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Riemann Hypothesis and the Distribution of Prime Numbers

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Abstract: ***The conjecture was formulated by Germany Mathematician G F Bernhard Riemann in 1859, after whom it is named. He observed that the frequency of prime numbers is very closely related to the behavior of an elaborate function ζ (s) =1+1/2s+1/4s+. . . called the Riemann Zeta function, where ζ is zeta. The conjecture is in number theory in pure Mathematics. It is of great interest because it implies results about the distribution of the prime numbers. The conjecture is one of the seven millennium problems to be awarded US$ 1million each by Clay Mathematics Institute if proved by anyone.***

Keywords: Riemann hypothesis, Twinprimes, Non - twin primes, Boscomplex Web Method (BWM), Flowchart

1. Introduction

The Riemann hypothesis is a conjecture that the Riemann Zeta function has its zeros only at the negative even integers - 2, - 4, - 6. . . and complex numbers with real part 1/2. The conjecture states that: "The real part of every nontrivial zero of the Riemann Zeta function is 1/2". Thus, if the hypothesis is correct, all the nontrivial zeros lie on the critical vertical straight line consisting of the complex numbers 1/2+it, where t is a real number and is the imaginary unit. The hypothesis is therefore, concerned with the locations of these nontrivial zeros.

2. Proof

Boscomplex Web Method (BWM)

Fig.1 (b) below shows Boscomplex Web Method (BWM) diagram.

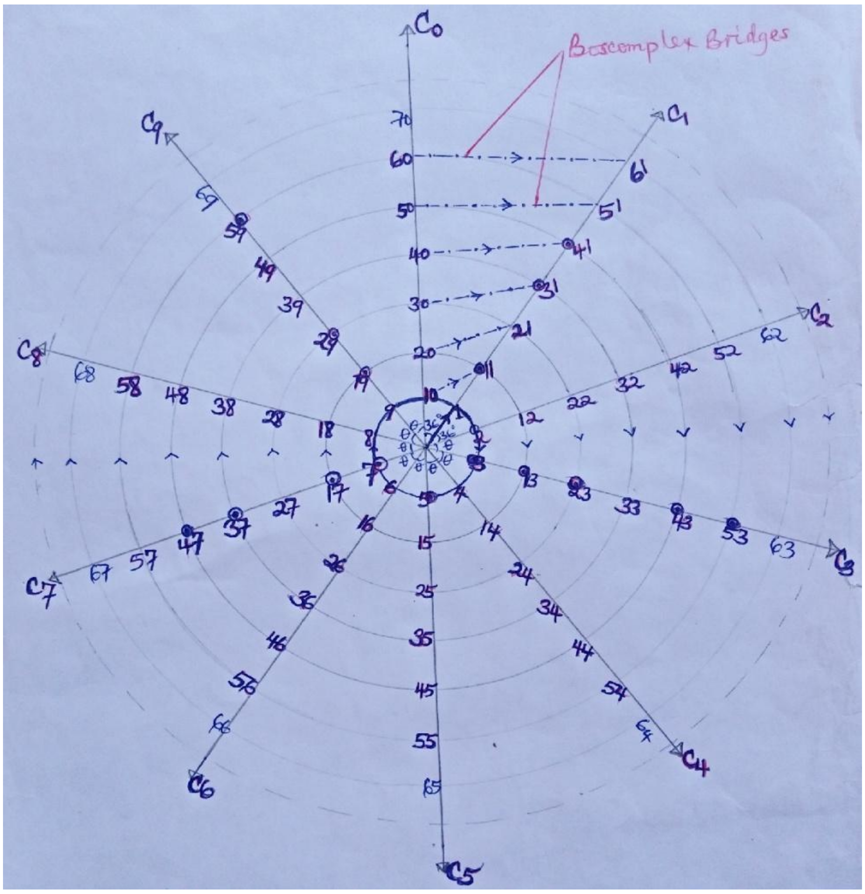

Figure 1: (a) Boscomplex Web Method (BWM)

The figure 1 (a) above just as in the Goldbach's conjecture shows the arrangement of natural numbers in cyclic manner that are intercepted by 10 Cardinals. Half of the Cardinals (i.e. 5 Cardinals) carry even numbers and the other half (5) carry odd numbers as shown in the fig.1 above. There are infinitely many circles that intercept with the ten Cardinals. It is noted that all the Cardinals that carry even numbers do not contain prime numbers except Cardinal C_2 contains 2 as the only even prime number in Boscomplex Web Method (BWM). All the Cardinals that carry odd numbers contain at least one prime number. Cardinal c_5 contains only one prime number 5, just as C_2 has 2 only as a prime number. This means that any combination of numbers that ends with either two (2) or five (5) is not a prime member. The ten (10) Cardinals are named as c_0, c_1, $c_2 \ldots c_8$ and c_9 as in the above diagram. They are separated from each other by an angle $\varnothing = 36^\circ$ (1). The angle $\varnothing$ is given by $\varnothing = 360^\circ / n$. (2), where 360º is the total degree of a circle, n is the number of Cardinals, and n=10 (3). The Cardinals are connected to one another by Boscomplex Bridges with dotted lines between c_0 and c_1 { (i.e. even numbers ending with zero (0) and odd numbers ending with one (1) }. Each Cardinal is intercepted by cyclic patterns at various points. The first circle is a set of natural numbers from 1 to 9 and ends with ten (10) as the tenth Cardinal which is a combination of 1 and 0. The 2^{nd}, 3^{rd}, $4^{th} \ldots \infty^{th}$ circles are at an interval of 10 from each other. They carry numbers whose last digits correspond to the digits of the Cardinal numbers e.g.

