Sieve of prime numbers

and testing their using algorithms

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O V E R V I E W

This study suggests grouping of numbers that do not divide the number 3 and/or 5 in eight collumns . Allocation results obtained from multiplication of numbers is based on column belonging to him .

If in the Sieve of Eratosthenes the majority of multiplication of prime numbers result in a results devoid of practical benefit (numbers divisible by 2 , 3 and/or 5) , in the sieve of prime numbers using tables , each multiplication of prime number gives a result in a number not divisible to 2 , 3 and/or 5 .

List of keywords : column , factor , position , sieve , termination .

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SIEVE OF PRIME NUMBERS USING TABLES

This paper deals with the study of odd numbers that cannot be divided with 3 and/or 5 by grouping them in eight collumns, as follows:

Table no. 1

C O L U M N

Position	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
0	7	11	13	17	19	23	29	31
1	37	41	43	47	49	53	59	61
2	67	71	73	77	79	83	89	91
3	97	101	103	107	109	113	119	121

....

The multiplication versions are in number of 36 , their results being allocated according to columns, as follows :

Col.1 =	Col.	1x8	2x4	3x5			6x7		
Col.2 =	Col.	1x6	2x8	3x4		5x7			
Col.3 =	Col.	1x5	2x6	3x8	4x7				
Col.4 =	Col.	1x2		3x7	4x8	5x6			
Col.5 =	Col.	1x1	2x7	3x3	4x4	5x8	6x6		
Col.6 =	Col.	1x7	2x3		4x5		6x8		
Col.7 =	Col.	1x4	2x5	3x6				7x8	
Col.8 =	Col.	1x3	2x2		4x6	5x5		7x7	8x8

Position calculus

From the result of multiplying two numbers subtract the number assigned at position zero of the column namely one of the numbers 7 - 11 - 13 - 17 - 19 - 23 - 29 - 31 , the result is divided by 30 . Integer obtained indicates the position of that number considering its column origin .

Ex. :

7 x 7 = 49 ; 49 – 19(col.5) = 30 ; p = 30:30 = 1 ; 7 x 11 = 77 ; 77 – 17(col.4) = 60 ; p = 60 : 30 = 2 ;

127 x 2 341 = 297 307 ; 297 307 – 7(col.1) =297 300 ; p = 297 300 : 30 = 9 910

Formulas for determining the position :

Following the multiplication operation between i(p0) : 7-11-13-17-19-23-29-31 numbers and all the numbers in Table 1 we obtain as results the position occupied by them as below :

Be ,

	7 x 7	7 x 37	7 x 67	7 x 97	...		
p =	1	1+7	1+7x2	1+7x3	...	1 + 7n	col.5
	7 x 11	7 x 41	7 x 71	7 x 101	...		
p =	2	2+7	2+7x2	2+7x3	...	2 + 7n	col. 4
	7 x 13	7 x 43	7 x 73	7 x 103	...		
p =	2	2+ 7	2+7x2	2+7x3	...	2 + 7n	col. 8
	7 x 17	7 x 47	7 x 77	7 x 107	...		
p =	3	3+7	3+7x2	3+7x3	...	3 + 7n	col.7
	7 x 19	7 x 49	7 x 79	7 x 109	...		
P =	4	4+7	4+7x2	4+7x3	...	4 + 7n	col.3
	7 x 23	7 x 53	7 x 83	7 x 113	...		
P=	5	5+7	5+7x2	5+7x3	...	5 + 7n	col.2
	7 x 29	7 x 59	7 x 89	7 x 119	...		
P =	6	6+7	6+7x2	6+7x3	...	6 + 7n	col.6

	7 x 31	7 x 61	7 x 91	7 x 121	...		
P =	7	7+7	7+7x2	7+7x3	...	7 + 7n	col.1
	11 x 7	11 x 37	11 x 67	11 x 97	...		
P =	2	2+11	2+11x2	2+11x3	...	2 + 11n	col.4
	11 x 11	11 x 41	11 x 71	11 x 101	...		
P =	3	3+11	3+11x2	3+11x3	...	3 + 11n	col.8

