Prime Function Complete Proof

Analysis, Infinite Equation, Base 2^n Distributive Property

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Abstract

Function and method for solving the distribution of prime numbers accurately using the combination of step functions, polynomial functions, inverse functions and continuous functions. Equation $\lim_{n\to\infty} p(n) = \{3 + 2(n + x_p) | x_p = x_3 + x_5 + x_7 + x_{11} + \cdots x_p\}$ is true for all integer where $n > 0$ for the distribution and generation of exact values of prime numbers without exception. This formula is efficient by means of modern supercomputers for the task of expanding term x_p.

1 Introduction

Prime numbers perhaps are the most interesting group of numbers in real number system due to its unpredictable nature, unusual distribution and complexity. They follow an asymptotic path for positive integers.

2 Definition

Let c be any integer

Let m be any integer ≥ 4

Let n be any integer > 0

Let p be any prime number to be tested for all n

Let n_p as non-prime number

2.1 Range for testing prime p

Integer m shall limit to test within the integer c, whereas c has a range between $2 \le c \le \lfloor\sqrt{m}\rfloor$. Prime identities shall equal to $\frac{p}{c} = \left\lfloor\frac{p}{c}\right\rfloor$.

2.2 Properties

All even integer m are n_p.

Any integer m divisible by p are n_p where $p \le \lfloor\sqrt{m}\rfloor$.

Integer 5 is the first real prime number because of the constraint of $p \le \lfloor\sqrt{m}\rfloor$, where $\lfloor\sqrt{m}\rfloor \neq \sqrt{m} \wedge \lfloor\sqrt{m}\rfloor > 1$.

3 Function

Prime Function p defined as:

$p(n) = \{3 + 2(n + x_p) | x_p = x_3 + x_5 + x_7 + x_{11} + \cdots x_p\}$ for $n > 0$. This is the most accurate but extensive prime producing function as it contains infinite number of terms.

3.1 Function p producing all odd integer:

$p_o = 3 + 2n$

3.2 Function p where $p(mod\ 3) \neq 0$:

$p_3 = 3 + 2(n + x_3)$

$\therefore x_3 = \left\lfloor\frac{n-1}{2}\right\rfloor$

3.3 Function p where $p(mod\ 5) \neq 0$:

$p_5 = 3 + 2(n + x_3 + x_5)$

$\therefore x_3 = \left\lfloor\frac{n-1+x_5}{2}\right\rfloor$

$\therefore a_5 = (n-2)(mod\ 8) + 2$

$\therefore x_5 = \left\lfloor\frac{a_5-1}{7}\right\rfloor + 2\left\lfloor\frac{n-2}{8}\right\rfloor + \left\lfloor\frac{1}{n}\right\rfloor$

3.4 Function p where $p(mod\ 7) \neq 0$:

$p_7 = 3 + 2(n + x_3 + x_5 + x_7)$

$\therefore x_3 = \left\lfloor\frac{n-1+x_5+x_7}{2}\right\rfloor$

$\therefore a_5 = (n - 2 + x_7)(mod \;\; 8) + 2$

$\therefore x_5 = \left\lfloor \frac{a_5 - 1}{7} \right\rfloor + 2\left\lfloor \frac{n-2+x_7}{8} \right\rfloor + \left\lfloor \frac{1}{n+x_7} \right\rfloor$

$\therefore a_7 = (n - 14)(mod \;\; 48) + 14$

$\therefore x_7 = g_7 + 8\left\lfloor \frac{n-14}{48} \right\rfloor + \left\lfloor \frac{n+2}{2n} \right\rfloor$; g_7 (see below)

Using Step Group Function (see **List 4**),

$$g_7 = \left\{ \sum_h \left\lfloor \frac{a_7 - 1}{h} \right\rfloor | h = (h_1, h_2, h_3, \dots h) \right\}$$

$$g_7 = \left\{ \sum_h \left\lfloor \frac{a_7 - 1}{h} \right\rfloor | h = (13, 19, 22, 28, 31, 37, 48, 50) \right\} - \left\{ \sum_h \left\lfloor \frac{a_7 - 1}{h} \right\rfloor | h = (26, 38, 39, 44, 56, 57) \right\}$$

Where $p(n) = \{n | n \geq 1\}$; step function $p(n)$ is prime for all integers $n = 1, 2, 3, \dots, 13$. The primes for $n = 1, 2, 3, \dots, 13$ are $5, 7, 11, 13, \dots, 47$. Function $p(n)$ has a property of $p(n) \neq \{3n | p \;\wedge\; 5n | p \;\wedge\; p | p \dots | n > 1\}$.

