Scheme For Finding The Next Term Of A Sequence Based On Evolution. {Version 7}. ISSN 1751-3030

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Abstract

In this research investigation, the author has detailed a novel method of finding the next term of a sequence based on Evolution.

Theory

Given any Sequence of the kind,

\[ S = \{y_1, y_2, y_3, \ldots, y_{n-1}, y_n\} \]

We first write them as

\[ S = \left\{ \begin{array}{l}
y_1 = N p_{j_1 + \delta_1}, \quad y_2 = N p_{j_2 + \delta_2}, \quad y_3 = N p_{j_3 + \delta_3}, \quad \ldots, \quad y_{n-1} = N p_{j_{n-1} + \delta_{n-1}}, \\
y_n = N p_{j_{n} + \delta_{n}}
\end{array} \right\} \]

where in \( N p_{j_1 + \delta_1} \), \( N \) is the Order Number of the Higher Order Sequence Of Primes in which the number \( y_1 \) is slated,
\( (j_i + \delta_i) \) is the position number of the Prime Metric Basis Element. Here, \( j_i \)'s are Positive Integers and \( 0 < \delta_i < 1 \).

For Example,

7 which is the 4th Prime Metric Basis Element of the Standard Primes, the Order [1] of which can be taken to 1. Therefore 7 can be written as \( ^1p_4 \). In a similar fashion, 8 can be written as

\[
^1P_{4+\left(\frac{8-7}{11-7}\right)}
\]

where 7 is the nearest previous prime number of 8 and 11 is the next nearest prime number of 8. Here, in the notation \( ^1P_{4+\left(\frac{8-7}{11-7}\right)} \), we can consider \( \left(\frac{8-7}{11-7}\right) \) as the \( \delta \), the 4 as the \( j \) and the 1 as the \( N \). We can also denote any number in a similar fashion using Higher Order Primes as well. [1] i.e., \( N > 1 \).

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Given \( (j_i + \delta_i) \), a method of calculating the Decimal (Pseudo) Prime corresponding to \( (j_i + \delta_i) \) in \( ^N P_{(j_i+\delta_i)} \). Method 1

If \( \delta_i \) is equal to \( \left(\frac{a_1a_2a_3\ldots a_{k-1}a_k}{10^k}\right) \) where \( 0 < a_l < 10 \) for \( l = 1 \) to \( k \), we write
Given \( {N \choose p} \), a method of calculating the Decimal (Pseudo) Position \( (j_i + \delta_i) \), i.e., the Prime Metric Basis Element Position corresponding to \( {N \choose p} \) in the Sequence of \( N^{th} \) Order Sequence Of Primes.

We write the given number (positive integer) say \( a \) as

\[
a \equiv ^N p\left( {j_i + \frac{c}{d}} \right) \quad \text{where} \quad c = \left( a - ^N p_{j_i} \right), \quad d = \left( ^N p_{(j_i+1)} - ^N p_{j_i} \right)
\]

We then write the Position of \( {N \choose p} \) as

\[
j_i + \delta_i =
\]

\[
j_i + \left\{ \frac{\text{Position of Largest Prime Number} < c}{\text{Position of Largest Prime Number} < d} \right\} + \frac{c_1}{d_1} + \frac{c_2}{d_2} + \frac{c_3}{d_3} + ...
\]

where

\[
\frac{c_1}{d_1} = \frac{c}{d} - \left\{ \frac{\text{Position of Largest Prime Number} < c}{\text{Position of Largest Prime Number} < d} \right\}
\]

and

\[
^N p_{(j_i+1)} = ^N p_{j_i} + \left\{ \frac{(a_{1}a_{2}a_{3}......a_{k-1}a_{k})^h \text{PrimeNumber}}{(10^k)^h \text{PrimeNumber}} \right\} \left\{ ^N p_{j_i+1} - ^N p_{j_i} \right\}
\]
\[ \frac{c_2}{d_2} = \frac{c_1}{d_1} \left\{ \begin{array}{l} \frac{\text{Position of Largest Prime Number} < c_1}{\text{Position of Largest Prime Number} < d_1} \end{array} \right\} \]

and so on so forth.