(i) 10, 20, 30, 40, correspond with 0.
(ii) 11, 21, 31, 41 correspond with 1.
(iii) 12, 22, 32, 42 correspond with 2.
(iv) 13, 23, 33, 43 correspond with 3.
(v) Etc.

The numbers 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 give the Cardinal numbers c_0, c_2, c_3,. . . c_8 and c_9. Zero is placed at the center of each circle (reference point) as in the above diagram. The direction of cyclic movement is clockwise and it starts from the center of each circle at 0 to 1 along c_1 then through the first circle from 1 to 10 where a bridge is crossed from 10 to 11 i.e. from c_0 to c_1. The process is repeated with 2^{nd}, $3^{rd} \ldots \infty^{th}$ circles. Cardinalsc$_0$ and c_1 are connected by Boscomplex Bridges for one to cross from c_0 to c_1. Therefore, the space between c_0 and c_1 acts as a river known as Boscomplex River.

NB: The numbers indicated with red dots are prime numbers.

Fig, 1 (b) below shows the arrangement of the prime numbers on Boscomplex Web. The spiral (cyclic) journey starts from the first prime number two (2) which is the only even prime number. To cross from one circle to the other, Boscomplex Bridges have to be crossed as shown in the diagram with dotted lines.

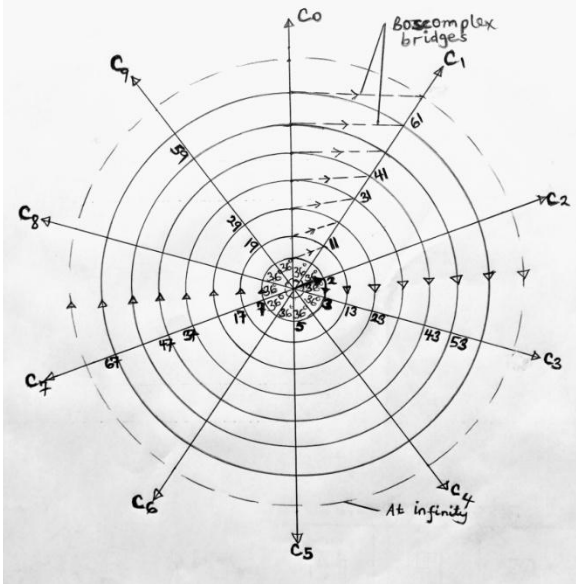

Figure 1 (b): Boscomplex Web Method

3. Twin Prime Numbers

Equation:

If two adjacent Twin prime numbers are p and p_n, the equation for finding the next prime p_n is given by

$p_n = p+2$. (4)

Where p_n= next prime number.
p_n=preceding prime number
2= d=Boscomplex constant, k_b
d is the difference between p and p_n.

Derivation of $p_n = p+2$

From the first circle, I have integers; 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 as a combined number but the journey starts from 0 at the center.

The prime numbers from this set are 2, 3, 5 and 7; 2 being the first prime number and the only even number.

Therefore, to locate the 2^{nd} prime after 2, we use the formula; p_{next}= (average of adjacent even numbers, e_1 and e_2) + (difference between them).

=> $p_n = (e_1+e_2)/2 + d$. But $(e_1+e_2)/2 = p$ (7), where p is preceding prime number that p^n follows.
d=2=Boscomplex constant, k_b.

To find d= 2, start from center, 0 as the first even number e_1 to 2 as the next even number e_2, then determine the difference between them i.e.

0, _____________1__________________2
e_1< - - - d_1 - - - -- >l< - - - - - d_2 - - - - - - >e_2

$$\sum_{e_1}^{e_2} d_i.$$

=> $d = d_1 + d_2$ (8)

Where e_1 is the preceding even number before p, e_2 is the proceeding even number before p_n.
= (1 - 0) + (2 - 1)
=1+1
$\therefore$d=2 units.

From $p_n= (e_1+e_2) /2+d$,
=> $p_n= (0+2) /2+2$
$p_n=1+2 <=> p_n=p+2$
$p_n=1+2=3$ remember 1 is not a prime number.
Thus $p_n=3$.
∴Next prime number, $p_n=3$.

NB: (i) zero (0) as the first even number is placed at the center from which the spiral journey starts.
(ii) 2 and 3 are not Twin prime numbers since they have difference of one (1) between them.

Similarly the next prime number after 3 is given by;
$p_n= (e_1+e_2) /2+d$,
2, - - - - - - - - - - - - - 3, - - - - - - - - - , 4
l< - - - - - - d_1 - - - - >l< - - - d_2 - - - >l
e_1 e_2

From $\sum_{e_1}^{e_2} d_i$

- - >$d=d_1+d_2$
d=1+1= 2units
=> $p_n= (2+4) /2+2$
$p_n=3+2<=> p_n=p+2$
∴$p_n=5$.

The next prime number after 5 as the fourth prime number
Given; 0, 1, 2, 3, 4, 5, 6, 7
I< - - d_1 - - >l< - - d_2 - - >l
e_1 e_2
I< - - - - - - - d - - - - - - - >l
$d=d_1+d_2= (5 - 4) + (6 - 5)$
∴d=1+1=2
Or $\sum_{e_1}^{e_2} d_i= d_1+d_2= 1+1=2$
From $p_n= (e_1+e_2) /2+2 <=> p_n=p+2$
=> $p_n= (4+6) /2+2$
$P_n =5+2 <=> p_n=p+2$
∴ $p_n=7$.