……

	31 x 7	31 x 37	31 x 67	31 x 97	...		
P =	7	7+31	7+31x2	7+31x3	...	7 + 31n	col.1
	31 x 11	31 x 41	31 x 71	31 x 101	...		
P =	11	11+ 31	11+31x2	11+31x3	...	11 + 31n	col.2

………

	31 x 31	31 x 61	31 x 91	31 x 121	...		
P =	31	31+31	31+31x2	31+31x3	...	31 + 31n	col.8

Or , i(p1) : 37-41-43-47-49-53-59-61 multiplied with all the numbers in table 1 :

	37 x 7	37 x 37	37 x 67	37 x 97	...		
P =	1+7	1+7+37	1+7+37x2	1+7+37x3	...	1 + 7 + 37n	col.5
	37 x 11	37 x 41	37 x 71	37 x 101	...		
P =	2+11	2+11+37	2+11+37x2	2+11+37x3	...	2 + 11 + 37n	col.4

……

	61 x 31	61 x 61	61 x 91	61 x 121	...		
P=	31 + 31	31+31 + 61	31+31 + 61x2	31+31 + 61x3	...	31 + 31 + 61n	col.8

Or , i(p2) : 67-71-73-77-79-83-89-91 multiplied with all the numbers in table 1 :

67 x 7 67 x 37 67 x 67 67 x 97 ...

P = 1+7x2 1+7x2+67 1+7x2+67x2 1+7x2+67x3 ... 1 + 7x2 + 67n col.5

67 x 11 67 x 41 67 x 71 67 x 101 ...

P = 2+11x2 2+11x2+67 2+11x2+67x2 2+11x2+67x3 ... 2 + 11x2 + 67n col.4

....

71 x 7 71 x 37 71 x 67 71 x 91 ...

P = 2+7x2 2+7x2+71 2+7x2+71x2 2+7x2+71x3 2 + 7x2 + 71n col.4

71 x 11 71 x 41 71 x 71 71 x 101 ...

P = 3+11x2 3+11x2+71 3+11x2+71x2 3+11x2+71x3 ... 3 + 11x2 + 71n col.8

....

91 x 7 91 x 37 91 x 67 91 x 97 ...

P = 7+7x2 7+7x2 + 91 7+7x2 + 91x2 7+7x2 + 91x3 ... 7 + 7x2 + 91n col.1

....

91 x 31 91 x 61 91 x 91 91 x 121 ...

P = 31+31x2 31+31x2 + 91 31+31x2 + 91x2 31+31x2 + 91x3 ... 31+31x2 + 91n col.8

Or , i(p3) : 97-101-103-107-109-113-119-121 multiplied with all the numbers in table 1 :

97 x 7 97 x 37 97 x 67 97 x 97 ...

P = 1+7x3 1+7x3+97 1+7x3+97x2 1+7x3+97x3 ... 1 + 7x3 + 97n col.5

97 x 11 97 x 41 97 x 71 97 x 101 ...

P = 2+11x3 2+11x3+97 2+11x3+97x2 2+11x3+97x3 ... 2 + 11x3 + 97n col.4

....

97 x 31 97 x 61 97 x 91 97 x 121 ...

P = 7+31x3 7+31x3+97 7+31x3+97x2 7+31x3+97x3 ... 7+31x3 + 97n col.1

....

Or positions ocupied by the result of the multiplication between numbers i(p0) , i(p1) , i(p2) , ... , i(pn) , with all the numbers in table 1 , showing tabular form as follows :

Table no. 2

C O L U M N

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
7	5	4	2	1	6	3	2	+7n
6	11	8	2	10	4	6	3	+11n
8	7	13	12	5	4	9	2	+13n
6	7	16	17	9	10	3	12	+17n
8	18	4	14	19	10	6	11	+19n
22	5	8	14	17	23	9	12	+23n
22	18	16	12	10	6	29	27	+29n
7	11	13	17	19	23	29	31	+31n

Positon occupied p(0) as a result of multiplication of numbers i(p0) and all the numbers in table 1 ; n = 0,1,2,3, ...

