Export a sequence of prime numbers

Nguyen Van Quang

Abstract. *We introduce an efficient method for exporting a sequence of prime numbers by using Excel*

1. Introduce.

There are many well known methods for searching a prime numbers as sieve of Eratosthennes, primality test[1,2],and almost check a number one by one for finding a prime number. The new method will help us export a list of prime numbers up to a given limit without missing by using Excel.

2. Complete a list of prime numbers up to p^2_{k+1}, if list of prime numbers up to p_k is known.

Given prime numbers from 2 to p_k, we complete a table for exporting a sequence of prime number as follows:

Using the properties of the multiplication of numbers:

a. *In a product, if a factor equals to 0 then product equals to 0, if the product equals to 0 then at least one of its factors equals to 0.*
b. *In a product, if all factors equal to 1, then the product equals to 1, and multiply any number by 1, given result equals itself.*

To apply Excel, we have to form a following table : number of rows=$(p^2_{k+1}+5)/2$ × number of columns = k+2

- In the first column, we fill number 2 and sequence of odd natural numbers from 3 to p^2_{k+1}.
- From second to k^{th} columns: fill the prime numbers from $p_i = 3$ to p_k in the second row, for i^{th} column, fill number *1* in the row which corresponds to prime number p_i of the first column. Then fill for all columns by following order: fill number 0 in the i^{th} column such that distance (number of rows) from this number 0 to above number *1* equals to p_i (difference = $2p_i$), then continue filling numbers 0 with the same step p_i , finally fill number 1 in the remaining blank cells. That mean cells (intersection of row containing n and i^{th} column, and denoted by n/i) n/i = 0 then n is divisible by p_i, cells n/i = 1 then n is not divisible by p_i, except $n = p_i \in [2, p_k]$
- After filling all columns, multiply all columns together, export is a sequence of prime number up to p^2_{k+1}, it is shown in the final column.
- We can calculate the total of prime numbers by multiplying all columns except first column. Then make sum all results (show in the column before final column).
- With the help of Excel, we can do each step easily and quickly (table 1)

2 & sequence of odd numbers	Prime numbers from 3 to p_k							Prime numbers	
2	3	5	7	11	.	p_{k-1}	p_k	1	2
3	*1*	1	1	1	1	1	1	1	3
5	1	*1*	1	1	1	1	1	1	5
7	1	1	*1*	1	1	1	1	1	7
9	0	1	1	1	1	1	1	0	0
11	1	1	1	*1*	1	1	1	1	11
13	1	1	1	1	1	1	1	1	13
15	0	0	1	1	1	1	1	0	0
17	1	1	1	1	1	1	1	1	17
19	1	1	1	1	1	1	1	1	19
21	0	1	0	1	1	1	1	0	0
23	1	1	1	1	1	1	1	1	23
25	0	0	1	1	1	1	1	0	0
27	0	1	1	1	1	1	1	0	0
29	1	1	1	1	1	1	1	1	29
31	1	1	1	1	1	1	1	1	31
33	0	1	1	0	1	1	1	0	0
35	1	0	0	1	1	1	1	0	0
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
P^2_{k+1}									
Total of prime numbers								...	

Table 1: Apply Excel to complete a list of prime numbers up to p^2_{k+1}, and its total

Example1: Complete a list of all prime numbers up to 11^2 and its total.

2 & sequence of odd numbers	p_i = 3;5;7			Prime numbers	
2	**3**	**5**	**7**	1	2
3	*1*	1	1	1	3
5	1	*1*	1	1	5
7	1	1	*1*	1	7
9	0	1	1	0	0
11	1	1	1	1	11
13	1	1	1	1	13
15	0	0	1	0	0
17	1	1	1	1	17
19	1	1	1	1	19
21	0	1	0	0	0
23	1	1	1	1	23
25	1	0	1	0	0
27	0	1	1	0	0
29	1	1	1	1	29
31	1	1	1	1	31
33	0	1	1	0	0
35	1	0	0	0	0
37	1	1	1	1	37
39	0	1	1	0	0
41	1	1	1	1	41
43	1	1	1	1	43
45	0	0	1	0	0
47	1	1	1	1	47
49	1	1	0	0	0
51	0	1	1	0	0
53	1	1	1	1	53
55	1	0	1	0	0
57	0	1	1	0	0
59	1	1	1	1	59
61	1	1	1	1	61
63	0	1	0	0	0
65	1	0	1	0	0
67	1	1	1	1	67
69	0	1	1	0	0
71	1	1	1	1	71
73	1	1	1	1	73
75	0	0	1	0	0
77	1	1	0	0	0
79	1	1	1	1	79
81	0	1	1	0	0
83	1	1	1	1	83
85	1	0	1	0	0
87	0	1	1	0	0
89	1	1	1	1	89
91	1	1	0	0	0
93	0	1	1	0	0
95	1	0	1	0	0
97	1	1	1	1	97
99	0	1	1	0	0
101	1	1	1	1	101
103	1	1	1	1	103
105	0	0	0	0	0
107	1	1	1	1	107
109	1	1	1	1	109
111	0	1	1	0	0
113	1	1	1	1	113
115	1	0	1	0	0
117	0	1	1	0	0
119	1	1	0	0	0
11^2= 121					
Total of prime numbers				30	