Summary of the above steps;

Step1: Identify the first prime number p in the set.

Step2: Identify the adjacent even numbers e_1 and e_2.

Step3: sum the mean of e_1 and e_2 with $k_b=d=2$. (9), to give p_n.

Expression (9) gives the vertical critical line i.e. the line passes through d=2.

From the second circle, the following are the set of numbers; 11, 12, 13, 14, 15, 16, 17, 18, 19, 20. The prime numbers from this circle are; 11, 13, 17 and 19, with 11 and 13, 17 and 19 as twin prime numbers whilst 13 and 17 as non - twin prime numbers in the set i.e.
$p_n=11$, $e_1=10$, $e_2=12$, $p_n=?$
$p_n= (e_1+e_2) /2+k_b$ (10)
<=> $p_n=p+k_b$, where $k_b=d=2$
$p_n= (10+12) /2+2$
=11+2
∴$p_n=13$

NB: From the above example for twin prime numbers, $(e_1+e_2) /2$=preceding prime, p.
=> $(e_1+e_2) /2=p$, prime before the next prime (p_n).
∴$p_n=p+d$ (11)
=> $p_n=p+k_b$. (12)

Hence $p_n=p+2$, hence shown.
∴ $p_n=p+2$ is the general equation for finding the next twin prime number, where;
p_n is the next prime, p is the preceding prime that p_n follows.2 is Boscomplex constant, $k_b=d$, d is the difference between p and p_n.

From (11), $d=p_n – p$ (13)

A graph of twin prime, p_t against difference, d

Table 1 (a) below shows ungrouped frequency distribution of twin primes in ascending order

$p_t=p+2$/units	3	5	7	11	13	17	19	29	31	41	43	59	. . .
d/units	2	2	2	2	2	2	2	2	2	2	2	2	…

Points to be plotted;
(2, 3), (2, 5), (2, 7), (2, 11), (2, 13), (2, 17), (2, 19), (2, 29), (2, 29), (2, 31), (2, 41), (2, 43), (2, 59).

A graph of pt. against d
Scale;
Horizontal scale; 1cm: 2units
Vertical scale; 1cm: 2 unit

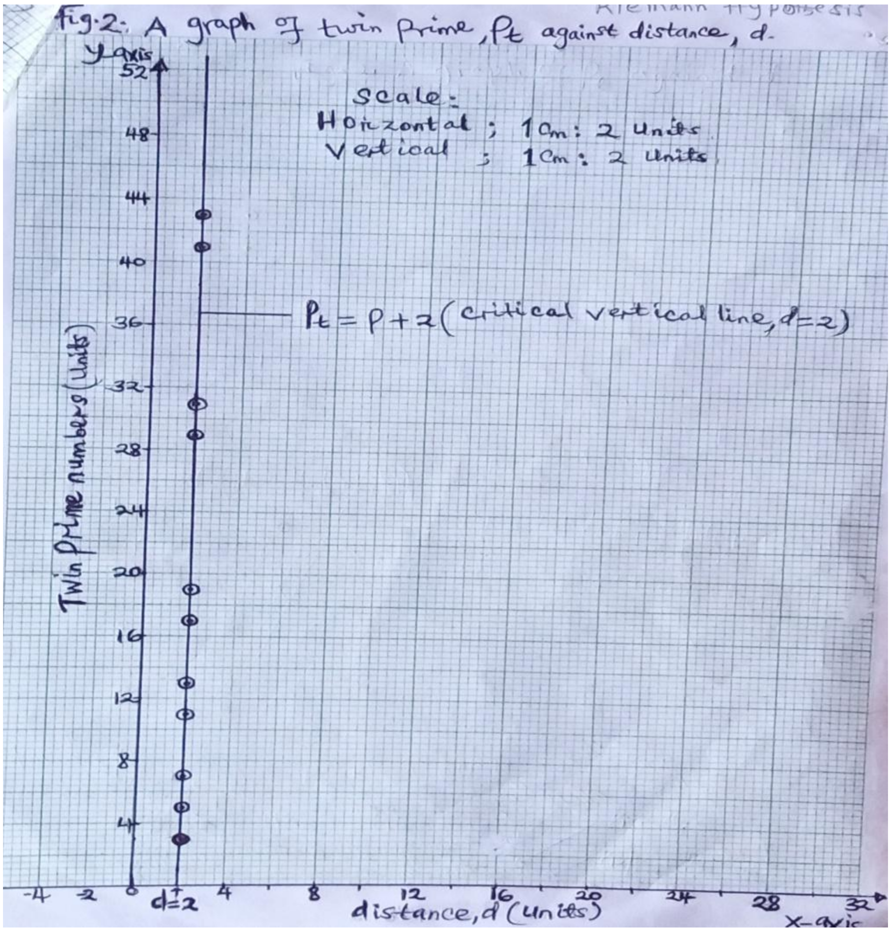

Figure 2

From the graph above, it's shown that the vertical critical line passes through Boscomplex constant k_b=d=2. Hence all the nontrivial zeros lie on the critical vertical straight line passing through 2. If the line x=d=0 acts as a mirror line, the image of the critical vertical line passing through x=d=2 passes through x=d= - 2 where the Riemann Zeta function ζ (s) =0.

Table 1 (b): below shows the grouped frequency distribution of twin primes in ascending order.

