The Prime Numbers

Let Ni be a natural integer less than or equal to N, then exists the formula as follows:

\[ Ni \leq N \]  

(1)

In terms of the above formula we can obtain the array as follows:

\( (1), (2), (3), (4), (5), \ldots, (N) \).  

From the above arrangement we can obtain the formula as follows:

\[ Ni(N) = N - \text{Total of integers } Ni \leq N \]  

(2)

If Ni can be divided by the prime anyone less than or equal to \( \sqrt{N} \), then sieves out the positive integer Ni; If \( N_p \) can not be divided by all primes less than or equal to \( \sqrt{N} \), then the number \( N_p \) is a prime.

The Sieve Method

Let \( Pi \) be a prime less than or equal to \( \sqrt{N} \), the number of integers \( Ni \) can be divided by the prime \( Pi \) is \( \text{INT} \{ N/Pi \} \), the number of integers \( Ni \) can not be divided by the prime \( Pi \) is:

\[ N_p(N, Pi) = N - \text{INT} \{ N/Pi \} = \text{INT} \{ N \times (1-1/Pi) \} \]  

(3)

Where the \( \text{INT} \{ \} \) expresses the taking integer operation of formula spread out type in \{ \}.

The New Prime Number Distribution Theorem

Let \( Pi(N) \) be the number of primes less than or equal to \( N \), \( Pi(2 \leq Pi \leq Pm) \) be taken over the primes less than or equal to \( \sqrt{N} \), then exists the formulas as follows:

\[ Pi(N) = \text{INT} \{ N \times \prod (1-1/Pi) \} + m - 1 = Li(N) - 0.5 \times Li(N^{0.5}) \pm 0.5 \times Li(N^{0.5}) \]  

(4)

\[ Li(N^{0.5}) \geq Li(N) - Pi(N) \geq 0 \]  

(The Riemann Hypothesis is proved)

\[ Pi(N) = R(N) \times K \times (Li(N) - R(N)) \]  

, \( 1 \geq K \geq -1 \).

\[ P(K) = 1.99471140200716338696973029997 \times EXP(-12.5 \times K \times K) \]

Where the \( \text{INT} \{ \} \) expresses the taking integer operation of formula spread out type in \{ \}, the \( Li(N) \) is the logarithmic integral function, the \( R(N) \) is the Riemann Prime Counting Function, the \( P(K) \) is the Normal Distribution \( N(\mu=0, \sigma=0.2) \).

The Normal Distribution Theorem of Prime Numbers

Let \( Pi(N) \) be the number of primes less than or equal to \( N \), for any real number \( N \), the New Prime Number Distribution Theorem can be expressed by the formulas as follows:

\[ Pi(N) = R(N) + K \times (Li(N) - R(N)) \]  

, \( 1 \geq K \geq -1 \).

\[ Pi(N) = R(N) \pm (Li(N) - R(N)) \]  

, \( Pi(N) = Li(N) - 0.5 \times Li(N^{0.5}) \pm 0.5 \times Li(N^{0.5}) \]  

(8)
The Extreme Limit Formulas of New Prime Number Distribution Theorem

Let $P_i(N)$ be the prime-counting function that gives the number of primes less than or equal to $N$, for any real number $N$, then prime number theorem can be expressed by the formula as follows:

$$P_i(N) = \text{INT} \{N \times (1 - 1/P_1) \times (1 - 1/P_2) \times \ldots \times (1 - 1/P_m) + m - 1\}$$

Where the $\text{INT} \{ \ldots \}$ expresses the taking integer operation, $P_1, P_2, \ldots, P_m$ are all prime numbers less than or equal to $\sqrt{N}$, the $\text{Li}(N)$ is the logarithmic integral of formula spread out type in $\{ \ldots \}$.

### Distribution Theorem

**Citation:** Sha YY. Gauss Riemann Shayinyue Prime Number Distribution Theorem. SM J Biometrics Biostat. 2018; 3(3): 1035.