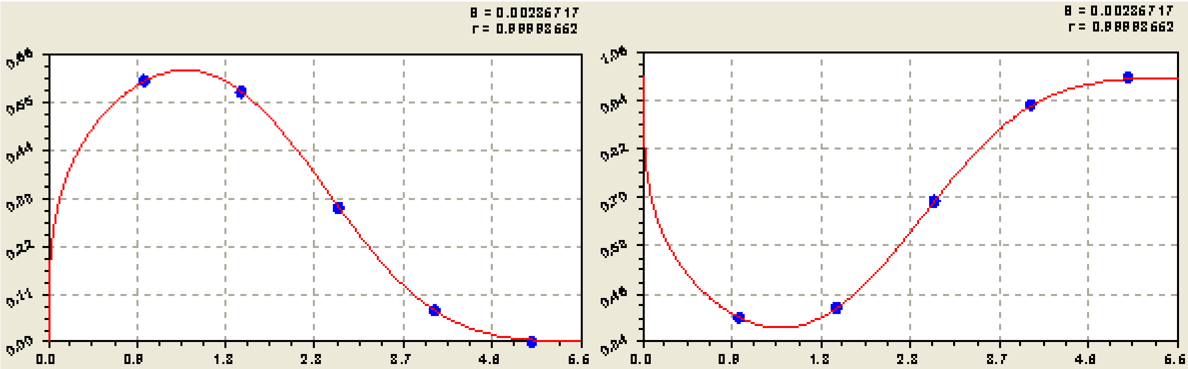

Figure 2. Share units (left) and zero (right) in the rows of the matrix: S - dispersion; r - correlation coefficient

Table 3. Influence of discharge binary system (498 lines)

i_2	p_{i_2}	$\sum z_2$	Share 1	$\sum(z_2 = 0)$	Share 0	$2^{i_2 - 1} \sum z_2$	$\sum z_2 / \sum\sum z_2$
1	1	0	0	498	1	0	0
2	2	298	0.5984	200	0.4016	596	0.3855
3	4	285	0.5723	213	0.4277	1140	0.3687
	8	153	0.3072	345	0.6928	1224	0□1979
5	16	36	0.0723	462	0.9277	576	0.0466
6	32	1	0.0020	497	0.9980	32	0.0013
All		773	-	2215	-	3568	-

In favor of computing the number of units, there are two distinctive features:

1) the number of zeros (trivial and nontrivial) is almost three times as many units (Table 3);

2) the design of the formula (3) is easier compared with the expression (4).

Apparently, the option is 0,61623 with increasing number of $n \to \infty$ will approach to the golden ratio 0,618 .... Then, on the critical line are $\phi^{-1} = 0,618...$ ones and 0,6182 zeros.

Contribution amounts for units of columns (Figure 3) to the total (Table 3, 773) will be equal

$$\sum z_2 / \sum\sum z_2 = 0,39902(i_2 - 1)^{0.32247} \exp(-0,034914(i_2 - 1)^{3,09819}). \quad (5)$$

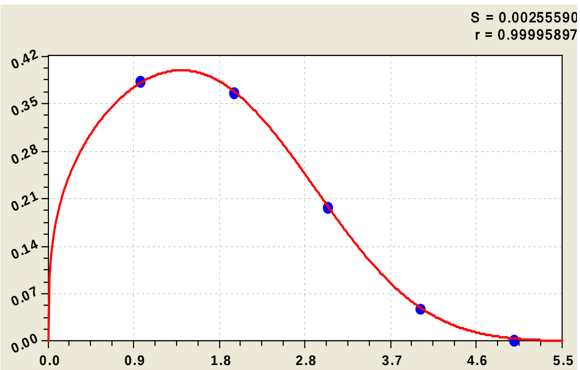

Figure 3. Schedule the amount of the contribution of units in the columns of Table 1

On the critical line $i_2 = 2$ contribution approaching to the square of the golden section.

9. Influence of Increment

The explanatory variable we take the increase of a prime number. Then on the different digits of the binary number system formed their statistical model (Table 4) type

$$z_2 = a_1 - a_2 \cos(\pi p(n) / (a_3 + a_4 p(n)^{a_5}) - a_6), \quad (6)$$

where $a_1 ... a_6$ - the parameters of the model (6).

