Scheme For Finding The Next Term Of A Sequence Based On Evolution. {Version 6}. ISSN 1751-3030

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Research Manuscript

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

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

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,
\((j_1 + \delta_1)\) is the position number of the Prime Metric Basis Element. Here, \(j_1\)’s are Positive Integers and \(0 < \delta_1 < 1\).

For Example,

7 which is the 4\(^{th}\) 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

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

where 7 is the nearest previous prime number of 8 and 11 is the next nearest prime number of 8. Here, in the notation \(1 \times p_{4+\left(\frac{8-7}{11-7}\right)}\), we can consider \(\frac{8-7}{11-7}\) 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., \(N > 1\).


given \(\left(j_i + \delta_i\right)\), a method of calculating the Decimal (Pseudo) Prime corresponding to \(\left(j_i + \delta_i\right)\) in \(p_{(j_i+\delta_i)}\). Method 1

If \(\delta_i\) is equal to \(\frac{a_1a_2a_3\ldots a_{k-1}a_k}{10^k}\) where \(0 < a_l < 10\) for \(l = 1\) to \(k\), we write
\[ \begin{align*}
N_{p_{(j_i+\delta_i)}} &= N_{p_{j_i}} + \\
&\left( a_1a_2a_3 \ldots \ldots a_{k-1}a_k \right)^{th} \text{ PrimeNumber} \\
of \ N^{th} \text{ Order} &\\
&\left( 10^k \right)^{th} \text{ PrimeNumber} \\
of \ N^{th} \text{ Order} \\
&\left\{ N_{p_{j_i+1}} - N_{p_{j_i}} \right\}
\end{align*} \]

Given \( \left( N_{p} \right) \), a method of calculating the Decimal (Pseudo) Position \( \left( j_i + \delta_i \right) \), i.e., the Prime Metric Basis Element Position corresponding to \( \left( N_{p} \right) \) in the Sequence of \( N^{th} \text{Order} \) Sequence Of Primes.

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

\[ a = N_{p_{\left( j_i + \frac{c}{d} \right)}} \left\{ \begin{array}{l}
c = \left( a - N_{p_{j_i}} \right), d = \left( N_{p_{(j_i+1)}} - N_{p_{j_i}} \right)\
\end{array} \right. \]

We then write the Position of \( \left( N_{p} \right) \) as

\[ j_i + \delta_i = \left\{ \begin{array}{l}
c^{th} \text{ Prime in the } N^{th} \text{ Order} \\
\text{Sequence of Primes} \\
d^{th} \text{ Prime in the } N^{th} \text{ Order} \\
\text{Sequence of Primes} \\
\end{array} \right. \]
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 2)

If \( \delta_i \) is equal to 

\[
\begin{align*}
\left\{ \begin{array}{l}
\text{c}^{\text{th} \text{ Prime in the N}^{\text{th} \text{ Order}}} \\
\text{Sequence of Primes} \\
\text{d}^{\text{th} \text{ Prime in the N}^{\text{th} \text{ Order}}} \\
\text{Sequence of Primes}
\end{array} \right.
\end{align*}
\]

where

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

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

For our representational simplicity, we label our

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

and

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

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.
\[ E^{(j+1)Y_i} \left( j \cdot Y_i \right) = j \cdot Y(i+1) \] where \((j+1)Y_i\) is the Evolution Order. By Evolution Order, we mean the difference between the Prime Basis Position Number of \(j \cdot Y(i+1)\) (when slated thusly) and the Prime Basis Position Number of \(j \cdot Y_i\) given that we are considering this in \(N = 1\). This means that \(j \cdot Y_i\) needs to be evolved \((j+1)Y_i\) times to get \(j \cdot Y(i+1)\). Please see [2] for Evolution method. We repeat this process till we get \(E^{(n)Y_i} \left( (n-1)Y_i \right) \Rightarrow (n-1)Y(i+1)\). We now evolve \((n-1)Y(i+1)\) by one step using [2] and get \(E^1 \left( (n-1)Y(i+1) \right) \). Note that \(E^1 \left( (n-1)Y(i+1) \right) \Rightarrow (n-2)Y(i+1)\).

We repeat this procedure, downwards, repeatedly to find \(E^1 \left( (2)Y_n \right) \Rightarrow (1)Y(n+1)\). If the Evolution Order \((j+1)Y_i\) is negative, this implies that \(j \cdot Y_i\) needs to be devolved by \((j+1)Y_i\) to reach \(j \cdot Y(i+1)\). 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.

$E^2_{y_1}(1, y_1) = 1, y_2, E^2_{y_2}(1, y_2) = 1, y_3$. Now, we write

$E^3_{y_1}(2, y_1) = 2, y_2$. We now evolve $3, y_1$ by one step using $[2]$, i.e., perform $E^3_{y_1}(3, y_1)$. And now, we write $E^3_{y_1}(3, y_1) = 3, y_4 = y_4$ 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 $E^1(1) = E^1(\frac{2}{2}) = \frac{3}{2}$, from $[2]$.

References