The Calculation of New Prime Number Theorem Formula

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Short Commentary

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

$$Pi(N) = INT \{N \times (1 - 1/P_1) \times (1 - 1/P_2) \times \dots \times (1 - 1/P_m) + m - 1\},$$

where the $INT \{...\}$ expresses the taking integer operation of formula spread out type in $\{...\}$, $P_1, P_2, \dots, P_m$ are all prime numbers less than or equal to $\sqrt{N}$.

According to the above formula we can obtain the formula as follows:

$$Pi(N) \approx Psha(N) \equiv Li(N) \times (1 - (1 + 1/(\ln(N) - 5))/\sqrt{N})$$

$$\geq Sha(N) \equiv 2/(1 + \sqrt{(1 - 4/\ln(N))}) \times N/\ln(N) \geq N/(\ln(N) - 1),$$

where $Li(N)$ is the logarithmic integral function, the $\ln(N)$ denotes the natural logarithm of N .

One: The Peculiarity of New Prime Number Theorem Formula

Let $P_1, P_2, \dots, P_n$ are all prime numbers less than or equal to P_n , then exists the formula as follows:

$$INT \{N_i \times (1 - 1/P_1) \times (1 - 1/P_2) \times (1 - 1/P_3) \times \dots \times (1 - 1/P_n) - 1\} = 0, 1 \leq N_i \leq P_n$$

For example:

$$INT \{1 - 1\} = INT \{1 - 1\} = \{1 - 1\} = 0$$

$$INT \{1 \times (1 - 1/2) - 1\} = INT \{1 - 1/2 - 1\} = \{1 - 0 - 1\} = 0$$

$$INT \{2 \times (1 - 1/2) - 1\} = INT \{2 - 2/2 - 1\} = \{2 - 1 - 1\} = 0$$

$$INT \{1 \times (1 - 1/2) \times (1 - 1/3) - 1\} = INT \{1 - 1/2 - 1/3 + 1/6 - 1\}$$

$$= \{1 - 0 - 0 + 0 - 1\} = 0$$

$$INT \{2 \times (1 - 1/2) \times (1 - 1/3) - 1\} = INT \{2 - 2/2 - 2/3 + 2/6 - 1\}$$

$$= \{2 - 1 - 0 + 0 - 1\} = 0$$

$$INT \{3 \times (1 - 1/2) \times (1 - 1/3) - 1\} = INT \{3 - 3/2 - 3/3 + 3/6 - 1\}$$

$$= \{3 - 1 - 1 + 0 - 1\} = 0$$

$$INT \{4 \times (1 - 1/2) \times (1 - 1/3) - 1\} = INT \{4 - 4/2 - 4/3 + 4/6 - 1\}$$