If we ignore the first and last bits binary system, the closest to a rational number 1/2 on real values is the discharge $i_2 = 2$. For the critical line $i_2 = 2$ equation (6) is reduced (Figure 4) to the form

$$z_2(i_2 = 2) = 1/2 - 1/2 \cos(\pi p(n) / 2). \quad (7)$$

Thus completes the proof of the Riemann hypothesis and remove the message from the Internet: "Here the famous Riemann hypothesis, that the real part of the root is always exactly equal to 1/2, no one has yet proven, although the proof of it would have been for the theory of prime numbers in the highest degree the importance. At the present time, the hypothesis is verified for seven million of the roots".

With increasing power of prime numbers equation (7) for the critical line continues, but the graphs such as Figure 4 will be more frequent fluctuations due to higher growth. The increment is growing much more slowly than simple numbers. This will increase the power of the series.

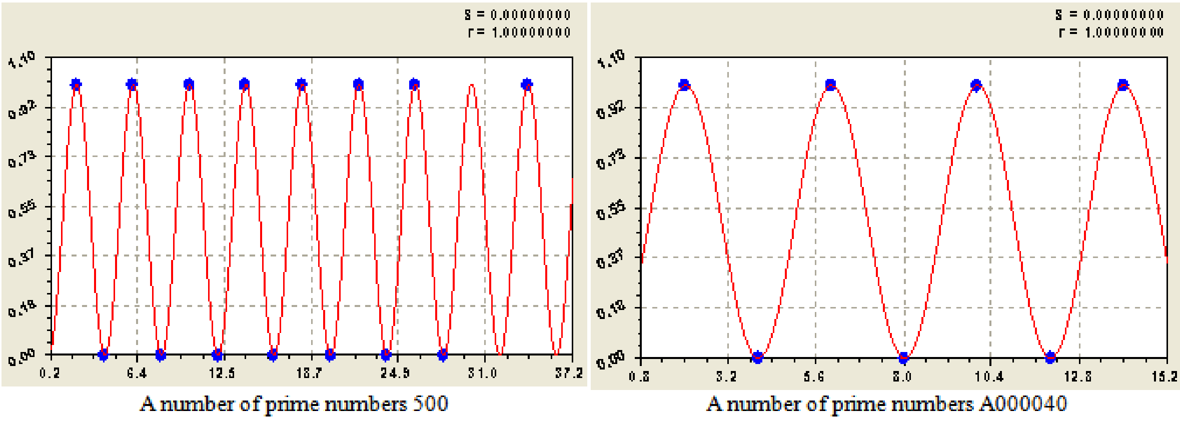

Figure 4. Graphics (6) to prove the Riemann Hypothesis: S - dispersion; r - correlation coefficient

Table 4. The influence of the increment of a simple number to a binary number of digits of the binary system

Digit number i_2	Part $p_{i_2}(n)$	The parameters of the statistical model of a binary number						Correlation coefficient. r
		a_1	a_2	a_3	a_4	a_5	a_6	
1	1	0	0	0	0	0	0	1
2	2	1/2	1/2	2	0	0	0	1
3	4	1/2	0,70711	4	0	0	0,78540	1
4	8	0,45433	0,62621	155,4496	-128,0887	0,038904	-0,99258	0,9367
5	16	0,50303	0,50302	708,9489	-17,94895	1,02956	-2,82289	0,9997

10. The Binary Number for Non-emergency Lines

Table 4 shows the parameters of equation (6).

To model the formula (6) patterns $z_2(p(n)) = f(p(n))$ of Table 1 excludes those lines that are in the column trivial zeros (empty cells). Then there is an array of ones and non-trivial zeros. With the increase in the discharge of a binary number of lines in the array $z_2(p(n))$ will be reduced. Graphs are shown in Figure 5.