Pt=p+2/units	3-5	5-7	11-13	17 - 19	29 - 31	41 - 43	59 - 61	. . .
d/units	2	2	2	2	2	2	2	. . .

NB: From this grouped data, different aspects of statistics can be calculated e. g. the mean, median, mode, standard deviation, variance, quartiles, deciles, percentiles etc.

Graphs of Ogive, moving average, can be plotted. Rank correlations i.e. Pearson's, Spearman's and Kendall's rank correlations.

4. Non Twin Prime Numbers

The equation for finding non twin primes is given by

p_n= (average of numbers between adjacent primes) +1/2 (difference between average number and preceding prime).

==> $p_n = (n_1+n_2+n_3+. . .) / N_i + 1/2\,(d)$ (14)

$d \geq 1$ (15)

Where n_1, n_2, n_3. . . are numbers between p_n and average number.

N_i= number of items $n_1, n_2, n_3 ... n_i$.

d=difference between average number and the preceding prime (i.e. mid of difference).

$$\textbf{Derivation of } p_n = \frac{(n_1+n_2+n_3+. . .)}{N_i} + 1/2d.$$

Let two non prime numbers p and p_n be 7 and 11 respectively. Considering the set of numbers from 7 to 11, where p=7, p_n=11. i.e.

	n_1	n_2	n_3	
7,	8,	9,	10,	11

p < - - d_1 - - >I< - - d_2 - - >I<- - d_3- - >I< - - d_4- - >p_n

I< - - - - - - - - - - - - - - - d - - - - - - - - - - - - - - - >I

n_1=8, n_2=9, n_3=10, N_i=3.

$d=d_1+d_2+d_3+d_4$ (16)

d=1+1+1+1=4 by addition.

Or $\sum_{i=p}^{i=p_n} d_i$,

Where p is the preceding prime number, p_n is the next prime number, and d_i is the difference between p and p_n, i.e.

$d= d_1+d_2+d_3 + ...+ d_i$.

Or by counting d=4

=>N_i=d - 1 (17)

Hence

$d=N_i+1$ (18)

$$p_n = \frac{(n_1+n_2+n_3)}{N_i} + 1/2\,(d)$$

$$\Rightarrow p_n = \frac{(8+9+10)}{3} + 4/2$$

=27/3+2

=9+2=11

$\therefore P_n$=11 as above.

Similarly 31 is a prime member, the next prime number, p_n=37, is given by;

$p_n = (n_1+n_2+n_3+...)\ /Ni+1/2\ (d)$

Given 31, 32, 33, 34, 35, 36, 37

p< - - - d - - - - - - - - - - >p_n

$\Rightarrow p_n = (32+33+34+35+36)\ /5+6/2$

=34+3

$\therefore p_n$=37 as above.

Similarly the next prime number after 37 is 41. This is given by;

p_n= (Average of numbers between them) + 1/2d.

$\therefore p_n = (38+39+40)\ /3+4/2$

p_n=41 as above

In general, the next prime number, p_n for non - twin prime is given by;

p_n= (mean of numbers between adjacent primes) +1/2

Hence

$$p_n = \frac{(n_1+n_2+n_{3+}...)}{N_i} + 1/2d \qquad (19)$$

Therefore, the distribution of prime numbers is a function defined by two Equations as below.

(i) $p_n=p+2$ for twin primes.

(ii) $p_n = (n_1+n_2+n_3+...)\ /N_i + 1/2d$, for non Twin primes.

NB: (i) (14) can be expressed in terms of d by replacing N_i with d - 1 as in (17).

$$\text{i.e. from } p_n = \frac{(n_1+n_2+n_3+...)}{N_i} + 1/2d.$$

Given N_i=d - 1, from (17)

$$\Rightarrow p_n = \frac{(n_1+n_2+n_3+...)}{d-1} + 1/2d$$

$$= \frac{2\,(n_1+n_2+n_3+...) + d\,(d-1)}{2\,(d-1)}$$

$$= \frac{2\,(n_1+n_2+n_3+...) + d^2 - d}{2\,(d-1)}$$

$$\therefore p_n = \frac{(n_1+n_2+n_3+...)}{d-1} + 1/2\,(d^2 - d) \qquad (20)$$

Equation (14) can also be expressed interms of N_i by replacing d in (14) with N_i+1 as in (18).

$$\text{i.e. from } p_n = \frac{(n_1+n_2+n_3+...)}{N_i} + 1/2d.$$

From (18), $d=N_i+1$

$\Rightarrow p_n = (n_1+n_2+n_3+...)\ /\ N_i+1/2d$

$$P_n = \frac{2\,(n_1+n_2+n_3+...) + 1/2\,(N_i+1)}{2N_i}$$

$$= \frac{2\,(n_1+n_2+n_3+...) + (N_i^2 + N_i)}{2N_i}$$

$$\therefore p_n = \frac{(n_1+n_2+n_3+...) + 1/2\,(N_i^2 + N_i)}{N_i} \qquad (21)$$

The flow chart below shows the distribution of prime numbers by using the two functions (equations), (11) and (14).