$$= \{4 - 2 - 1 + 0 - 1\} = 0$$

$$INT \{1 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) - 1\}$$

$$= INT \{1 - 1/2 - 1/3 - 1/5 + 1/6 + 1/10 + 1/15 - 1/30 - 1\}$$

$$= \{1 - 0 - 0 - 0 + 0 + 0 - 0 - 1\} = 0$$

$$INT \{2 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) - 1\}$$

$$= INT \{2 - 2/2 - 2/3 - 2/5 + 2/6 + 2/10 + 2/15 - 2/30 - 1\}$$

$$= \{2 - 1 - 0 - 0 + 0 + 0 - 0 - 1\} = 0$$

$$INT \{3 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) - 1\}$$

$$= INT \{3 - 3/2 - 3/3 - 3/5 + 3/6 + 3/10 + 3/15 - 3/30 - 1\}$$

$$= \{3 - 1 - 1 - 0 + 0 + 0 - 0 - 1\} = 0$$

$$INT \{4 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) - 1\}$$

$$= INT \{4 - 4/2 - 4/3 - 4/5 + 4/6 + 4/10 + 4/15 - 4/30 - 1\}$$

$$= \{4 - 2 - 1 - 0 + 0 + 0 - 0 - 1\} = 0$$

$$INT \{5 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) - 1\}$$

$$= INT \{5 - 5/2 - 5/3 - 5/5 + 5/6 + 5/10 + 5/15 - 5/30 - 1\}$$

$$= \{5 - 2 - 1 - 1 + 0 + 0 - 0 - 1\} = 0$$

$$INT \{6 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) - 1\}$$

$$= INT \{6 - 6/2 - 6/3 - 6/5 + 6/6 + 6/10 + 6/15 - 6/30 - 1\}$$

$$= \{6 - 3 - 2 - 1 + 1 + 0 + 0 - 0 - 1\} = 0$$

Two: The Calculation of New Prime Number Theorem Formula

$$Pi(N) = INT \{N \times (1 - 1/P_1) \times (1 - 1/P_2) \times (1 - 1/P_3) \times \dots \times (1 - 1/P_m) + m - 1\}$$

For example:

$$Pi(1) = INT \{1 - 1\} = \{1 - 1\} = 0$$

$$Pi(2) = INT \{2 - 1\} = \{2 - 1\} = 1$$

$$Pi(3) = INT \{3 - 1\} = \{3 - 1\} = 2$$

$$Pi(2) = INT \{2 \times (1 - 1/2) + 1 - 1\}$$

$$= INT \{2 - 2/2 + 1 - 1\} = \{2 - 1 + 1 - 1\} = 1$$

$$Pi(3) = INT \{3 \times (1 - 1/2) + 1 - 1\}$$

$$= INT \{3 - 3/2 + 1 - 1\} = \{3 - 1 + 1 - 1\} = 2$$

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$$\begin{aligned} \text{Pi}(4) &= \text{INT} \{4 \times (1 - 1/2) + 1 - 1\} \\ &= \text{INT} \{4 - 4/2 + 1 - 1\} = \{4 - 2 + 1 - 1\} = 2 \end{aligned}$$

$$\begin{aligned} \text{Pi}(5) &= \text{INT} \{5 \times (1 - 1/2) + 1 - 1\} \\ &= \text{INT} \{5 - 5/2 + 1 - 1\} = \{5 - 2 + 1 - 1\} = 3 \end{aligned}$$

$$\begin{aligned} \text{Pi}(6) &= \text{INT} \{6 \times (1 - 1/2) + 1 - 1\} \\ &= \text{INT} \{6 - 6/2 + 1 - 1\} = \{6 - 3 + 1 - 1\} = 3 \end{aligned}$$

$$\begin{aligned} \text{Pi}(7) &= \text{INT} \{7 \times (1 - 1/2) + 1 - 1\} \\ &= \text{INT} \{7 - 7/2 + 1 - 1\} = \{7 - 3 + 1 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(8) &= \text{INT} \{8 \times (1 - 1/2) + 1 - 1\} \\ &= \text{INT} \{8 - 8/2 + 1 - 1\} = \{8 - 4 + 1 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(3) &= \text{INT} \{3 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{3 - 3/2 - 3/3 + 3/6 + 2 - 1\} = \{3 - 1 - 1 + 0 + 2 - 1\} = 2 \end{aligned}$$

$$\begin{aligned} \text{Pi}(4) &= \text{INT} \{4 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{4 - 4/2 - 4/3 + 4/6 + 2 - 1\} = \{4 - 2 - 1 + 0 + 2 - 1\} = 2 \end{aligned}$$

$$\begin{aligned} \text{Pi}(5) &= \text{INT} \{5 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{5 - 5/2 - 5/3 + 5/6 + 2 - 1\} = \{5 - 2 - 1 + 0 + 2 - 1\} = 3 \end{aligned}$$

$$\begin{aligned} \text{Pi}(6) &= \text{INT} \{6 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{6 - 6/2 - 6/3 + 6/6 + 2 - 1\} = \{6 - 3 - 2 + 1 + 2 - 1\} = 3 \end{aligned}$$

