An-Extended-Study- of-Prime-Numbers-2022

Amaler Jee

29-03-2022

Abstract

Numbers is a sea, crossing over to the desired destination which can only be guided by the Primes signs. Howbeit, the Primes function $\mathrm{P(x)}$ is still keeping his secret since it was wanted by Euclid for a quite long ago. As a substitution, those silver linings are also known as Rzhong-scores Ƶs, which were documented in «$\mathrm{A-little-bit-Discovery-of-Prime-Numbers-2021}$»^{R1}, in short «Discovery», could be a manner to fit the composite numbers function as $\mathrm{H(x)}$ may work for this sailing.

Key words: Primes, Rzhong-score, Composite Numbers Function, Polygon, Discrete Fourier

I, Polygonal Transformations:

After transformation, in «Discovery», the Right triangle which has a Triangular numbers hypotenuse is achieved in Table 1.1 below.

In the model of Triangular numbers,

Triangular numbers are {1,3,6,10,15...} by function $f(x) = \frac{x(x+1)}{2}, x \geq 1$;

and Ƶ s are $\{f(x) = \frac{x(x+1)}{2} - 6 : x \geq 7,\ f(x) = \frac{x(x+1)}{2} - 10 : x \geq 11,\ f(x) = \frac{x(x+1)}{2} - 15 : x \geq 16, \dots\}$ within the collection $\{f(x) = \frac{x(x+1)}{2} - \mathrm{Trno} : x \geq (\mathrm{Trno}+1)\}$;

and Ƶs start numbers are {22,56,121,232,407...} by function $f(x) = \frac{x(x-1)}{2} + 1, x \in \{7,11,16,22,29 \dots\}$.

1															
P2	P3														
4	P5	6													
P7	8	9	10												
P11	12	P13	14	15											
16	P17	18	P19	20	21										
Z22	P23	24	25	26	27	28									
P29	Z30	P31	32	33	34	35	36								
P37	38	Z39	40	P41	42	P43	44	45							
46	P47	48	Z49	50	51	52	P53	54	55						
Z56	57	58	P59	Z60	P61	62	63	64	65	66					
P67	Z68	69	70	P71	Z72	P73	74	75	76	77	78				
P79	80	Z81	82	P83	84	Z85	86	87	88	P89	90	91			
92	93	94	Z95	96	P97	98	Z99	100	P101	102	P103	104	105		
106	P107	108	P109	Z110	111	112	P113	Z114	115	116	117	118	119	120	
Z121	122	123	124	125	Z126	P127	128	129	Z130	P131	132	133	134	135	136

Table 1.1, Triangular numbers model, blue lines are Ƶs

On 03-03-2022, $\mathrm{Cauchy's\ Polygonal\ Number\ Theorem}^{R2}$ became the source of inspiration. The transform could have more changes by shaping with other polygonal numbers, such as Square numbers, Pentagonal numbers, Hexagonal numbers, Heptagonal numbers, Octagonal numbers and Nonagonal numbers and so on.

On 03-04-2022, Theorem-1.1: Moreover, each one of Polygonal models must have its own Silver Linings, namely Ƶs.

Thus, in the model of Square numbers, the Right triangle which has a Square numbers hypotenuse is achieved in Table 1.2.
Square numbers are {1,4,9,16,25...} by function $f(x) = x^2, x \geq 1$;
and Ƶ s are $\{f(x) = x(x-1) - 2: x \geq 4,\ f(x) = x(x-1) - 4: x \geq 6,\ f(x) = x(x-1) - 6: x \geq 8, \dots\}$ within the collection $\{f(x) = x(x-1) - \text{Trno}: x \geq (\text{Trno} + 2)\}$ and $\{f(x) = x(x-1) + 2: x \geq 2,\ f(x) = x(x-1) + 4: x \geq 4, \dots\}$ within the collection $\{f(x) = x(x-1) + \text{Trno}: x \geq \text{Trno}\}$;
and Ƶ s start numbers are {10,26,50,82,122...} by function $f(x) = x(x-2) + 2, x \in \{4,6,8,10,12 \dots\}$ and are {4,16,36,64,100...} by function $f(x) = x^2, x \in \{2,4,6,8,10,12 \dots\}$.

