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Prime Numbers New Pattern, Formulas and ASA Method

Ali Hameed Yassir[1*]

[1]*Computer Science and Information Technology College, Sumer University, Iraq.*

Author's contribution

The sole author designed, analyzed and interpreted and prepared the manuscript.

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Abstract

The author proposes this paper to present a solution for natural distribution of prime numbers along numbers line, the author discovers the new pattern and proposes two formulas and the new method to generate prime numbers accurately, the two formulas work as series of processes without any presumption. The paper enhances efforts in the field of theory of numbers, Author transforms the method that is proposed by him into programming language code written in C++ and the code is so easy to implement, execute and develop.

Keywords: Prime number; prime number method; ASA method; prime number pattern; prime number formulas.

2017 Mathematics subject classification: 11N05, 11N80, 11A41.

1 Introduction

Theory of numbers develops constantly, and there are several categories of preparation, natural number, Integer numbers, Real and complex numbers, some believe that the study of numerology stopped a long time ago, but mathematicians are still making efforts to learn a lot about numbers, besides the great development

**Corresponding author: E-mail: alihameed_48@yahoo.com;*

in many other sciences, Mathematics is developed to answer a lot of questions in physics, astronomy, information technology and many others [1].

Natural numbers are very well known 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 ...., prime numbers also are an infinite set of numbers. There are unpredictable locations within the distribution of prime numbers along of natural numbers line since the earliest date mathematicians could not surround the concept of prime numbers, except through some mathematical formulas that attempted to explain the behavior and some properties of prime numbers [2,3].

Number theorists study prime numbers as well as the properties of objects made out of integers. A prime number (or a prime) is a natural number greater than one that has no positive divisors other than one and itself. In another way, a prime number is a positive integer number having exactly two positive divisors, namely 1 and p (The set of all primes is often denoted by P). An integer n is composite if n> 1and n is not prime. An integer n is composite if and only if it admits a nontrivial factorization n = ab ,where a, b are integers, each strictly between 1 and n .Though the definition of primality is exquisitely simple, the resulting sequence 2 ,3 ,5 ,7, of primes will be the highly nontrivial collective object of our attention. The wonderful properties, known results, and open conjectures pertaining to the primes are manifold. A semiprime is a natural number that is the product of two prime numbers. The number 1 is considered not a prime number, there are various methods to determine whether a given number n is prime. The most basic routine, trial division, is of little practical use because of its slowness. One group of modern primality tests are applicable to arbitrary numbers, while more efficient tests are available for particular numbers. Most such methods only tell whether n is prime or not. Routines also yielding one (or all) prime factors of n are called factorization algorithms. But previous methods seem to be worthless [4,5,6].

2 Infinite Set of Prime Numbers

There are infinitely many prime numbers. Another way of saying this is that. This statement is referred to as Euclid's theorem is the first theorem that proves a prime set number is infinite. The sequence {2, 3, 5, 7, 11, 13…} of prime numbers never ends. Other more proofs of the infinitude of primes are known, including an analytical proof by Euler, Goldbach's proof based on Fermat numbers [7], Furstenberg's proof using general topology [8], and Kummer's elegant proof [9,10,11].

3 New Prime Numbers Pattern and Formulas

The author proposes the formulas of generating the prime numbers based on the order in which the numbers were prepared, author arranges odd numbers in a sequential pattern. This pattern only sorts the prime numbers and some semi prime numbers. The author uses the brief ASA to name a part of this paper's title. This brief is abbreviated from the name of the author (Ali), the name of author's wife (Ayat) and author's daughter (Shams). The pattern where numbers are arranged according to it led to derive two formulas, this pattern is built as a table stores sequentially the prime numbers and some semi prime numbers, and the ASA method removes semi prime numbers and keeps only prime numbers. Table 1 represents the pattern that arranges the odd numbers first.

As shown in Table 1, the numbers are distributed over table cells as six columns while the prime and semi prime numbers appear at the green areas. This distribution continues to include all numbers in the same order. Prime and semi prime numbers are still appearing at green area in column 1 and column 5. The author keeps the column 1 and column 5 in green when the rest of the columns were deleted. Table 2 represents prime and some semi prime numbers that remain from Table 1. Column 1 and column 5 contain the infinite set of all prime numbers, column 1 and column 5 also contain an infinite set of some semiprime numbers.