$$\begin{aligned} \text{Pi}(7) &= \text{INT} \{7 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{7 - 7/2 - 7/3 + 7/6 + 2 - 1\} = \{7 - 3 - 2 + 1 + 2 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(8) &= \text{INT} \{8 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{8 - 8/2 - 8/3 + 8/6 + 2 - 1\} = \{8 - 4 - 2 + 1 + 2 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(9) &= \text{INT} \{9 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{9 - 9/2 - 9/3 + 9/6 + 2 - 1\} = \{9 - 4 - 3 + 1 + 2 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(10) &= \text{INT} \{10 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{10 - 10/2 - 10/3 + 10/6 + 2 - 1\} = \{10 - 5 - 3 + 1 + 2 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(11) &= \text{INT} \{11 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{11 - 11/2 - 11/3 + 11/6 + 2 - 1\} = \{11 - 5 - 3 + 1 + 2 - 1\} = 5 \end{aligned}$$

$$\begin{aligned} \text{Pi}(12) &= \text{INT} \{12 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{12 - 12/2 - 12/3 + 12/6 + 2 - 1\} = \{12 - 6 - 4 + 2 + 2 - 1\} = 5 \end{aligned}$$

$$\begin{aligned} \text{Pi}(13) &= \text{INT} \{13 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{13 - 13/2 - 13/3 + 13/6 + 2 - 1\} = \{13 - 6 - 4 + 2 + 2 - 1\} = 6 \end{aligned}$$

$$\begin{aligned} \text{Pi}(14) &= \text{INT} \{14 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{14 - 14/2 - 14/3 + 14/6 + 2 - 1\} = \{14 - 7 - 4 + 2 + 2 - 1\} = 6 \end{aligned}$$

$$\begin{aligned} \text{Pi}(15) &= \text{INT} \{15 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{15 - 15/2 - 15/3 + 15/6 + 2 - 1\} = \{15 - 7 - 5 + 2 + 2 - 1\} = 6 \end{aligned}$$

$$\begin{aligned} \text{Pi}(16) &= \text{INT} \{16 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{16 - 16/2 - 16/3 + 16/6 + 2 - 1\} = \{16 - 8 - 5 + 2 + 2 - 1\} = 6 \end{aligned}$$

$$\begin{aligned} \text{Pi}(17) &= \text{INT} \{17 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{17 - 17/2 - 17/3 + 17/6 + 2 - 1\} = \{17 - 8 - 5 + 2 + 2 - 1\} = 7 \end{aligned}$$

$$\begin{aligned} \text{Pi}(18) &= \text{INT} \{18 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{18 - 18/2 - 18/3 + 18/6 + 2 - 1\} = \{18 - 9 - 6 + 3 + 2 - 1\} = 7 \end{aligned}$$

$$\begin{aligned} \text{Pi}(19) &= \text{INT} \{19 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{19 - 19/2 - 19/3 + 19/6 + 2 - 1\} = \{19 - 9 - 6 + 3 + 2 - 1\} = 8 \end{aligned}$$

$$\begin{aligned} \text{Pi}(20) &= \text{INT} \{20 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{20 - 20/2 - 20/3 + 20/6 + 2 - 1\} = \{20 - 10 - 6 + 3 + 2 - 1\} = 8 \end{aligned}$$

$$\begin{aligned} \text{Pi}(21) &= \text{INT} \{21 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{21 - 21/2 - 21/3 + 21/6 + 2 - 1\} = \{21 - 10 - 7 + 3 + 2 - 1\} = 8 \end{aligned}$$

$$\begin{aligned} \text{Pi}(22) &= \text{INT} \{22 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{22 - 22/2 - 22/3 + 22/6 + 2 - 1\} = \{22 - 11 - 7 + 3 + 2 - 1\} = 8 \end{aligned}$$

$$\begin{aligned} \text{Pi}(23) &= \text{INT} \{23 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{23 - 23/2 - 23/3 + 23/6 + 2 - 1\} = \{23 - 11 - 7 + 3 + 2 - 1\} = 9 \end{aligned}$$

$$\begin{aligned} \text{Pi}(24) &= \text{INT} \{24 \times (1 - 1/2) \times (1 - 1/3) + 2 - 1\} \\ &= \text{INT} \{24 - 24/2 - 24/3 + 24/6 + 2 - 1\} = \{24 - 12 - 8 + 4 + 2 - 1\} = 9 \end{aligned}$$