Given \((j_i + \delta_i)\), a method of calculating the Decimal (Pseudo) Prime corresponding to \((j_i + \delta_i)\) in \(N^{th}\) \(p(j_i + \delta_i)\). (Method 2)

If \(\delta_i\) is equal to \(\{c^{th} \text{ Prime in the } N^{th}\ \text{Order}\} \div \{d^{th} \text{ Prime in the } N^{th}\ \text{Order}\}\) where

\[ c = \left( a^{-N} p_{j_i} \right), d = \left( N p_{(j_i+1)} - N p_{j_i} \right) \]

\[ N p_{(j_i+\delta_i)} = N p_{j_i} + \left\{ \begin{array}{l} \frac{c^{th} \text{ Prime in the } N^{th}\ \text{Order}}{\text{Sequence of Primes}} \end{array} \right\} \left\{ \begin{array}{l} \frac{d^{th} \text{ Prime in the } N^{th}\ \text{Order}}{\text{Sequence of Primes}} \end{array} \right\} \left\{ N p_{j_i+1} - N p_{j_i} \right\} \]

For Simplicity, we can take \(N = 1\).

For our representational simplicity, we label our \(S = \{y_1, y_2, y_3, \ldots, y_{n-1}, y_n\}\) as
\[ S = \{y_1, y_1, y_2, y_1, \ldots, y_{n-1}, y_1, y_n\} \]

where the left south subscript 1 indicates that these numbers are at the level 1 (Base) of the triangle we are going to build.

We now compute the Evolution Orders

\[ E^{(j+1)}_{y_i}(y_j) = y_{(i+1)} \]

where \((j+1)_{y_i}\) is the Evolution Order. By Evolution Order, we mean the difference between the Prime Basis Position Number of \(y_{(i+1)}\) (when slated thusly) and the Prime Basis Position Number of \(y_{i}\) given that we are considering this in \(N = 1\). This means that \(y_{i}\)

needs to be evolved \((j+1)_{y_i}\) times to get \(y_{(i+1)}\). Please see [2] for Evolution method. We repeat this process till we get

\[ E^{(n)}_{y_i}(y_{(n-1)}) = y_{(i+1)}. \]

We now evolve \((n-1)_{y_{(i+1)}}\) by one step using [2] and get \(E^1((n-1)_{y_{(i+1)}})\). Note that

\[ E^1((n-1)_{y_{(i+1)}})((n-2)_{y_i}) = (n-2)y_{(i+1)}. \]

We repeat this procedure, downwards, repeatedly to find

\[ E^1((1)_{y_n}) = (1)y_{(n+1)}. \]

If the Evolution Order \((j+1)_{y_i}\) is negative, this implies that \(y_{i}\) needs to be devolved by \((j+1)_{y_i}\) to reach \(y_{(i+1)}\). That is when the Evolution Order is Negative, we need to consider Devolution by the amount
of the Evolution Order. We illustrate this with an Example of three terms.

Considering

\[ S = \{y_1, y_2, y_3\} \] which we write as

\[ S = \{y_1, y_2, y_3\} \] for future representational simplicity.

\[ E^{y_1} \left( y_1 \right) = y_2, \quad E^{y_2} \left( y_2 \right) = y_3. \]

Now, we write

\[ E^{y_1} \left( y_1 \right) = y_2. \]

We now evolve \( y_1 \) by one step using [2], i.e., perform \( E^1(y_1) \). And now, we write

\[ E^1 \left( y_1 \right) = y_2. \]

Finally, we write,

\[ E^1 \left( y_3 \right) = y_4 = y_4 \] which is the next term of the sequence \( S = \{y_1, y_2, y_3\} \). This method can be used advantageously for forecasting.

Note that \( E^1(0) = 0 \) and \( E^1(1) = E^1 \left( \frac{2}{2} \right) = \frac{3}{2} \), from [2].

References

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