Table 1. Odd numbers pattern

Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24
25	26	27	28	29	30
31	32	33	34	35	36
37	38	39	40	41	42
43	44	45	46	47	48
49	50	51	52	53	54
55	56	57	58	59	60
61	62	63	64	65	66
67	68	69	70	71	72
73	74	75	76	77	78
79	80	81	82	83	84
85	86	87	88	89	90
91	92	93	94	95	96
97	98	99	100	101	102
103	104	105	106	107	108
109	110	111	112	113	114
115	116	117	118	119	120
…	…	…	…	…	…
…	…	…	…	…	….

Table 2. Prime and semiprime numbers

Column 1	Column 2
1	5
7	11
13	17
19	23
25	29
31	35
37	41
43	47
49	53
55	59
61	65
67	71
73	77
79	83
85	89
91	95
97	101
103	107
109	113
115	119
…..etc.	…..etc.

Table 2 led to derive two formulas because there is a constant period to move increasingly, first formula is derived from column 1 as shown in Table 2, the first formula is derived and based on the first element in column 1 the prime number 7, the next prime or semi prime in column1, arrow 3 be the value of 7 plus 6 and so on to generate all numbers in column 1, also the same thing is existed at column 2, the first prime number is the number 5, so to generate the elements of column 2 is done by adds a value number 6. As an example to find the next number in column 1 and arrow 3, the value of [1,3] = 7+3*6. The value of [1,3] =25. It is important to note that the number 3 here means the position of the next prime or semi prime after the number 7 at column 1, another example to find the value of [2,4] which means to find the next prime or semi prime in column 2 after number 5 at arrow 1 which has a position 4, so the value of [2,4] = 5+4*6, the value of [2,4] =29. So the formula 1 that can be derived from column 1 which generate the next value is derived as below:

Let n_1 be the next position in column 1, let x_1 be the variable that refers to the value of the next position so:

$$X_1 = 7 + (6n_1) \tag{1}$$

Where n_1 >=0, n_1 is an appositive integer number.

And the formula 2 that can be derived from column 2 which generates the next value is derived as below:

Let n_2 be the next position in column 2, let x_2 refers to value of the next position

So:

$$X_2 = 5 + (6n_2) \tag{2}$$

Where n_2 >=0. n_2 is an appositive integer number.

4 ASA Prime Numbers Method

The method is proposed to eliminate the semi prime number from the remainder number of previous pattern semi, the process is done as shown in Table 2 by sorting the two column into one column as a vector contains the semi and prime numbers in an ascendingly arrangement. 1, 5, 7, 11, 13, 17, 19, 23, 25, 29, 31, 35, 37, 41, 43, 47, 49, 53, 55, 59, 61, 65, 67, 71, 73, 77, 79, 83, 85, 89, 91, 95, 97, 101, 103, 107, 109, 113, 115, 119. This produce a vector that has a mix of semiprime and prime numbers that arranges randomly, the method to eliminate semiprime numbers is done by generate a 2d array by multiply the horizontal vector by vertical vector, let x represents the vector so to generate 2d array is done by multiplying horizontal x by the same vertical vector x, as example if the vector has the generated semi and prime numbers starting from number 5, then vector x = {5, 7, 11, 13, 17, 19, 23, 25}, so the 2d array is shown in Table 3:

Table 3. Two-dimensional array of X vector Multiplication

X * X= [2 d]	5	7	11	13	17	19	23	25
5	25	35	55	65	85	95	115	125
7	35	49	77	91	119	133	161	175
11	55	77	121	143	187	209	253	275
13	65	91	143	169	221	247	299	325
17	85	119	187	221	289	323	391	425
19	95	133	209	247	323	361	437	475
23	115	161	253	299	391	437	529	575
25	125	175	275	325	425	475	575	625