$$\begin{aligned} \text{Pi}(5) &= \text{INT} \{5 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\ &= \text{INT} \{5 - 5/2 - 5/3 - 5/5 + 5/6 + 5/10 + 5/15 - 5/30 + 3 - 1\} \\ &= \{5 - 2 - 2 - 1 + 1 + 0 + 0 - 0 + 3 - 1\} = 3 \end{aligned}$$

$$\begin{aligned} \text{Pi}(6) &= \text{INT} \{6 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\ &= \text{INT} \{6 - 6/2 - 6/3 - 6/5 + 6/6 + 6/10 + 6/15 - 6/30 + 3 - 1\} \\ &= \{6 - 3 - 2 - 1 + 1 + 0 + 0 - 0 + 3 - 1\} = 3 \end{aligned}$$

$$\begin{aligned} \text{Pi}(7) &= \text{INT} \{7 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\ &= \text{INT} \{7 - 7/2 - 7/3 - 7/5 + 7/6 + 7/10 + 7/15 - 7/30 + 3 - 1\} \\ &= \{7 - 3 - 2 - 1 + 1 + 0 + 0 - 0 + 3 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(8) &= \text{INT} \{8 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\ &= \text{INT} \{8 - 8/2 - 8/3 - 8/5 + 8/6 + 8/10 + 8/15 - 8/30 + 3 - 1\} \\ &= \{8 - 4 - 2 - 1 + 1 + 0 + 0 - 0 + 3 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(9) &= \text{INT} \{9 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\ &= \text{INT} \{9 - 9/2 - 9/3 - 9/5 + 9/6 + 9/10 + 9/15 - 9/30 + 3 - 1\} \\ &= \{9 - 4 - 3 - 1 + 1 + 0 + 0 - 0 + 3 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(10) &= \text{INT} \{10 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\ &= \text{INT} \{10 - 10/2 - 10/3 - 10/5 + 10/6 + 10/10 + 10/15 - 10/30 + 3 - 1\} \\ &= \{10 - 5 - 3 - 2 + 1 + 1 + 0 - 0 + 3 - 1\} = 4 \end{aligned}$$

$$\begin{aligned} \text{Pi}(11) &= \text{INT} \{11 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\ &= \text{INT} \{11 - 11/2 - 11/3 - 11/5 + 11/6 + 11/10 + 11/15 - 11/30 + 3 - 1\} \\ &= \{11 - 5 - 3 - 2 + 1 + 1 + 0 - 0 + 3 - 1\} = 5 \end{aligned}$$

$$\begin{aligned} \text{Pi}(12) &= \text{INT} \{12 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\ &= \text{INT} \{12 - 12/2 - 12/3 - 12/5 + 12/6 + 12/10 + 12/15 - 12/30 + 3 - 1\} \\ &= \{12 - 6 - 4 - 2 + 2 + 2 + 2 - 1\} = 5 \end{aligned}$$