1															
P2	P3	E4													
P5	6	P7	E8	9											
E10	P11	12	P13	E14	15	E16									
P17	E18	P19	20	21	E22	P23	E24	25							
E26	27	E28	P29	30	P31	E32	33	E34	35	E36					
P37	E38	39	E40	P41	42	P43	E44	45	E46	P47	E48	49			
E50	51	E52	P53	E54	55	56	57	E58	P59	E60	P61	E62	63	E64	
65	E66	P67	E68	69	E70	P71	72	P73	E74	75	E76	77	E78	P79	E80
E82	P83	E84	85	E86	87	E88	P89	90	91	E92	93	E94	95	E96	P97
P101	E102	P103	E104	105	E106	P107	E108	P109	110	111	E112	P113	E114	115	E116
E122	123	E124	125	E126	P127	E128	129	E130	P131	132	133	E134	135	E136	P137
145	E146	147	E148	P149	E150	P151	E152	153	E154	155	156	P157	E158	159	E160
E170	171	E172	P173	E174	175	E176	177	E178	P179	E180	P181	182	183	E184	185
P197	E198	P199	E200	201	E202	203	E204	205	E206	207	E208	209	210	P211	E212
E226	P227	E228	P229	E230	231	E232	P233	E234	235	E236	237	E238	P239	240	P241

Table 1.2, Square numbers model, green lines are Ƶs

In the Pentagonal numbers model, the Right triangle which has a Pentagonal numbers hypotenuse is achieved in Table 1.3.
Pentagonal numbers are {1,5,12,22,35...} by function $f(x) = \frac{x(3x-1)}{2}, x \geq 1$;

and Ƶ s are $\{f(x) = \frac{x(3x-5)}{2}: x \geq 3,\ f(x) = \frac{x(3x-5)}{2} - 4: x \geq 7,\ f(x) = \frac{x(3x-5)}{2} - 6: x \geq 9, \dots\}$ within the collection $\{f(x) = \frac{x(3x-5)}{2} - \text{Trno}: x \geq (\text{Trno} + 3)\}$;

and Ƶs start numbers are {6,52,93,248,377...} by function $f(x) = \frac{x(3x-7)}{2} + 3, x \in \{3,7,9,14,17,24 \dots\}$.

1														
P2	P3	4	P5											
6	P7	8	9	10	P11	12								
P13	14	15	16	P17	18	P19	20	21	22					
P23	24	25	26	27	28	P29	30	P31	32	33	34	35		
36	P37	38	39	40	P41	42	P43	44	45	46	P47	48	49	5
52	P53	54	55	56	57	58	P59	60	P61	62	63	64	65	6
P71	72	P73	74	75	76	77	78	P79	80	81	82	P83	84	8
93	94	95	96	P97	98	99	100	P101	102	P103	104	105	106	P
118	119	120	121	122	123	124	125	126	P127	128	129	130	P131	1
146	147	148	P149	150	P151	152	153	154	155	156	P157	158	159	1
177	178	P179	180	P181	182	183	184	185	186	187	188	189	190	P
P211	212	213	214	215	216	217	218	219	220	221	222	P223	224	2
248	249	250	P251	252	253	254	255	256	P257	258	259	260	261	2
288	289	290	291	292	P293	294	295	296	297	298	299	300	301	3
P331	332	333	334	335	336	P337	338	339	340	341	342	343	344	3

Table 1.3, Pentagonal numbers model, blue lines are Ƶs

Top 7 Polygonal numbers models, from Triangular numbers to Nonagonal numbers, were studied in this investigation.

******

II, H(x), The First Look:

Basically, infinite polygonal models have interminable twinkling silver linings are striking now.

On 03-04-2022, Theorem-2.1: All Ƶs collection in all Polygonal models must cover all composite numbers. Furthermore, Ƶs collection in all Odd Polygonal models must contain all odd composite numbers and even one contains all even composite numbers.

For the initial case study, 40 composite numbers were extracted from 4 Ƶs, are $f(x)=\frac{x(x+1)}{2}-6: x\geq 7$, $f(x)=\frac{x(3x-5)}{2}-4: x\geq 7$, $f(x)=\frac{x(5x-11)}{2}: x\geq 5$, and $f(x)=\frac{x(7x-17)}{2}: x\geq 7$, in top 4 Odd Polygonal models. Samples are shown in Chart 2.1.