4 Step Group Function

Let g_0 as the summation of all similar floor expressions:

$g_0 = \left\lfloor \frac{n}{h_1} \right\rfloor + \left\lfloor \frac{n}{h_2} \right\rfloor + \left\lfloor \frac{n}{h_3} \right\rfloor + \cdots \left\lfloor \frac{n}{h} \right\rfloor$ for n is any expression; h is any real number

$$g_0 = \left\{ \sum_h \left\lfloor \frac{n}{h} \right\rfloor | h = (h_1, h_2, h_3, \dots h) \right\}$$

5 Initial Analysis $p(mod \;\; 3) \neq 0$

In order to work on prime number function accurately, we need two things. First, by determining their distributive property where $\lfloor \sqrt{p} \rfloor - \sqrt{p} = 0$. Second by expanding its domain n with new expression in terms of n through step function.

6 Infinite Equation and Prime Range Reducer

All prime numbers $p(n)$ follow pattern at all prime value. We can reduce the range by establishing or adding a new constraint for each prime. Let say the function

$\therefore p_5 = \left\{3 + 2(n + x_3 + x_5) \,\middle|\, a_5 = (n-2)(mod \;\; 8) + 2 \,\middle|\, x_5 = \left\lfloor \frac{a_5 - 1}{7} \right\rfloor + 2\left\lfloor \frac{n-2}{8} \right\rfloor + \left\lfloor \frac{1}{n} \right\rfloor \right\}$ is true for all, where $p(mod \;\; 3) \neq 0 \;\wedge\; p(mod \;\; 5) \neq 0$. We can establish a new prime function by changing its constraint $n = n + x_n$ for the equation of

$\therefore p_7 = \left\{3 + 2(n + x_3 + x_5 + x_7) \,\middle|\, a_5 = (n - 2 + x_7)(mod \;\; 8) + 2 \,\middle|\, x_5 = \left\lfloor \frac{a_5 - 1}{7} \right\rfloor + 2\left\lfloor \frac{n-2+x_7}{8} \right\rfloor + \left\lfloor \frac{1}{n+x_7} \right\rfloor \right\}$

where x_7 is an additional constraint for eliminating all numbers of $7|p$ and thus the new equation is $p(mod \;\; 7) \neq 0$.

7 General Equation

$\lim_{n\to\infty} \; p(n) = \{3 + 2(n + x_p) | x_p = x_3 + x_5 + x_7 + x_{11} + \cdots x_p\}$

8 Proof that $p(n)$ followed by logarithmic path pattern for reducing the range

Computed up to $29|p$ due to limited processing power.

p(n) p(mod n) ≠0	Pattern repeats every	Factor	2^n n
3	1	2^0	1
5	2	2^1	2
7	8	2^3	3
11	48	$2^4(3)$	5.58496250072116
13	480	$2^5(3)(5)$	8.90689059560852
17	5, 760	$2^7(3^2)(5)$	12.4918530963297
19	92, 160	$2^{11}(3^2)(5)$	16.4918530963297
23	1, 658, 880	$2^{12}(3^4)(5)$	20.661778097772
29	36, 495, 360	$2^{13}(3^4)(5)(11)$	25.1212097164093

Table 1

9 Proof

9.1 Original Equation p_o:

n	P	p_o	T
	prime numbers	odd integers	TRUE FALSE
		$3+2n$	
1	5	5	TRUE
2	7	7	TRUE
3	11	9	FALSE
4	13	11	FALSE
5	17	13	FALSE