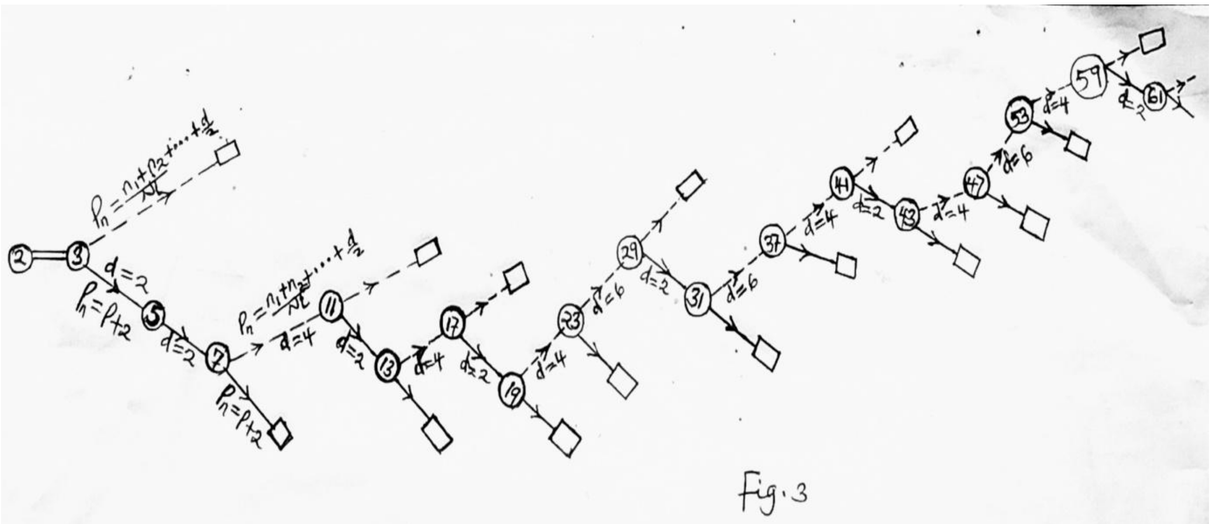

Figure 3: Showing distribution of prime numbers

——>—— defines the function $p_n=p+2$ for twin primes where 2=difference, d (interval) between two adjacent prime numbers.

- - - > - - - - defines function

$$p_n = \frac{(n_1+n_2+n_3+...)}{N_i} + 1/2d, \text{ for non twin primes.}$$

==is a route (or bridge) that links 2 the only even prime number to the first odd prime, 3.

O indicates the home for printing the prime numbers in the flow chart.
[]is an empty set.
d can be obtained from $d=p_n - p$ as in (13), if p and p_n are known.

NB: In general, the sum of the difference (interval) between any two adjacent prime numbers plus the preceding prime number of any set equals to the next prime. That's $p_n = p + d$, where $d \neq 2$ as a constant in twin prime numbers. Therefore, the general Boscomplex prime distribution function (pdf), is given by $p_n = p + d$.
That's $p_n=p+d$

Examples
1. The first prim, p=2
The next prime, $p_n=3$, given by $p_n=p+d$.
Where d=difference between p_n and p (i.e. between 2 and 3) respectively.
=> $d=p_n-p=3 - 2=1$
$\therefore$ d=1unit.
From $p_n=p+d$
$p_n=2+1$
$\therefore p_n=3$ as above.

2. The next prime, $p_n=5$ when p=3.
Difference, d between 5 and 3 is given by;
$d=p_n - p$
$=5-3=2$
$\therefore$ d=2
From $p_n=p+d$
=> $p_n=3+2=5$ as above.

3. The next prime number, p_n after p=5 when d=2 is given by;
$p_n=p+d$
=> $p_n=5+2=7$
$\therefore p_n=7$

4. For prime set 7 and 11 where $p_n=11$, p=7.
$P_n= 11$ is calculated from $p_n=p+d$
From $d=p_{n\,-}\,p$
=> d=11 - 7=4
$\therefore p_n=p+d=7+4=11$ as above.

Therefore, in the above flow chart, when each of the differences (intervals) are added to the proceeding primes of each set, the next primes are obtained.

A graph of non - twin primes, p_{tn} against difference, d
The following are some of the Non - twin primes arranged in order of their distribution with their differences from each of their preceding prime numbers with which they are non twin primes. Here only the upper limits are considered except the first prime number 2.

Table 2 (a): below shows ungrouped frequency distribution for non twin primes

$P_{tn}=(n_1+n_2+n_3+...)/N_i+1/2d$ (units)	2	3	11	17	23	29	37	41	47	53	59	...
d (units)	0	1	4	4	4	6	6	4	4	6	6	...

Points to be plotted are; (0, 2), (1, 3), (4, 11), (4, 17), (4, 23), (6, 29), (6, 37), (4, 41), (4, 47), (6, 53) (6, 59).

A graph of P_{tn} against d
Scale;
Horizontal scale; 1cm: 2 units
Vertical scale; 1cm: 2 units