Table 2: Apply Excel to complete a list of all prime numbers up to 11^2 and its total

3. To find a prime number greater than n ($p^2_k<n<p^2_{k+1}$) and its succeeding prime numbers (a sequence of prime numbers greater than n).

Assume n is odd natural number, n is written as: $n = 2h_1 + 1 = 3h_2 + a_2 = 5h_3 + a_3 = \ldots = p_k h_k + a_k = \ldots = p_{k+j}h_{k+j} + a_{k+j}$ with $0 \leq a_i < p_i$.(if n is even number , begin from n+1). We can take p_{k+j} ($p_k \leq p_{k+j} < n$) as we mention.

Then form a following table:

- In the first column, we fill a sequence of odd natural number from n to the value as we mention, then fill prime numbers from 3 to p_{k+j} for the following columns in the first row, the final column for result.
- In the second row (row n), fill $a_2, a_3, \ldots, a_k, \ldots a_{k+j}$ in the columns respectively.
- Fill the first numbers 0 for each column in the rows n + 2, n + 4, n + 6 , . . ., n +2m , if $a_i + 2m = p_i$ with a_i is the odd number, or $(a_i + 2m)/2 = p_i$ with a_i is the even number.
- Then fill number 0 for all columns with each step (number of rows) equals to p_i for i^{th} column, and fill number 1 in the remaining blank cells. Finally multiply all columns together, result is shown in the final column (table 3).

Sequence of odd numbers	p_i = 3 to p_{k+j}								Prime numbers
	3	5	.	.	p_k	.	.	P_{k+j}	
n	a_2	a_3	.	.	a_k	.	.	a_{k+j}	.
n + 2	.	.	.	.	.	.	.	.	.
n + 4	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.

Table 3: Aplly Excel for finding a prime number greater than n ($p^2_k< n < p^2_{k+1}$) and its succeeding prime numbers

Example2: Find a prime number greater than n =1023 and its succeeding prime numbers.

Odd numbers	p_i = 3 to 31										Prime numbers
	3	5	7	11	13	17	19	23	29	31	
n =1023	0	3	1	0	9	3	16	11	8	0	0
1025	1	0	1	1	1	1	1	1	1	1	0
1027	1	1	1	1	0	1	1	1	1	1	0
1029	0	1	0	1	1	1	1	1	1	1	0
1031	1	1	1	1	1	1	1	1	1	1	1031
1033	1	1	1	1	1	1	1	1	1	1	1033
1035	0	0	1	1	1	1	1	0	1	1	0
1037	1	1	1	1	1	0	1	1	1	1	0
1039	1	1	1	1	1	1	1	1	1	1	1039
1041	0	1	1	1	1	1	1	1	1	1	0
1043	1	1	0	1	1	1	1	1	1	1	0
1045	1	0	1	0	1	1	0	1	1	1	0
1047	0	1	1	1	1	1	1	1	1	1	0
.	.	.	.	.	.	.	.	.	.	.	.

Table 4: Aplly Excel for finding a prime number greater than n =1023 and its succeeding prime numbers.

Reference

[1]. Sieve of Erastosthenes; Sieve of Sundaram; Sieve of Atkin; Sieve theory; Primality test/ Excel formula; Trial division -Wikipedia.

[2]. Quang N V, Using formula for searching a prime number in the interval $[p_k, p^2_{k+1}]$.viXra:1512.0291v2(NT)

Email : quangnhu67@yahoo.com.vn

Hue -Vietnam