Bagadi, R. (2017). Scheme For Finding The Next Term Of A Sequence Based On Evolution. {Version 7}. ISSN 1751-3030. *PHILICA.COM Article number 1144.*
http://www.philica.com/display_article.php?article_id=1144

Scheme For Finding The Next Term Of A Sequence Based On Evolution. {Version 7}. 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,

$$S=\{y_1,y_2,y_3,.......,y_{n-1},y_n\}$$

We first write them as

$$S=\left\{\begin{array}{l} y_1={}^{N}p_{j_1+\delta_1},y_2={}^{N}p_{j_2+\delta_2},y_3={}^{N}p_{j_3+\delta_3},.......,y_{n-1}={}^{N}p_{j_{n-1}+\delta_{n-1}}, \\ y_n={}^{N}p_{j_n+\delta_n} \end{array}\right\}$$

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,

$\left(j_1 + \delta_1\right)$ 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 ${}^{1}p_4$. In a similar fashion, 8 can be written as

${}^{1}p_{4+\left(\frac{8-7}{11-7}\right)}$ where 7 is the nearest previous prime number of 8 and 11 is the next nearest prime number of 8. Here, in the notation ${}^{1}p_{4+\left(\frac{8-7}{11-7}\right)}$, we can consider $\left(\frac{8-7}{11-7}\right)$ as the δ, 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* ${}^{N}p_{\left(j_i+\delta_i\right)}$. *Method 1*

If δ_i is equal to $\left(\frac{a_1 a_2 a_3 \ldots\ldots a_{k-1} a_k}{10^k}\right)$ where $0 < a_l < 10$ for $l = 1 \; to \; k$, we write

$$^{N}p_{(j_i+\delta_i)} = {}^{N}p_{j_i} + \left\{ \frac{(a_1a_2a_3.......a_{k-1}a_k)^{th}\ \text{PrimeNumber of } N^{th}\ \text{Order}}{(10^k)^{th}\ \text{PrimeNumber of } N^{th}\ \text{Order}} \right\} \left\{ {}^{N}p_{j_i+1} - {}^{N}p_{j_i} \right\}$$

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} Order Sequence Of Primes.

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

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

We then write the Position of $\left({}^{N}p\right)$ *as*

$$j_i + \delta_i =$$

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

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

$$\frac{c_2}{d_2}=\frac{c_1}{d_1}-\left\{\frac{Position\ of\ Largest\ Prime\ Number<c_1}{Position\ of\ Largest\ Prime\ Number<d_1}\right\}$$

and so on so forth.

Given $\left(j_i+\delta_i\right)$, a method of calculating the Decimal (Pseudo) Prime corresponding to $\left(j_i+\delta_i\right)$ in ${}^{N}p_{(j_i+\delta_i)}$. (Method2)

If δ_i is equal to $\left\{\frac{c^{th}\ Prime\ in\ the\ N^{th}\ Order\ Sequence\ of\ Primes}{d^{th}\ Prime\ in\ the\ N^{th}\ Order\ Sequence\ of\ Primes}\right\}$ where

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

$${}^{N}p_{(j_i+\delta_i)}={}^{N}p_{j_i}+\left\{\frac{c^{th}\ Prime\ in\ the\ N^{th}\ Order\ Sequence\ of\ Primes}{d^{th}\ Prime\ in\ the\ N^{th}\ Order\ Sequence\ of\ Primes}\right\}\left\{{}^{N}p_{j_i+1}-{}^{N}p_{j_i}\right\}$$

For Simplicity, we can take $N=1$.

For our representational simplicity, we label our $S=\left\{y_1,y_2,y_3,\ldots\ldots,y_{n-1},y_n\right\}$ as

$S=\{{}_1y_1, {}_1y_2, {}_1y_3, \ldots\ldots, {}_1y_{n-1}, {}_1y_n\}$ 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

$E^{{}_{(j+1)}y_i}\left({}_j y_i\right) = {}_j y_{(i+1)}$ where ${}_{(j+1)}y_i$ is the Evolution Order. By Evolution Order, we mean the difference between the Prime Basis Position Number of ${}_j y_{(i+1)}$ (when slated thusly) and the Prime Basis Position Number of ${}_j y_i$ given that we are considering this in $N=1$. This means that ${}_j y_i$ needs to be evolved ${}_{(j+1)}y_i$ times to get ${}_j y_{(i+1)}$. Please see [2] for Evolution method. We repeat this process till we get $E^{{}_{(n)}y_i}\left({}_{(n-1)}y_i\right) = {}_{(n-1)}y_{(i+1)}$. 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 $E^{\left\{E^1\left({}_{(n-1)}y_{(i+1)}\right)\right\}}\left({}_{(n-2)}y_i\right) = {}_{(n-2)}y_{(i+1)}$.

We repeat this procedure, downwards, repeatedly to find $E^{\left\{{}_{(2)}y_n\right\}}\left({}_{(1)}y_n\right) = {}_{(1)}y_{(n+1)}$. If the Evolution Order ${}_{(j+1)}y_i$ is negative, this implies that ${}_j y_i$ needs to be devolved by ${}_{(j+1)}y_i$ to reach ${}_j y_{(i+1)}$. 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

$S=\{{}_1y_1, {}_1y_2, {}_1y_3\}$ for future representational simplicity.

$E^{2\,y_1}\left({}_1y_1\right)={}_1y_2$, $E^{2\,y_2}\left({}_1y_2\right)={}_1y_3$. Now, we write

$E^{3\,y_1}\left({}_2y_1\right)={}_2y_2$. We now evolve ${}_3y_1$ by one step using [2], i.e., perform $E^1\left({}_3y_1\right)$. And now, we write $E^{\left\{E^1\left({}_3y_1\right)\right\}}\left({}_2y_2\right)={}_2y_3$. Finally, we write, $E^{\left({}_2y_3\right)}\left({}_1y_3\right)={}_1y_4=y_4$ 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 $E^1(1)=E^1\left(\dfrac{2}{2}\right)=\dfrac{3}{2}$, from [2].

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