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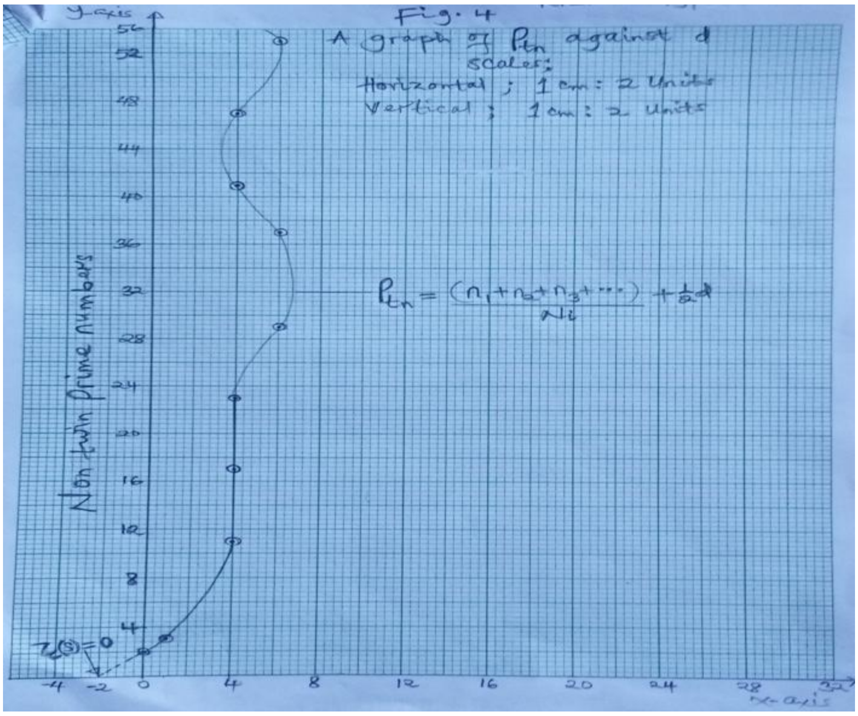

Figure 4

In the graph above, it's shown that the Riemann Zeta function has its zeros only at the negative even integers, i.e. - 2 for this case. Hence ζ (s) =0 at - 2.

NB: grouped frequency distribution table for non twinprimes is obtained as below.

Table 2 (b): below shows grouped frequency distribution table for non prime numbers

$P_{tn}= (n_1+n_2+n_3+. . . /N_i+1/2d$ (units)	2-3	7-11	13 - 17	19 - 23	23 - 29	31 - 37	37 - 41	43 - 47	47 - 53	. . .
d/units	1	4	4	4	6	6	4	4	6	. . .

Combination of twin prime, $p_{t.}$ And non - twin primes, p_{tn} against difference, d. That's to say twin primes and non twin primes combined together.

Table 3: below shows the distribution of twin primes and non twin primes with their differences from the first prime number, P_0=2.

P_t and P_{tns}	2	3	5	7	11	13	17	19	23	29	31	37	41	43	47	53	. . .
d= (pt and Ptn) - p0	0	1	3	5	9	11	15	17	21	27	29	35	39	41	45	51	. . .

Points to be plotted are;
(0, 2), (1, 3), (3, 5), (5, 7), (9, 11), (11, 13), (15, 17), (17, 19), (21, 23), (27, 29), (29, 31), (35, 37), (39, 41), (41, 43), (35, 47), (51, 53).

A graph of p_t and $P_{tn.}$ Against difference

Scale;
Horizontal scale; 1cm: 5 units
Vertical scale; 1cm: 2 units

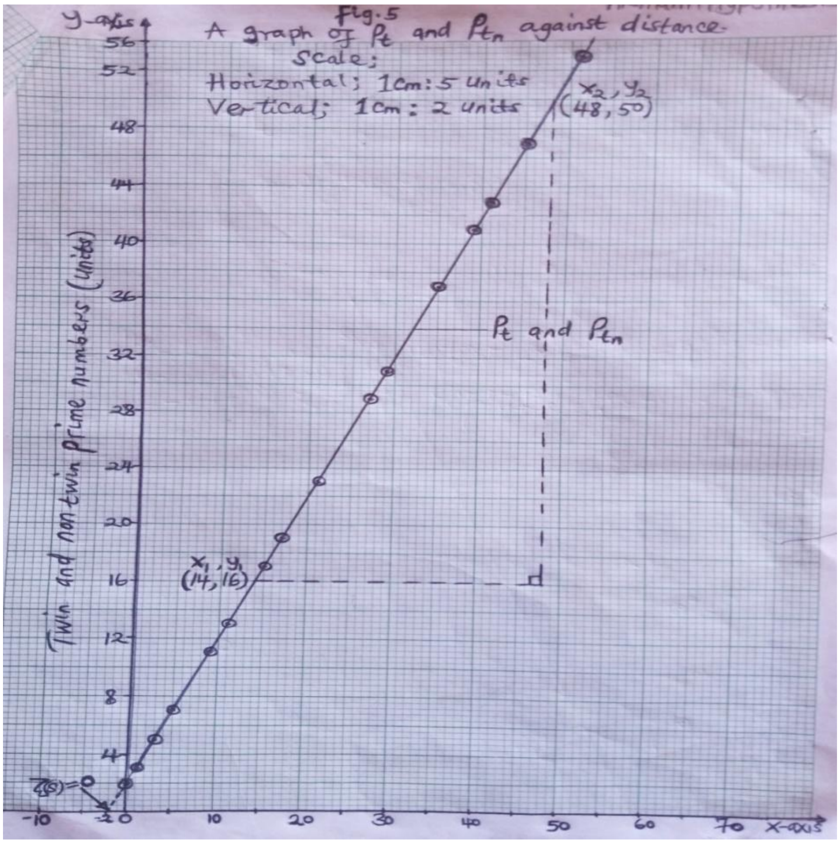

Figure 5

The slope, S of the graph = $\dfrac{\text{Change in y}}{\text{Change in x}}$

$$\Rightarrow S = \frac{y_2 - y_1}{x_2 - x_1}$$

S= (50 - 14) / (48 - 12) =36/36=1

∴ S=1.0 unit

By using Boscomplex method, the above slope can be calculated from;

Slope, S= ∅ / (90° - ∅), where ∅ is the angle between x - axis and the plotted line if it passes through the origin, or a horizontal line parallel to x - axis, (90° - ∅) is the angle between the plotted line and the y - axis.