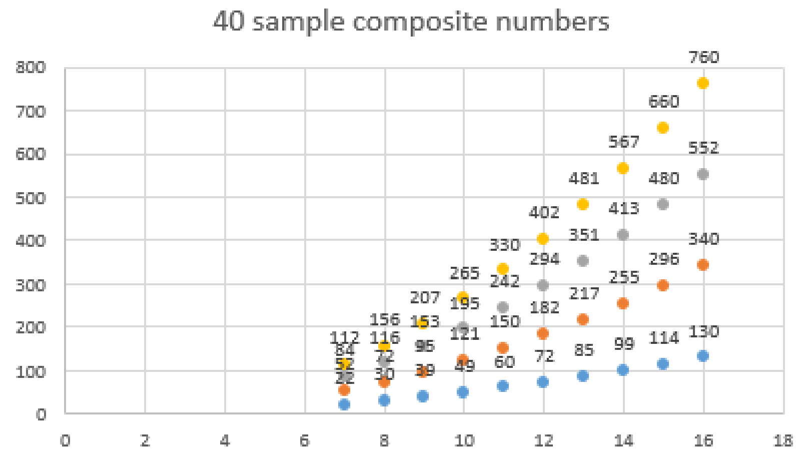

Chart 2.1

On 03-08-2022, there should be a way to combine all sample numbers into one function so that a cosmos composite number formula, H(x), will take the centre stage finally. And its first look can be regarded in Chart 2.2 is an irregular increase saw-tooth achieved.

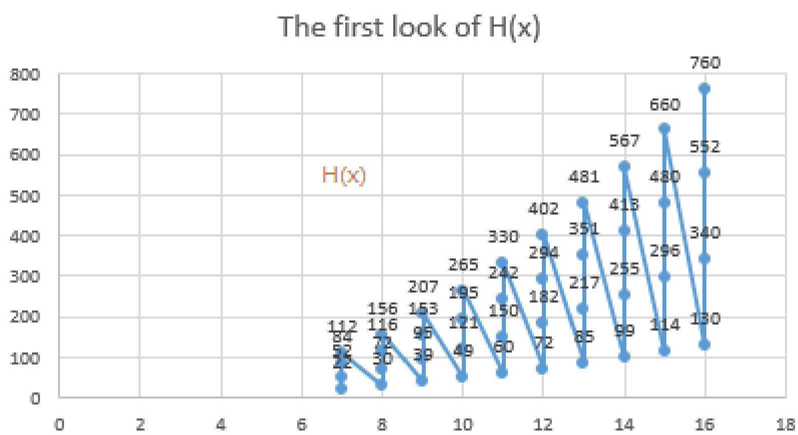

Chart 2.2

******

III, Exact $\mathrm{H(x)}$ Is Wanted:

A fitting curve for $\mathrm{H(x)}$ is $f(x) = x(2x-4) - 2.5,\ x \geq 7$ from Chart 2.2 can be perceived. However, a more accurate exact $\mathrm{H(x)}$ is wanted. $\mathrm{H(x)}$ should have more faces by changes.

On 03-14-2022, Reversing the x and y values in Chart 2.2, there is a new expression $\mathrm{H2(x)}$ is achieved in Chart 3.1.

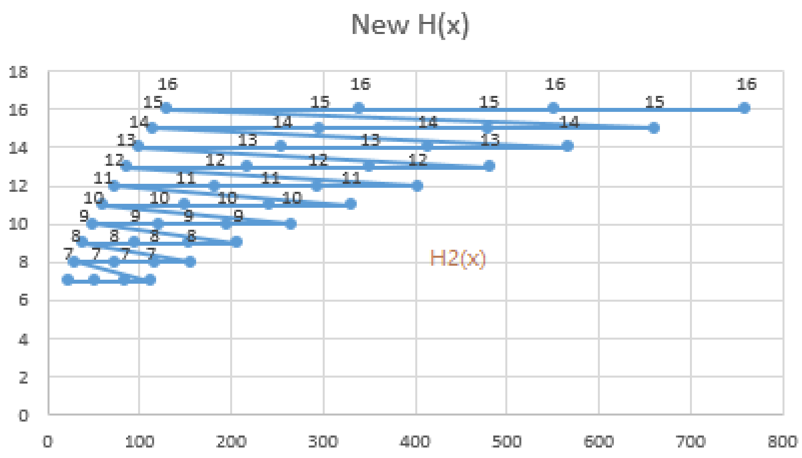

Chart 3.1

On 03-16-2022, By using GeoGebra “fitpoly” command, several explicit fitting curves can be evinced.