$p_0 = 2n + 3$ is true for $n \leq 2$

9.2 Equation p_3:

n	P	p_o	$3\|p$	p_3	T
	prime numbers	odd integers	position	$3\|p$	TRUE FALSE
	$3+2n$	$n=n$	$\Rightarrow$	$n = n + x_3$	
				$x_3 = \left\lfloor \frac{n-1}{2} \right\rfloor$	
1	5	5		5	TRUE
2	7	7		7	TRUE
3	11	9	1	11	TRUE
4	13	11		13	TRUE
5	17	13		17	TRUE
6	19	15	4	19	TRUE
7	23	17		23	TRUE
8	29	19		25	FALSE
9	31	21	7	29	FALSE
10	37	23		31	FALSE
11	41	25		35	FALSE
12	43	27	10	37	FALSE

$p_3 = \left\{3 + 2n \,\middle|\, n = n + x_3 \,\middle|\, x_3 = \left\lfloor \frac{n-1}{2} \right\rfloor \right\}$ is true for $n \leq 7$; eliminating all $3|p$.

$3|p$ is repeated every 3 interval of $n = \{3, 6, 9, 12, \dots \infty\}$ for $p_o = \{9, 15, 21, 27, \dots \infty\}$.

x_3 denotes for this interval.

9.3 Equation p_5:

n	P	p_3	$5\|p$	p_5	T
	prime numbers	$3\|p$	position	$5\|p$	TRUE FALSE
	$3+2n$	$n=n+x_3$	$\Rightarrow$	$n=n+x_3+x_5$	
		$x_3=\left\lfloor\frac{n-1}{2}\right\rfloor$	$\Rightarrow$	$x_3=\left\lfloor\frac{n-1+x_5}{2}\right\rfloor$	
				$a_5=(n-2)(mod\ \ 8)+2$	
				$x_5=\left\lfloor\frac{a_5-1}{7}\right\rfloor+2\left\lfloor\frac{n-2}{8}\right\rfloor+\left\lfloor\frac{1}{n}\right\rfloor$	
1	5	5		5	TRUE
2	7	7		7	TRUE
3	11	11		11	TRUE
4	13	13		13	TRUE
5	17	17		17	TRUE
6	19	19		19	TRUE
7	23	23		23	TRUE
8	29	25	1	29	TRUE
11	41	35	4	41	TRUE
13	47	41		47	TRUE
14	53	43		49	FALSE
18	71	55	11	67	FALSE
21	83	65	14	77	FALSE
28	113	85	21	103	FALSE
31	137	95	24	113	FALSE

$p_5=3+2n\ \left|n=n+x_3+x_5\right|x_3=\left\lfloor\frac{n-1+x_5}{2}\right\rfloor\left|x_5=\left\lfloor\frac{a_5-1}{7}\right\rfloor+2\left\lfloor\frac{n-2}{8}\right\rfloor+\left\lfloor\frac{1}{n}\right\rfloor\right|a_5=(n-2)(mod\ \ 8)+2$ is true for $n\leq 13$; eliminating all $5|p$.

$5|p$ is repeated every $3|7$ interval of $n=\{\ 8,11,18,21\ldots\infty\ \}$ for $p_o=\{\ 25,35,55,65\ldots\infty\ \}$. (See **Table 1**).

x_5 denotes for this interval.

$$p_5 = 3 + 2n|n = n + x_3 + x_5 \left| x_3 = \left\lfloor \frac{n-1+x_5}{2} \right\rfloor \right| x_5 = \left\lfloor \frac{a_5-1}{7} \right\rfloor + 2\left\lfloor \frac{n-2}{8} \right\rfloor + \left\lfloor \frac{1}{n} \right\rfloor |a_5 = (n-2)(mod \quad 8) + 2$$