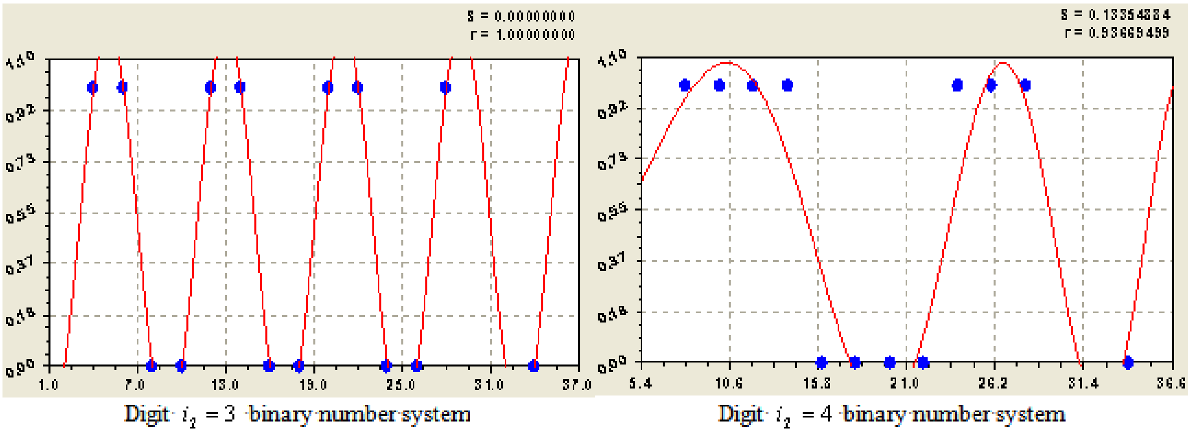

Figure 5. Graphics (6) changes in the binary number: S - dispersion; r - correlation coefficient

Zeros and ones are grouped together. Because of the small number of primes in an array 500 in column $i_2 = 4$ Table 1, as seen from the right graph in Figure 5, formed only two complete groups of four elements. Therefore formula (5) gets a full design.

To discharge $i_2 = 5$ the number of groups of ones and zeros (Figure 6) is clearly insufficient.

At the top there was formed the group of seven units, but at the bottom of the group of zeros is only being formed. Therefore we can define a rational power series of prime numbers, providing all the bits. The data in Table 4 shows that for $i_2 = 5$ the required 710 prime numbers (more than 708,9489).

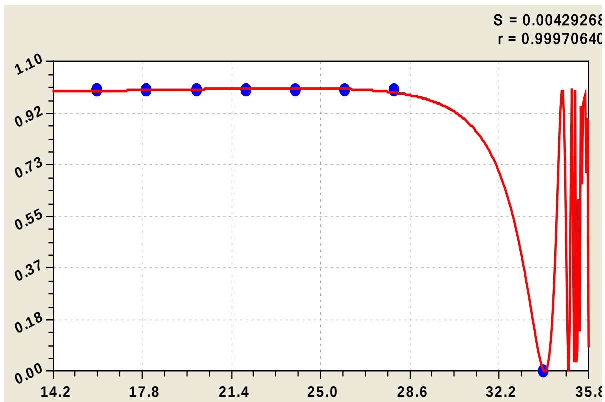

Figure 6. Schedule (5) for the fifth digit

It is noticed that while reducing the data set at $i_2 = 5$ to 36 lines of the character of the formulas in columns $i_2 = 2$ and $i_2 = 3$ is not changed. This indicates the saturation of these bits are the number of groups of ones and zeros. They are sufficient to identify patterns (6) with parameters from Table 4.

Then the third category with an increase in power $p(n)$ gets the physical meaning of the

$$z_2(i_2 = 3) \to 1/2 - 0,70711\cos(\pi\, p(n)/4 - \pi/4), \quad (8)$$

as shear waves 0,78539815 almost coincides with the value of the angle of $\pi/4$ = 0,7853975….

11. Check the Law

$z_2(i_2 = 2) = 1/2 - 1/2\cos(\pi\, p(n)/2)$. On the critical line $i_2 = 2$ indicated this model is stable and the other quantities of prime numbers (Figure 7).

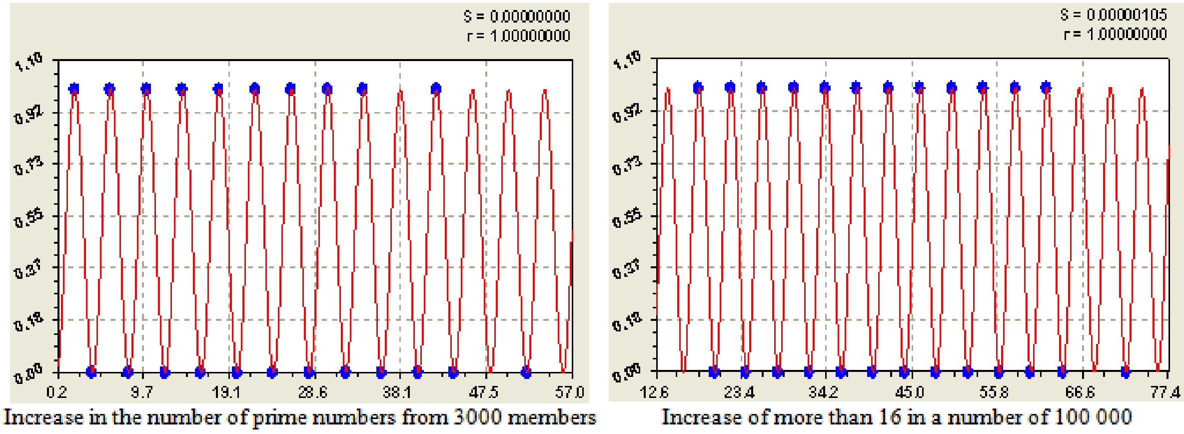

Figure 7. Graphs of law the distribution of the binary digits 0 and 1: S - dispersion; r - correlation coefficient