=>S=45° / (90° - 45°) =45°/45°

∴ S= 1.0 unit as above

Graphs of $p_{t.}$, $p_{tn.}$, $p_{t.}$ and $p_{tn.}$ Against difference Scales;

Horizontal scale; 1cm: 5 units

Vertical scale; 1cm: 5 units

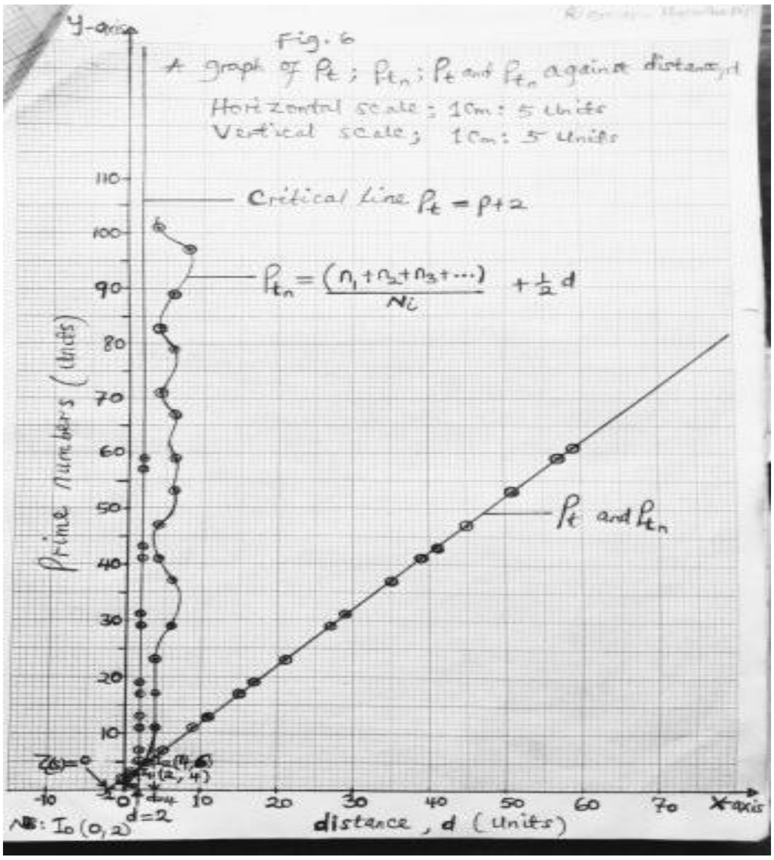

Figure 6

From the above graph, line $p_t=p+2$ is a vertical critical line passing through Boscomplex constant $k_b=d=2$. This is a graph of twinprimes, p_t against differences, d.

$$\text{The line } p_{tn}=\frac{(n_1+n_2+n_3+...)}{N_i}+1/2d$$

This is a curve of non twin prime numbers which is sinuous with minima at d= 4 and Maxima at d=7, the curve intercepts the y - axis at $p_o=2$ and crosses x - axis as line p_t and p_{tn} at Zeta function, $\zeta(s)=0$, where d= - 2. Also the straight line p_t and p_{tn} crosses the y - axis at p=2 and x - axis at Zeta function $\zeta(s)=0$, where d= - 2. Therefore, $\zeta(s)=0$ when s=d= - 2, hence its trivial zero is at - 2. The numbers - 2, ½ and d=2 (the position of the vertical critical line) in the above expression are the main numbers Riemann had been searching for.

$$\text{Slope, S of the line } p_t \text{ and } p_{tn}=\frac{\text{Change in y}}{\text{Change in x}}=(y_2-y_1)/(x_2-x_1)$$

= (34 - 8) / (32 - 6) =26/26=1

∴ S=1.

The slope, s can also be calculated from Boscomplex method, S=ΔI/Δd, where I is the intercept, d is the difference.

=> S= $(YI_2 - YI_1) / (XI_2 - XI_1)$ = (6 - 4) / (4 - 2) =2/2=1.

Or S= $(YI_1 - YI_0) / (XI_1 - XI_0)$ = (4 - 2) / (2 - 0) =2/2=1.

Similarly S= $(YI_3 - YI_0) / (XI_3 - XI_0)$ = (2 - 0) / (0_ - 2) =2/2=1.

Comparison between Riemann's Zeta Function With Equation For Non – Twin Prime Numbers

The Riemann Zeta function given by $\zeta(s)$ =1+1/2d. (23), is related to the frequency of the distribution of prime numbers given by the equation;

$$p_n=\frac{(n_1+n_2+n_3+...)}{Ni}+1/2d.$$

Comparing the left hand sides, i have $\zeta(s)=p_n$ (24),

Where ζ is zeta, p_n is next prime for non twinprimes.

Comparing the right hand sides, i have

$$1=\frac{n_1+n_2+n_3+...}{N_i} \quad (25)$$

=> $N_i=n_1+n_2+n_3=0$, since d=1 between p=2 and $p_n=3$, i.e. the 1st and 2nd primes respectively.

$$\text{Hence } \frac{(n_1+n_2+n_3+...)}{N_i}=\frac{\text{number of items}}{N_i}=0/N_i=0.$$

Also from N_i=d - 1

=> N_i=1 - 1, hence N_i=0.