9.4 Equation p_7:

n	P	p_5	$7\|p$	p_7	T
	prime numbers	$5\|p$	position	$7\|p$	TRUE FALSE
	$3+2n$	$n = n + x_3 + x_5$	$\Rightarrow$	$n = n + x_3 + x_5 + x_7$	
		$x_3 = \left\lfloor \frac{n-1+x_5}{2} \right\rfloor$	$\Rightarrow$	$x_3 = \left\lfloor \frac{n-1+x_5+x_7}{2} \right\rfloor$	
		$a_5 = (n-2)(mod \quad 8) + 2$	$\Rightarrow$	$a_5 = (n-2+x_7)(mod \quad 8) + 2$	
		$x_5 = \left\lfloor \frac{a_5-1}{7} \right\rfloor + 2\left\lfloor \frac{n-2}{8} \right\rfloor + \left\lfloor \frac{1}{n} \right\rfloor$	$\Rightarrow$	$x_5 = \left\lfloor \frac{a_5-1}{7} \right\rfloor + 2\left\lfloor \frac{n-2+x_7}{8} \right\rfloor + \left\lfloor \frac{1}{n+x_7} \right\rfloor$	
				$a_7 = (n-14)(mod \quad 48) + 14$	
				$x_7 (see \quad bottom)$	
1	5	5		5	TRUE
14	53	49	1	53	TRUE
21	83	77	8	83	TRUE
25	103	91	12	103	TRUE
28	113	103		113	TRUE
29	127	107		121	FALSE
32	139	119	19	137	FALSE
36	163	133	23	151	FALSE
43	197	161	30	181	FALSE
55	269	203	42	233	FALSE
58	281	217	45	247	FALSE
70	359	259	57	299	FALSE
77	401	287	64	331	FALSE
81	431	301	68	349	FALSE
88	463	329	75	379	FALSE
92	491	343	79	397	FALSE

99	547	371	86	431	FALSE
111	617	413	98	479	FALSE
114	641	427	101	491	FALSE
126	719	469	113	547	FALSE

$p_7 = \left\{3 + 2n \;\middle|\; n = n + x_3 + x_5 + x_7 \middle| x_3 = \left\lfloor\frac{n-1+x_5+x_7}{2}\right\rfloor \middle| x_5 = \left\lfloor\frac{a_5-1}{7}\right\rfloor + 2\left\lfloor\frac{n-2+x_7}{8}\right\rfloor + \left\lfloor\frac{1}{n+x_7}\right\rfloor \middle| a_5 = (n-2+x_7)(mod \;\; 8) + 2 \;\; \middle| a_7 \middle| x_7\right\}$ is true for $n \le 28$ eliminating all $7|p$.
$7|p$ is repeated every $7|4|7|4|7|12|3|12$. (See **Table 1**).
Using Step Group Function (see **List 4**),

$$g_7 = \left\{\sum_h \left\lfloor\frac{a_7-1}{h}\right\rfloor \middle| h = (13, 19, 22, 28, 31, 37, 48, 50)\right\} - \left\{\sum_h \left\lfloor\frac{a_7-1}{h}\right\rfloor \middle| h = (26, 38, 39, 44, 56, 57)\right\}$$

$$x_7 = g_7 + 8\left\lfloor\frac{n-14}{48}\right\rfloor + \left\lfloor\frac{n+2}{2n}\right\rfloor$$

x_7 denotes for this interval.

9.5 Equation p_{11}:

n	P	p_7	$11\|p$	p_{11}	T
	prime numbers	$7\|p$	position	$11\|p$	TRUE FALSE
	$3+2n$	$n = n + x_3 + x_5 + x_7$	$\Rightarrow$	$n = n + x_3 + x_5 + x_7 + x_{11}$	
		$x_3 = \left\lfloor\frac{n-1+x_5+x_7}{2}\right\rfloor$	$\Rightarrow$	$x_3 = \left\lfloor\frac{n-1+x_5+x_7+x_{11}}{2}\right\rfloor$	
		$a_5 = (n-2+x_7)(mod \;\; 8) + 2$	$\Rightarrow$	$a_5 = (n-2+x_7+x_{11})(mod \;\; 8) + 2$	
		$x_5 = \left\lfloor\frac{a_5-1}{7}\right\rfloor + 2\left\lfloor\frac{n-2+x_7}{8}\right\rfloor + \left\lfloor\frac{1}{n+x_7}\right\rfloor$	$\Rightarrow$	$x_5 = \left\lfloor\frac{a_5-1}{7}\right\rfloor + 2\left\lfloor\frac{n-2+x_7+x_{11}}{8}\right\rfloor + \left\lfloor\frac{1}{n+x_7+x_{11}}\right\rfloor$	
		$a_7 = (n-14)(mod \;\; 48) + 14$	$\Rightarrow$	$a_7 = (n-14+x_{11})(mod \;\; 48) + 14$	
		$x_7 = g_7 + 8\left\lfloor\frac{n-14}{48}\right\rfloor + \left\lfloor\frac{n+2}{2n}\right\rfloor$	$\Rightarrow$	$x_7 = g_7 + 8\left\lfloor\frac{n-14+x_{11}}{48}\right\rfloor + \left\lfloor\frac{n+2+x_{11}}{2(n+x_{11})}\right\rfloor$	
				$a_{11} = (n-29)(mod \;\; 480) + 29$	