With the increase in power series to 3000 increases the number of points in the graph. To test the subset was taken (1704 lines) increments $p(n) \geq 18$ from 100 000 prime numbers. It follows that in any sample observed our law (6) of the critical line.

12. The Minimum Sample of Prime Numbers

The method of cutting off the bottom of Table 1 (Table 5) determine the minimum sample, where the law still in effect sustained the critical line.

Table 5. The minimum number of prime numbers

Order n	Prime number $a(n)$	Increment $p(n)$	Discharge i_2 number					
			6	5	4	3	2	1
			Part of the increase					
			32	16	8	4	2	1
2	3	2	trivial zeros				1	0
3	5	2					1	0
4	7	4				1	0	0

The minimum number of non-critical primes form only three members, which was obtained by equation (5) with rational parameters given in Table 6.

Approximation error of 0.5 → 1/2 is negligible. Schedule a simple in construction of equation (6) is shown in Figure 8.

In other discharges $i_2 > 2$ should be increasing the number of (power) of primes.

Between increment and its component there is a pattern of transition of the numbers from the decimal system of notation to binary.

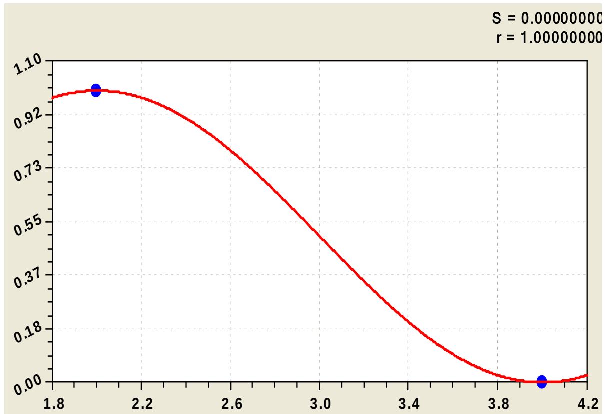

Figure 8. Schedule of the formula (6) for the three prime numbers

Table 6. The influence of the increment of a prime number to a binary number by the second digits of the binary system

Prime number $a(n)$	Increment $p(n)$	Parameters (6) a_1	a_2	a_3	Correlation coefficient r	Error ε
3	2	$\frac{1}{2}$	$\frac{1}{2}$	2	1	-9.989e-10
5	2					-9.989e-10
7	4					9.989e-10

13. Benchmarks

The first unit of the left formed the asymptotic line to the left of which there are only trivial zeros. Consider the benchmarks in the 500 prime numbers.

Benchmarks form a block. In an array of 500 points are few (Table 7), only five.

Proceeding from the condition that in the beginning of the series the gain is equal to the unit, was obtained (Figure 9) the formula

$$p_R(n) = \exp(0{,}80738 a_R(n)^{0{,}20489}), \qquad (9)$$

where the index R denotes a fixed points a prime number.

The use of benchmarks is much more compact than a relationship $x/\pi(x)$.

Table 7. Benchmark rate 500 prime numbers

Order n	Prime number $a(n)$	Increment $p(n)$	Binary digit i_2					
			6	5	4	3	2	1
			Part of the increase					
			32	16	8	4	2	1
2	3	2					1	0
4	7	4				1	0	0
24	89	8			1	0	0	0
99	523	18		1	0	0	1	0
217	1327	34	1	0	0	0	1	0