For top 8 composite numbers from the sample, the fitting function, namely Ͼ (x), is

On 03-16-2022, Function-3.1: $f(x) = 0.0000000000077x^7 - 0.0000000049039x^6 + 0.0000012592783x^5 - 0.0001680297251x^4 + 0.0124864001065x^3 - 0.5129488464191x^2 + 10.7137563225545x - 79.9817148492531$

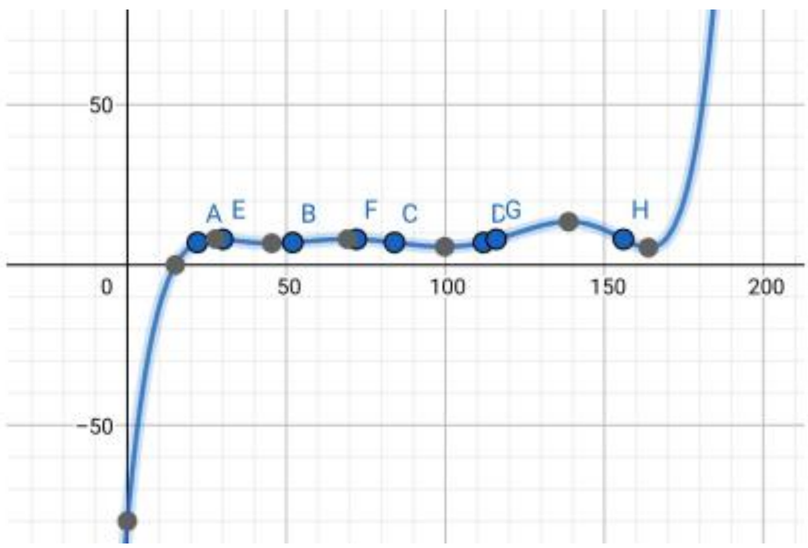

Chart 3.2, fitting curve for top 8 points

For top 12 composite numbers from the sample, the $\overline{\underline{\epsilon}}$ (x) is

On 03-16-2022, Function-3.2: $f(x) = 0x^{11} + 0x^{10} - 0.0000000000042x^9 + 0.0000000011206x^8 - 0.0000001910928x^7 + 0.0000218894157x^6 - 0.0017144667095x^5 + 0.0915675021453x^4 - 3.2585486981888x^3 + 73.3634917366407x^2 - 937.7484556925992x + 5150.2435720407375$

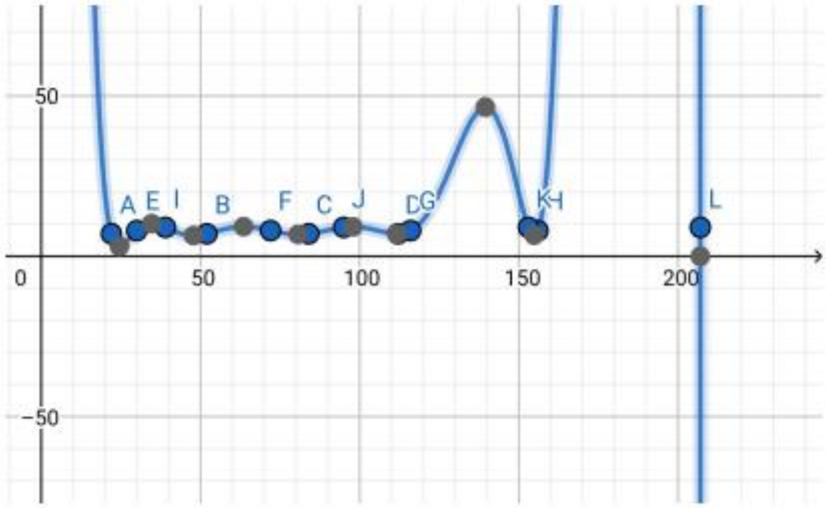

Chart 3.3, fitting curve for top 12 points

For top 16 composite numbers from the sample, the $\overline{\underline{\epsilon}}$ (x) is