				$x_{11}(see \quad bottom)$	
1	5	5		5	TRUE
29	127	121	1	127	TRUE
34	151	143	6	151	TRUE
37	167	157		167	TRUE
38	173	163		169	FALSE
44	199	187	16	197	FALSE
49	233	209	21	227	FALSE
60	293	253	32	277	FALSE
75	389	319	47	353	FALSE
79	419	341	51	373	FALSE
95	509	407	67	443	FALSE
105	587	451	77	493	FALSE
110	613	473	82	523	FALSE
119	661	517	91	563	FALSE
134	769	583	106	631	FALSE
150	881	649	122	709	FALSE
155	919	671	127	733	FALSE
170	1021	737	142	811	FALSE
180	1091	781	152	857	FALSE
185	1117	803	157	881	FALSE
200	1231	869	172	949	FALSE
211	1303	913	183	1007	FALSE
225	1433	979	197	1069	FALSE
245	1567	1067	217	1163	FALSE
256	1627	1111	228	1223	FALSE
261	1669	1133	233	1247	FALSE
270	1747	1177	242	1289	FALSE
275	1787	1199	247	1307	FALSE
286	1877	1243	258	1363	FALSE
306	2029	1331	278	1457	FALSE
320	2137	1397	292	1523	FALSE
331	2239	1441	303	1579	FALSE
346	2347	1507	318	1651	FALSE
351	2381	1529	323	1679	FALSE
361	2447	1573	333	1721	FALSE
376	2593	1639	348	1789	FALSE
381	2647	1661	353	1819	FALSE
397	2731	1727	369	1901	FALSE
412	2851	1793	384	1963	FALSE
421	2927	1837	393	2017	FALSE
426	2969	1859	398	2039	FALSE

436	3061	1903	408	2083	FALSE
452	3209	1969	424	2161	FALSE
456	3251	1991	428	2183	FALSE
471	3359	2057	443	2257	FALSE
482	3461	2101	454	2309	FALSE
487	3499	2123	459	2333	FALSE
497	3559	2167	469	2377	FALSE
502	3607	2189	474	2399	FALSE
528	3821	2299	500	2533	FALSE
531	3847	2321	503	2543	FALSE
557	4051	2431	529	2671	FALSE

$p_{11} = \{3 + 2n \ \mid \ n = n + x_3 + x_5 + x_7 + x_{11} | x_3 | x_5 | x_7 | x_{11}\}$ is true for $n \leq 37$ eliminating all $11|p$.
$11|p$ is repeated every $\begin{Bmatrix} 5, 10, 5, 11, 15, 4, 16, 10, 5, 9, 15, 16, 5, 15, 10, 5, 15, 11, 14, 20, 11, 5, 9, 5, \\ 11, 20, 14, 11, 15, 5, 10, 15, 5, 16, 15, 9, 5, 10, 16, 4, 15, 11, 5, 10, 5, 26, 3, 26 \end{Bmatrix}$.
(See **Table 1**).
Using Step Group Function (see **List 4**),

$$g_{11} = g_{11a} + 2g_{11b} - g_{11c} - 2g_{11d}$$

$$g_{11a} = \left\{ \sum_h \left\lfloor \frac{a_{11} - 1}{h} \right\rfloor \middle| h = \begin{pmatrix} 28, 32, 41, 45, 55, 69, 72, 87, 100, 108, 122, 137, \\ 141, 155, 164, 182, 192, 234, 238, 250, 260, 270, 279, 280, \\ 292, 302, 316, 329, 330, 343, 347, 362, 376, 388, 392, 397, \\ 412, 414, 415, 420, 429, 432, 439, 443, 450, 452, 456, 481 \end{pmatrix} \right\}$$