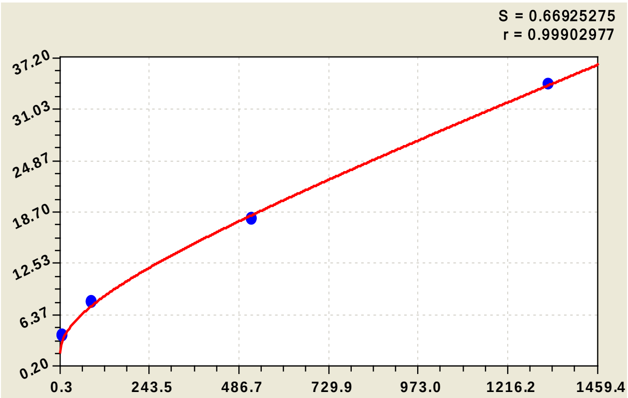

Figure 9. Schedule of benchmark functions of growth

14. Primary Increment

This - the third parameter (the first - a critical line 1/2), giving a picture of the increment rate of prime numbers. Parameter $p_P(n)$ for a number of 100 000 prime numbers are shown in Table 8, and he compiled the first appearance of the subsequent term. Primary increment is irregular, for example, an increase of 14 comes after 8 and earlier values of 10 and 12.

Various font allocated triangles (patterns of geometry) with sides (with $i_2 = 1$ - non-trivial zeros). Then the harmonious geometrical structures define the algorithm capacity increment, and even prime number.

Line increment varies with the initial constant "deuce", and there will be fluctuations, the trend

$$p_P(n) = 2 + 2{,}09287\, p(n)^{2{,}09287} \exp(-0{,}31341 p(n)^{1{,}06442}). \qquad (10)$$

For conditions $n \to \infty$ will always be $p_{\min}(n) = 2$.

15. The Envelope of the Line

Increments to the left of the asymptotic lines have trivial zeros. Therefore, taken into account the wave envelope line, which in different places concerns a critical line $i_2 = 2$.

This - the fourth parameter of the series.

Divide the increase in two parts $p(n) = p'(n) + p''(n)$. On the envelope line by line in the table (Figure 8) are located $p'(n) = 2^{i_2 \max - 1}$. And in the blocks $0 \le p''(n) = 2^{i_2 \max - 1} - 1$.

The trend with unit from the formula with three fluctuations looks like

$$p'(n) = 1 + 0{,}59470\, p(n)^{1{,}06436} + \dots. \qquad (11)$$

Table 8. The primary increase in the number of 100 000

Prime number $a(n)$	Growth $p(n)$	Binary digit i_2					
		6	5	4	3	2	1
		Part of increase					
		32	16	8	4	2	1
3	2					1	0
7	4				1	0	0
23	6				1	1	0
89	8			1	0	0	0
113	14			1	1	1	0
139	10			1	0	1	0
199	12			1	1	0	0
523	18		1	0	0	1	0
887	20		1	0	1	0	0
1129	22		1	0	1	1	0
1327	34	1	0	0	0	1	0
1669	24		1	1	0	0	0
1831	16		1	0	0	0	0
2477	26		1	1	0	1	0
2971	28		1	1	1	0	0
4297	30		1	1	1	1	0
5591	32	1	0	0	0	0	0
9551	36	1	0	0	1	0	0
15683	44	1	0	1	1	0	0
16141	42	1	0	1	0	1	0
19333	40	1	0	1	0	0	0
19609	52	1	1	0	1	0	0
28229	48	1	1	0	0	0	0
30593	38	1	0	0	1	1	0
34061	62	1	1	1	1	1	0
35617	54	1	1	0	1	1	0
45893	50	1	1	0	0	1	0
58831	58	1	1	1	0	1	0
81463	46	1	0	1	1	1	0
82073	56	1	1	1	0	0	0

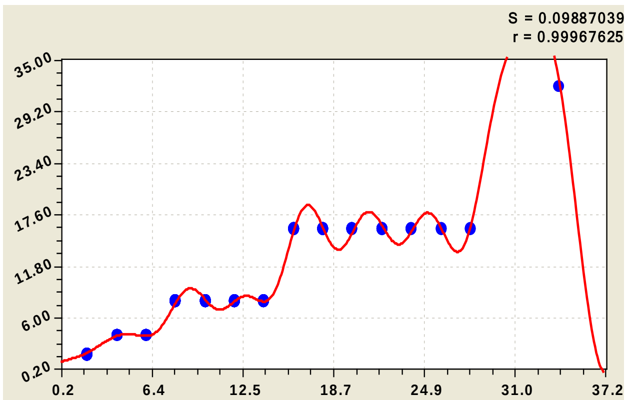

Figure 10. The graph of the envelope line increment numbers 500

At $n \to \infty$ in the formula (11) always will be in the beginning 1.

16. Conclusions

The critical line Riemann is located in a vertical column $i_2 = 2$ binary matrix of increment of number of simple. Not all non-trivial zeros lie on it. There is also a line of benchmarks, the initial rate (giving patterns of symmetry) and the bending around.

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