Similarly, $N_i=n_1+n_2+n_3+...=1$ when p=3 and $p_n=5$, 4 is the only number between 3 and 5.

=>The number of items $n_1, n_2, n_3...=1$

$$∴ 1=\frac{n_1+n_2+n_3+...}{N_i}=1/N_i.$$

$$1=\frac{1}{N_i} => N_i=1$$

Or from N_i= d - 1,

Difference, d between 3 and 5 is 2.

=> N_i=2 - 1

$\therefore N_i=1$

Number, N_i of items $n_1, n_2, n_3. . . =1$ i.e. 4 exists as the only integer between 3 and 5.

$$\Rightarrow \frac{n_1+n_2+n_3+\ldots}{N_i} = 1/1 = 1$$

Similarly, when $N_i=4$, i.e. $n_1, n_2, n_3, n_4. . .$

$$\Rightarrow \frac{n_1+n_2+n_3+\ldots}{N_i} = 4/4 = 1$$

$\therefore p_n=0+1+½ d$.

Hence $p_n = p + (1 + ½ d)$ or $p_n = p + ½ (2 + d)$. This method is also used to find the next twin prime number as well as $p_n= p + 2$ or $p_n = p + d$ as in (4) and (11) respectively. Therefore, the twin prime distribution function (pdf) known as Boscomplex prime distribution function, $p_n = p + (1 + ½ d)$ with its zeros only at positive even integer 2, and the real part of every nontrivial zeros of the Riemann Zeta function is 1/ 2.

Examples

Use Boscomplx twin prime distribution function to work the following next prime numbers;

a) To find the next prime number after 3, i.e. 5.

Solution:

From pdf, $p_n = p + (1 + ½ d)$;

p= 3, d= 2

$\rightarrow p_n = 3 + (1 + ½ d)$

$= 3 + ½ (4) = 3 + 2$

$p_n = 5$.

b) To calculate the next twin prime number after 5, i.e.

Solution:

From $p_n = p + ½ (2 + d)$

$= 5 + ½ (2 + 2)$

$= 5 + 2$

$p_n = 7$

c) To determine the next twin prime number after 11, i.e.13.

Solution:

p = 11, d= 2

From pdf, $p_n = p + ½ (2 + d)$

p = 11, d = 2

$p_n = 11 + ½ (2 + 2)$

$= 11 + ½ (4)$

$p_n = 13$.

d) Find the preceding twin prime number before 31.

Solution:

pn = 31, p =?, d= 2

Using $p_n = p + (1 + ½ d)$

$31 = p + [1 + ½ (2)]$

$31= p + [1 + 1]$

$\rightarrow p= 31 - 2= 29$

Prove using $p_n= p + 2$

$31= p + 2$

Hence p= 29

Comments

The Riemann Hypothesis is true since the distribution of the prime numbers has its zeros only at the positive integer 2, and the Riemann zeta function has its zero at negative even integer - 2. The real part of every nontrivial zero of the Riemann Zeta function is 1/2. All the nontrivial zeros lie at positive 2 on the critical vertical line $p_n=p+2$ passing through 2 i.e. p/d=3/2=1+1/2, 5/2=2+1/2, 7/2=3+1/2, 11/2=5+1/2=id+1/2≡ it +1/2, d=t is the complex number and i is imaginary number.

Applicability of Riemann Hypothesis

Having the proof to Riemann hypothesis at hand has many positive economic impacts on the World since it cuts across, from Mathematics to Economics and Sports science. In the field of Mathematics it covers areas of analysis and probability theory, Statistics.

1) In statistics we can use the data in the tables above to calculate mode, median, mean, standard deviation, variance, quartiles, deciles, percentiles etc from their respective formulae and also by using graphs e. g. Ogive, graphs of moving average, rank correlations e.g. Spearman's, Kendall's and Pearson's rank correlations.
2) In probability, fig.1 can be used to calculate the probabilities of even, odd, twin primes, non twinprimes, or a combination of them for given limits, etc.
3) In sports, fig.1 can be used to develop a gaming spinning machine for betting companies hence benefitting both sports betting companies as well as those who bet and the economic development of the countries hence the entire World.

5. Future Scope (Improvements)

Further improvements are possible, especially if one (1) is considered as a prime number in future which I believe it is, the later I can't discuss herein.

Author Profile

Adriko Bosco is from Terego District Uganda, an independent researcher in Mathematics, more especially the millennium mathematics and the Hilbert David's 23 Mathematics problems. The career objective of the author is to work for the development of Mathematics in Uganda and the World in general. He went to St. Joseph's college Ombaci and has certificate in ICT from Makerere University in Uganda. The author taught Physics, Chemistry, Biology and Mathematics in many Secondary schools in Uganda and South Sudan for seventeen years who was once the head - teacher of Wulu secondary School (2008 - 2010). He has many manuscripts in Mathematics since May 2020 including; 1. Riemann hypothesis, 2. Goldbach's conjecture, 3. Birch and Swinnerton—Dyer conjecture, 4. The Beal conjecture, 5. Twin prime conjecture, 6. Fermat's Last Theory, 7. Diophantine equations, 8. Solvability of a Diophantine equation, 9. Arbitrary quadratic forms, 10. Reciprocity laws and Algebraic number fields, 11. Deal with Pi (π) and Euler's constant, e, 12. He has derived some formulae for solving arithmetic mean, and so on which are due to be published. He is preparing a Mathematics book entitled **"The Book of Wisdom and Giniuseness"**. The author is also a song writer.