$$g_{11b} = \left\{ \sum_h \left\lfloor \frac{a_{11} - 1}{h} \right\rfloor | h = (168, 246, 320) \right\}$$

$$g_{11c} = \left\{ \sum_h \left\lfloor \frac{a_{11} - 1}{h} \right\rfloor \middle| h = \begin{pmatrix} 56, 64, 82, 84, 90, 110, 123, 135, 138, 140, 144, 160, 165, 174, 196, \\ 200, 207, 225, 244, 261, 274, 275, 282, 287, 288, 300, 308, 310, 315, 324, \\ 328, 336, 345, 352, 360, 366, 385, 411, 416, 423, 435, 451, 465, 468, 495 \end{pmatrix} \right\}$$

$$g_{11d} = \left\{ \sum_h \left\lfloor \frac{a_{11} - 1}{h} \right\rfloor | h = (216, 364, 476, 492, 500, 504) \right\}$$

$$x_{11} = g_{11} + 48 \left\lfloor \frac{n - 29}{480} \right\rfloor + \left\lfloor \frac{n + 3}{2n} \right\rfloor$$

x_{11} denotes for this interval.

10 Software Programs

Programs use for calculating the number of interval pattern.

10.1 Visual Studio C#:

```
public static long equation(long x)
{
    //Accuracy up to p=47
        long a, a1, a2;
        double b;
        long y;

        a1 = ((x - 2) % 8) / 6;
        a2 = (x - 2) / 8;
        a2 = 2 * a2;
        a = a1 + a2;

        b = (double)(x + a - 1) / 2;

        y = Math.Abs((int)(4 * b) + 5 + 2 * (int)b);

        return y;
}


private void PrimeCompute()
{
        long primeRem, primeDiv;
        long[] primesToBeRemoved = new long[100];
        long iNumPrimeRem, iRowIncreaser = 0;
        long primeTrial;
        long iPattern = 0, iNumPattern = 0;
        long iPrime;
        long maxTry;
        long[] iDiffArray = new long[50000000];
        long[] iPatternArray = new long[50000000];
        long[] pat = new long[25];

        primeDiv = 29;
        maxTry = 90000000;

        //Calculation
        long i;
        iNumPrimeRem = 1;

        do
        {
                iNumPrimeRem++;
```

```
                if (iNumPrimeRem > 1)
                {
                    i = Methods.equation(iNumPrimeRem);
                    primesToBeRemoved[iNumPrimeRem - 1] = Methods.equa-
tion(iNumPrimeRem);
                }
            }
            while (Methods.equation(iNumPrimeRem + 1) < primeDiv);

            primeRem = Methods.equation(iNumPrimeRem);
            iNumPrimeRem = iNumPrimeRem - 1;
            iPrime = iNumPrimeRem + 2;

            do
            {
            label1:

                primeTrial = Methods.equation(iPrime + iRowIncreaser);

                for (i = 1; i <= iNumPrimeRem; i++)
                {
                    if (primeTrial % primesToBeRemoved[i] == 0)
                    {
                        iRowIncreaser++;
                        goto label1;
                    }

                    if (i == iNumPrimeRem)
                    {
                        iPrime++;
                        iPattern++;
                        if (primeTrial != primeDiv & primeTrial % primeDiv == 0)
                        {
                            if (iDiffArray[1] == 0)
                            {
                                iPattern = 1;
                                iNumPattern = 1;
                            }
                            else
                            { iNumPattern++; }
                            iDiffArray[iNumPattern] = iPattern;
                        }
                    }
                }
            }
            while (iNumPattern < maxTry);
```

```
            //Difference
            for (i = 1; i <= iNumPattern - 1; i++)
            { iPatternArray[i] = iDiffArray[i + 1] - iDiffArray[i]; }

            //Pattern
            int n;
            long j = 0;

            n = pat.Count() - 1;

            for (i = 1; i <= n; i++)
            { pat[i] = iPatternArray[i]; }

            i = 0;

            do
            {
                i++;
                j++;

                if (pat[i] != iPatternArray[j + n])
                { i = 0; }
            } while (i < n);

            MessageBox.Show(j.ToString());
            Application.Exit();
        }
```