$$\begin{aligned}
 &= \text{INT} \{12 - 12/2 - 12/3 - 12/5 + 12/6 + 12/10 + 12/15 - 12/30 + 3 - 1\} \\
 &= \{12 - 6 - 4 - 2 + 2 + 1 + 0 - 0 + 3 - 1\} = 5 \\
 \text{Pi}(13) &= \text{INT} \{13 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{13 - 13/2 - 13/3 - 13/5 + 13/6 + 13/10 + 13/15 - 13/30 + 3 - 1\} \\
 &= \{13 - 6 - 4 - 2 + 2 + 1 + 0 - 0 + 3 - 1\} = 6 \\
 \text{Pi}(14) &= \text{INT} \{14 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{14 - 14/2 - 14/3 - 14/5 + 14/6 + 14/10 + 14/15 - 14/30 + 3 - 1\} \\
 &= \{14 - 7 - 4 - 2 + 2 + 1 + 0 - 0 + 3 - 1\} = 6 \\
 \text{Pi}(15) &= \text{INT} \{15 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{15 - 15/2 - 15/3 - 15/5 + 15/6 + 15/10 + 15/15 - 15/30 + 3 - 1\} \\
 &= \{15 - 7 - 5 - 3 + 2 + 1 + 1 - 0 + 3 - 1\} = 6 \\
 \text{Pi}(16) &= \text{INT} \{16 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{16 - 16/2 - 16/3 - 16/5 + 16/6 + 16/10 + 16/15 - 16/30 + 3 - 1\} \\
 &= \{16 - 8 - 5 - 3 + 2 + 1 + 1 - 0 + 3 - 1\} = 6 \\
 \text{Pi}(17) &= \text{INT} \{17 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{17 - 17/2 - 17/3 - 17/5 + 17/6 + 17/10 + 17/15 - 17/30 + 3 - 1\} \\
 &= \{17 - 8 - 5 - 3 + 2 + 1 + 1 - 0 + 3 - 1\} = 7 \\
 \text{Pi}(18) &= \text{INT} \{18 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{18 - 18/2 - 18/3 - 18/5 + 18/6 + 18/10 + 18/15 - 18/30 + 3 - 1\} \\
 &= \{18 - 9 - 6 - 3 + 3 + 1 + 1 - 0 + 3 - 1\} = 7 \\
 \text{Pi}(19) &= \text{INT} \{19 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{19 - 19/2 - 19/3 - 19/5 + 19/6 + 19/10 + 19/15 - 19/30 + 3 - 1\} \\
 &= \{19 - 9 - 6 - 3 + 3 + 1 + 1 - 0 + 3 - 1\} = 8 \\
 \text{Pi}(20) &= \text{INT} \{20 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{20 - 20/2 - 20/3 - 20/5 + 20/6 + 20/10 + 20/15 - 20/30 + 3 - 1\} \\
 &= \{20 - 10 - 6 - 4 + 3 + 2 + 1 - 0 + 3 - 1\} = 8 \\
 \text{Pi}(21) &= \text{INT} \{21 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{21 - 21/2 - 21/3 - 21/5 + 21/6 + 21/10 + 21/15 - 21/30 + 3 - 1\} \\
 &= \{21 - 10 - 7 - 4 + 3 + 2 + 1 - 0 + 3 - 1\} = 8 \\
 \text{Pi}(22) &= \text{INT} \{22 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{22 - 22/2 - 22/3 - 22/5 + 22/6 + 22/10 + 22/15 - 22/30 + 3 - 1\} \\
 &= \{22 - 11 - 7 - 4 + 3 + 2 + 1 - 0 + 3 - 1\} = 8 \\
 \text{Pi}(23) &= \text{INT} \{23 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{23 - 23/2 - 23/3 - 23/5 + 23/6 + 23/10 + 23/15 - 23/30 + 3 - 1\} \\
 &= \{23 - 11 - 7 - 4 + 3 + 2 + 1 - 0 + 3 - 1\} = 9 \\
 \text{Pi}(24) &= \text{INT} \{24 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{24 - 24/2 - 24/3 - 24/5 + 24/6 + 24/10 + 24/15 - 24/30 + 3 - 1\} \\
 &= \{24 - 12 - 8 - 4 + 4 + 2 + 1 - 0 + 3 - 1\} = 9 \\
 \text{Pi}(25) &= \text{INT} \{25 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{25 - 25/2 - 25/3 - 25/5 + 25/6 + 25/10 + 25/15 - 25/30 + 3 - 1\} \\
 &= \{25 - 12 - 8 - 5 + 4 + 2 + 1 - 0 + 3 - 1\} = 9 \\
 \text{Pi}(26) &= \text{INT} \{26 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{26 - 26/2 - 26/3 - 26/5 + 26/6 + 26/10 + 26/15 - 26/30 + 3 - 1\} \\
 &= \{26 - 13 - 8 - 5 + 4 + 2 + 1 - 0 + 3 - 1\} = 9 \\
 \text{Pi}(27) &= \text{INT} \{27 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{27 - 27/2 - 27/3 - 27/5 + 27/6 + 27/10 + 27/15 - 27/30 + 3 - 1\} \\
 &= \{27 - 13 - 9 - 5 + 4 + 2 + 1 - 0 + 3 - 1\} = 9 \\
 \text{Pi}(28) &= \text{INT} \{28 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{28 - 28/2 - 28/3 - 28/5 + 28/6 + 28/10 + 28/15 - 28/30 + 3 - 1\} \\
 &= \{28 - 14 - 9 - 5 + 4 + 2 + 1 - 0 + 3 - 1\} = 9 \\
 \text{Pi}(29) &= \text{INT} \{29 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{29 - 29/2 - 29/3 - 29/5 + 29/6 + 29/10 + 29/15 - 29/30 + 3 - 1\} \\
 &= \{29 - 14 - 9 - 5 + 4 + 2 + 1 - 0 + 3 - 1\} = 10 \\
 \text{Pi}(30) &= \text{INT} \{30 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{30 - 30/2 - 30/3 - 30/5 + 30/6 + 30/10 + 30/15 - 30/30 + 3 - 1\} \\
 &= \{30 - 15 - 10 - 6 + 5 + 3 + 2 - 1 + 3 - 1\} = 10 \\
 \text{Pi}(31) &= \text{INT} \{31 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{31 - 31/2 - 31/3 - 31/5 + 31/6 + 31/10 + 31/15 - 31/30 + 3 - 1\} \\
 &= \{31 - 15 - 10 - 6 + 5 + 3 + 2 - 1 + 3 - 1\} = 11 \\
 \text{Pi}(32) &= \text{INT} \{32 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{32 - 32/2 - 32/3 - 32/5 + 32/6 + 32/10 + 32/15 - 32/30 + 3 - 1\} \\
 &= \{32 - 16 - 10 - 6 + 5 + 3 + 2 - 1 + 3 - 1\} = 11 \\
 \text{Pi}(33) &= \text{INT} \{33 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{33 - 33/2 - 33/3 - 33/5 + 33/6 + 33/10 + 33/15 - 33/30 + 3 - 1\} \\
 &= \{33 - 16 - 11 - 6 + 5 + 3 + 2 - 1 + 3 - 1\} = 11 \\
 \text{Pi}(34) &= \text{INT} \{34 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{34 - 34/2 - 34/3 - 34/5 + 34/6 + 34/10 + 34/15 - 34/30 + 3 - 1\} \\
 &= \{34 - 17 - 11 - 6 + 5 + 3 + 2 - 1 + 3 - 1\} = 11 \\
 \text{Pi}(35) &= \text{INT} \{35 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{35 - 35/2 - 35/3 - 35/5 + 35/6 + 35/10 + 35/15 - 35/30 + 3 - 1\} \\
 &= \{35 - 17 - 11 - 7 + 5 + 3 + 2 - 1 + 3 - 1\} = 11 \\
 \text{Pi}(36) &= \text{INT} \{36 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{36 - 36/2 - 36/3 - 36/5 + 36/6 + 36/10 + 36/15 - 36/30 + 3 - 1\} \\
 &= \{36 - 18 - 12 - 7 + 6 + 3 + 2 - 1 + 3 - 1\} = 11 \\
 \text{Pi}(37) &= \text{INT} \{37 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{37 - 37/2 - 37/3 - 37/5 + 37/6 + 37/10 + 37/15 - 37/30 + 3 - 1\} \\
 &= \{37 - 18 - 12 - 7 + 6 + 3 + 2 - 1 + 3 - 1\} = 12 \\
 \text{Pi}(38) &= \text{INT} \{38 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{38 - 38/2 - 38/3 - 38/5 + 38/6 + 38/10 + 38/15 - 38/30 + 3 - 1\}
 \end{aligned}$$