As shown in Table 3 which is represented as a 2d array, so at a position where arrow 1 and column 1 are multiplied mathematically to produce the results of the 2d array. Actually the multiplication process does not make for all elements, if the result of any multiplication is greater than or equal to the last element in vector X then the processes of multiplication terminate at the same column to let the process to move to the next column starting from the top to bottom until reaches the last element in the column if the condition does not excite. As an example in Table 3 the value that is resulted from multiplying (5*5) which produces 25 in yellow color. This process does not continue if the result of the multiplication is greater than or equal to the last element in vector x, so there is no need to do multiplication process at positions which are labeled in gray color. This means that all the values of the vector X are prime numbers except the last value 25 which will terminated in the next step of the method, because it is not a prime number and it is a semi prime number because it has a factor that appears in 2 d array so the value of 25 in a vector X is deleted and labeled in a red cross. ASA method is to eliminate any numbers that have factors, the remainder numbers in vector X will be the pure prime numbers only. So the vector of prime numbers is the set of x= {5, 7, 11, 13, 17, 19, 23} without the element of 25 that is deleted. The author makes a programming code using C++ to generate prime numbers, there are many steps collect the ASA method mathematically:

1. Generate series of odd numbers and arrange them according to formula 1 and formula 2, Where most odd numbers that do not fall within columns 1 and 5 will be ignored
2. Arrange odd numbers in columns 1 and 5 in ascending order. A vector containing odd numbers will be generated containing prime and semiprime numbers.

To specify the prime numbers within this vector:

The same vector X is multiplied by itself to find out the common factors of numbers within the matrix if any number has factors will be deleted. The remaining numbers in the vector X from the previous operation are arranged ascendingly which are the pure prime numbers.

5 Conclusion

It is possible to conclude after reviewing of this paper that an author presents ASA method to solve the problem of the generation and the natural distribution of prime numbers along line numbers, at first applying the new pattern that is discovered by an author to sort the prime and semiprime numbers. Second, concluding the formulas of the pattern to represent this new pattern mathematically and programmatically. Third, applying a new method (ASA method) to elect the pure prime numbers from the mixture of only prime and semi-prime numbers, finally transforming of all previous steps into a programming language coding for reaching the best ways of use, This discovery will help bridge the gap in the prime numbers fields, solve the problems and errors that scientists have faced throughout history, Author hopes to develop this effort and promote it for the benefit of humanity and science.

Competing Interests

Author has declared that no competing interests exist.

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Appendix

C++ program code to generate prime numbers, for more prime numbers increase the parameter variables.

```
#include <iostream>
#include <cmath>
#include <vector>
using namespace std;
int main()
{ int t,s,i,j,k,l,x[1000],y[1000][1000],ar[1000],d[1000000];
x[0]=5;x[1]=7;j=0;i=0;t=0;
for (i=2;i<=998;i=i+2){ j=i+1;
x[i]=x[i-2]+6;
x[j]=x[i-1]+6; }
for (k=0;k<=999;k++)
{ for(l=0;l<=999;l++){
s=x[k]*x[l];
if (s<x[999]){
y[k][l]=s;}
else y[k][l]={};}}
cout<<" the code is programmed by author: ali hameed yassir"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<"prime and semi prime numbers vector:"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
for (k=0;k<=999;k++){ for(l=0;l<=999;l++){
{ if (y[k][l]!=0){
d[t]=y[k][l];
cout<<"d["<<t<<"] = "<<d[t]<<endl;
t=t+1;}}}}
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<" vector of prime number after delete semi-prime number are:"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
for (i=0;i<=999;i++){
for (j=0;j<=t;j++){
if (x[i]==d[j])
   x[i]=0;
}}
s=0;
for (i=0;i<=999;i++){
cout<<"x["<<i<<"]"<<"= "<<x[i]<<endl;
```

```
s=s+1;}
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<" the pure prime number with 2 & 3 are:"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
cout<<"++++++++++++++++++++++++++++++++++++++++++++++++++++++"<<endl;
for (i=0;i<=s-1;i++){
if (x[i]!=0) {ar[i]=x[i];
cout<<ar[i]<<endl;}}
return 0;}
```


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