10.2 Visual Basic

```
Function equation(x As Long) As Double

Dim a As Long, b As Double

a = Int(((x - 2) Mod 8) / 6) + 2 * Int((x - 2) / 8)

b = (x + a - 1) / 2

equation = Abs(4 * b + 5 + 2 * Int(b))

End Function


Sub primeEquationAndRemovalProg()

Dim primeRem As Long, primeDiv As Long

Dim primesToBeRemoved(1 To 10) As Long

Dim iNumPrimeRem As Long, i As Long, iRowIncreaser As Long
```

```
Dim primeTrial As Long
Dim iPattern As Long, iNumPattern As Long
Dim iPrime As Long
Dim maxTry As Long
Dim iDiffArray(1 To 20000000) As Long, iPatternArray(1 To 20000000) As Long
Dim pat(1 To 25) As Integer

primeRem = 23
primeDiv = 29
maxTry = 90000000

iNumPrimeRem = 1
Do Until equation(iNumPrimeRem) = primeRem
iNumPrimeRem = iNumPrimeRem + 1
    If iNumPrimeRem > 1 Then
    primesToBeRemoved(iNumPrimeRem - 1) = equation(iNumPrimeRem)
    End If
Loop

iNumPrimeRem = iNumPrimeRem - 1
iPrime = iNumPrimeRem + 2

Do Until iNumPattern = maxTry
label1:
primeTrial = equation(iPrime + iRowIncreaser)

    For i = 1 To iNumPrimeRem
    If primeTrial Mod primesToBeRemoved(i) = 0 Then
    iRowIncreaser = iRowIncreaser + 1
```

```
        GoTo label1
        End If

        If i = iNumPrimeRem Then
        iPrime = iPrime + 1
        iPattern = iPattern + 1

            If primeTrial <> primeDiv And primeTrial Mod primeDiv = 0 Then
                If iDiffArray(1) = 0 Then
                iPattern = 1
                iNumPattern = 1
                Else
                iNumPattern = iNumPattern + 1
                End If
            iDiffArray(iNumPattern) = iPattern
            End If
        End If
        Next
    Loop

    'Difference
    For i = 1 To (iNumPattern - 1)
    iPatternArray(i) = iDiffArray(i + 1) - iDiffArray(i)
    Next

    'Pattern
    Dim n As Integer, j As Long

    n = UBound(pat) - LBound(pat) + 1
```

```
For i = 1 To n
pat(i) = iPatternArray(i)
Next

i = 0

Do Until i = n

i = i + 1
j = j + 1

If pat(i) <> iPatternArray(j + n) Then
i = 0
End If

Loop

MsgBox (j)

End Sub
```

11 Importance and Practical Application

11.1 For the development of quantum computers.

11.2 For attacking the 150-year-old Riemann Hypothesis in the field of pure mathematics.

12 Conclusion

This prime producing function is the most accurate function as it produces prime numbers accurately without exception. As the accuracy increases, also with the number of terms. If we calculate $p(mod \quad 11) \neq 0$, we can reach the first 100th terms; $p(mod \quad 13) \neq 0$ for the 1000th terms; $p(mod \quad 23) \neq 0$ for the first 1 millionth; $p(mod \quad 31) \neq 0$ for 1 billionth; so on and so forth. Due to unpredictable nature of primes, it is hereby concluded that the equation of prime has limitless number of terms as it is being proven. I will state a conjecture; it will be named **"Prime Function Conjecture"**, it is state that there's no such prime producing function exist with limited number of terms.

References

1. https://en.wikipedia.org/wiki/Prime_number_theorem#Statement_of_the_theorem
2. https://en.wikipedia.org/wiki/Formula_for_primes
3. https://en.wikipedia.org/wiki/Prime_number