$$\begin{aligned}
 &= \{38 - 19 - 12 - 7 + 6 + 3 + 2 - 1 + 3 - 1\} = 12 \\
 \text{Pi}(39) &= \text{INT} \{39 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{39 - 39/2 - 39/3 - 39/5 + 39/6 + 39/10 + 39/15 - 39/30 + 3 - 1\} \\
 &= \{39 - 19 - 13 - 7 + 6 + 3 + 2 - 1 + 3 - 1\} = 12 \\
 \text{Pi}(40) &= \text{INT} \{40 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{40 - 40/2 - 40/3 - 40/5 + 40/6 + 40/10 + 40/15 - 40/30 + 3 - 1\} \\
 &= \{40 - 20 - 13 - 8 + 6 + 4 + 2 - 1 + 3 - 1\} = 12 \\
 \text{Pi}(41) &= \text{INT} \{41 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{41 - 41/2 - 41/3 - 41/5 + 41/6 + 41/10 + 41/15 - 41/30 + 3 - 1\} \\
 &= \{41 - 20 - 13 - 8 + 6 + 4 + 2 - 1 + 3 - 1\} = 13 \\
 \text{Pi}(42) &= \text{INT} \{42 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{42 - 42/2 - 42/3 - 42/5 + 42/6 + 42/10 + 42/15 - 42/30 + 3 - 1\} \\
 &= \{42 - 21 - 14 - 8 + 7 + 4 + 2 - 1 + 3 - 1\} = 13 \\
 \text{Pi}(43) &= \text{INT} \{43 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{43 - 43/2 - 43/3 - 43/5 + 43/6 + 43/10 + 43/15 - 43/30 + 3 - 1\} \\
 &= \{43 - 21 - 14 - 8 + 7 + 4 + 2 - 1 + 3 - 1\} = 14 \\
 \text{Pi}(44) &= \text{INT} \{44 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{44 - 44/2 - 44/3 - 44/5 + 44/6 + 44/10 + 44/15 - 44/30 + 3 - 1\} \\
 &= \{44 - 22 - 14 - 8 + 7 + 4 + 2 - 1 + 3 - 1\} = 14 \\
 \text{Pi}(45) &= \text{INT} \{45 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{45 - 45/2 - 45/3 - 45/5 + 45/6 + 45/10 + 45/15 - 45/30 + 3 - 1\} \\
 &= \{45 - 22 - 15 - 9 + 7 + 4 + 3 - 1 + 3 - 1\} = 14
 \end{aligned}$$