On 03-16-2022, Function-3.3: $f(x) = 0x^{15} - 0x^{14} + 0x^{13} - 0x^{12} + 0.0000000000001x^{11} - 0.000000000026x^{10} + 0.0000000042496x^9 - 0.0000005197874x^8 + 0.000047845079x^7 - 0.0033090363246x^6 + 0.1702549680249x^5 - 6.3874465731033x^4 + 168.793091592257x^3 - 2959.5196086351975x^2 - 30716.081192669222x + 141926.90578373868$

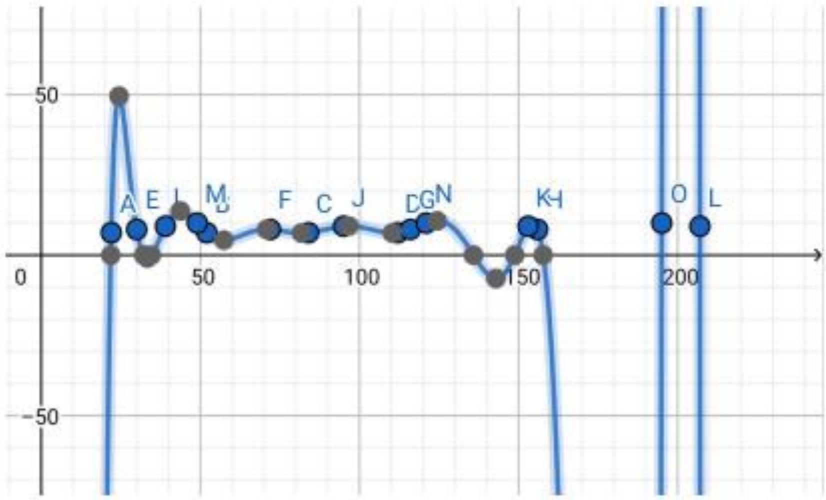

Chart 3.4, fitting curve for top 16 points

Obviously, fitting area larger the fitting function more complicated.

******

IV, Fitting $\mathrm{H(x)}$ By Discrete Fourier:

After all, a more general $\mathrm{H(x)}$ is the goal, the exact fitting formulas for a finite domain sample are generated though.

One possible manner can be identified is $\text{Discrete Fourier Theorem}^{R3}$ to pursue the general $\mathrm{H(x)}$ in an irregular recursive way. Both $\mathrm{H(x)}$ and $\mathrm{H2(x)}$ have the base functions as Ƶ function, is denoted by Ƶ$\mathrm{(x)}$, and composite sample function, is denoted by ₠ $\mathrm{(x)}$.

On 03-18-2022, Theorem-4.1: So that there are two composite numbers equations could be obtained below,

On 03-18-2022, Equation-4.1: $\frac{\sum H(x)}{\sum_{n=0}^{N-1} \text{Ƶ}(\mathrm{x}) e^{-j2\pi n/N}} = 1$

On 03-18-2022, Equation-4.2: $\frac{\sum H2(x)}{\sum_{n=0}^{N-1}\left(\sum \text{₠}\ (\mathrm{x})\right) e^{-j2\pi n/N}} = 1$

On 03-16-2022, Anticipation-4.1: There must be the upper limit may cover all composite numbers for distinguishing base functions instead of ∞.

In which, $\mathrm{H(x)}$ and $\mathrm{H2(x)}$ appear upon the scene; and by using related software and programming, many things, inseparable from this study, within $\{1,2,3, \ldots 5.3 \times 10^5\}$ generally speaking, are done and performed and tested. Definitely, the great work impulse of the $\mathrm{P(x)}$ research is the impulse of $\mathrm{H(x)}$ study in a wonderful variety of Ƶs. The trumpet of a prophecy! O wind, if the $\mathrm{H(x)}$ comes, can $\mathrm{P(x)}$, which is namely $\neg H(x)$ or $\not\subset H(x)$, be far behind?!

amaler from Beijing 04/06/2022

Reference:

R1, https://edf.lms.ac.uk/status.php?p_id=40145&cr=D75A342000

R2, https://www.jstor.org/stable/1194225

R3, https://en.wikipedia.org/Discrete_Fourier_transform

R4, Handbook of Mathematics, Hep Press, 2002, ISBN 7-04-003401-8, https://www.hep.com.cn

Information and SourceCode:

https://github.com/amaler0823/PrimeTrees

Tools:

Excel, GeoGebra, Java