$$\begin{aligned}
 \text{Pi}(46) &= \text{INT} \{46 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{46 - 46/2 - 46/3 - 46/5 + 46/6 + 46/10 + 46/15 - 46/30 + 3 - 1\} \\
 &= \{46 - 23 - 15 - 9 + 7 + 4 + 3 - 1 + 3 - 1\} = 14 \\
 \text{Pi}(47) &= \text{INT} \{47 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{47 - 47/2 - 47/3 - 47/5 + 47/6 + 47/10 + 47/15 - 47/30 + 3 - 1\} \\
 &= \{47 - 23 - 15 - 9 + 7 + 4 + 3 - 1 + 3 - 1\} = 15 \\
 \text{Pi}(48) &= \text{INT} \{48 \times (1 - 1/2) \times (1 - 1/3) \times (1 - 1/5) + 3 - 1\} \\
 &= \text{INT} \{48 - 48/2 - 48/3 - 48/5 + 48/6 + 48/10 + 48/15 - 48/30 + 3 - 1\} \\
 &= \{48 - 24 - 16 - 9 + 8 + 4 + 3 - 1 + 3 - 1\} = 15
 \end{aligned}$$

Three: The Limit of New Prime Number Theorem Formula

Let $\text{Pi}(N)$ be the prime-counting function that gives the number of primes less than or equal to N , for any real number N . The new prime number theorem can be expressed by the formula as follows:

$$\text{Pi}(N) = \text{INT} \{N \times (1 - 1/P_1) \times (1 - 1/P_2) \times \dots \times (1 - 1/P_m) + m - 1\},$$

where the $\text{INT} \{\dots\}$ expresses the taking integer operation of formula spread out type in $\{\dots\}$, $P_1, P_2, \dots, P_m$ are all prime numbers less than or equal to $\sqrt{N}$. For example:

Conclusion

According to the above formula we can obtain the formula as follows:

$$\text{Pi}(N) \approx \text{Psha}(N) \equiv \text{Li}(N) \times (1 - (1 + 1/(\text{Ln}(N) - 5)) / \sqrt{N})$$

$$\geq \text{Sha}(N) \equiv 2 / (1 + \sqrt{1 - 4 / \text{Ln}(N)}) \times N / \text{Ln}(N) \geq N / (\text{Ln}(N) - 1),$$

where $\text{Li}(N)$ is the logarithmic integral function, the $\text{Ln}(N)$ denotes the natural logarithm of N .