7+31	5+23	4+19	2+11	1+7	6+29	3+17	2 +13	+37n
6+17	11+31	8+23	2+7	10+29	4+13	6+19	3+11	+41n
8+19	7+17	13+31	12+29	5+13	4+11	9+23	2+ 7	+43n
6+11	7+13	16+29	17+31	9+17	10+19	3+ 7	12+23	+47n
8+13	**18+29**	**4+ 7**	**14+23**	**19+31**	**10+17**	**6+11**	**11+19**	**+49n**
22+29	5+ 7	8+11	14+19	17+23	23+31	9+13	12+17	+53n
22+23	18+19	16+17	12+13	10+11	6+ 7	29+31	27+29	+59n
7+7	11+11	13+13	17+17	19+19	23+23	29+29	31+31	+61n

Position occupied p(1) as a result of multiplication of numbers i(p1) and all the numbers in table 1 ; n = 1,2,3,4, ...

Positions of p(1) are used to calculate p(2) , p(3) , p(4) , ... , p(n) multiplying i(p0) as follows :

7+31x2	5+23x2	4+19x2	2+11x2	1+7x2	6+29x2	3+17x2	2+13x2	+67n
6+17x2	11+31x2	8+23x2	2+7x2	10+29x2	4+13x2	6+19x2	3+11x2	+71n
8+19x2	7+17x2	13+31x2	12+29x2	5+13x2	4+11x2	9+23x2	2+7x2	+73n
6+11x2	**7+13x2**	**16+29x2**	**17+31x2**	**9+17x2**	**10+19x2**	**3+7x2**	**12+23x2**	**+77n**
8+13x2	18+29x2	4+7x2	14+23x2	19+31x2	10+17x2	6+11x2	11+19x2	+79n
22+29x2	5+7x2	8+11x2	14+19x2	17+23x2	23+31x2	9+13x2	12+17x2	+83n
22+23x2	18+19x2	16+17x2	12+13x2	10+11x2	6+7x2	29+31x2	27+29x2	+89n
7+7x2	**11+11x2**	**13+13x2**	**17+17x2**	**19+19x2**	**23+23x2**	**29+29x2**	**31+31x2**	**+91n**

Positions occupied p(2) as a result of multiplication of numbers i(p2) and all the numbers in table 1 ; n = 2,3,4,5, ...

....

Calculation algorithm :

1. Fill in table 1with all the numbers to be tested if they are prime number ;
2. Write all numbers under test , in order of their increasing in column 9, table no. 2;
3. Fill p0 formulas in table 2 ;
4. Mark all numbers divisible in table 1 by the formulas of p0 , mean :

- all numbers corresponding to column 1 occupying positions and 7 + 7n

-	- // -	2	- // -	5 + 7n
-	- // -	3	- // -	4 + 7n

....

-	- // -	8	- // -	2 + 7n
-	- // -	1	- // -	6 + 11n

....

-	- // -	8	- // -	31 + 31n

Note that each multiple of prime numbers 7-11-13-17-19-23-29-31 added with constant factor giving as a result a certain position for a certain column which has as correspondent an odd number not divisible by 3 and/or 5 .

5. Eliminates all the numbers in column 9 table 2 that were marked in table 1 according to the formulas of p0 ;

6. Fill formulas of p1 table 2 ; number 49 was removed according to table 1 no longer consider ;

7 . Repeat the operations made in step 4 and 5 according to the formulas p 1 ;

8. Fill formulas of p2 table 2 and repeat the operations in step 4 and 5 . Numbers not eliminated in column 9 table 2 are prime numbers .

In column 9 we register numbers under test up to P(max) . After using the final position calculation the numbers in column 9 can be registerred on rows , following the procedure from step 5 . Maxim position calculation is the iteger number of the maximum number being tested radical divided by 30 .

Formulas belonging composite numbers are omitted .

The algorithm uses formulas primes numbers squared correlating n = 0,1,2,3, ... with Pn

Formulas are obtained by the simple method : after writing p1 , either following table is obtained from the above table plus each i(p0) .

Conclusion : like Sieve of Eratosthenes our sieve spreadsheet works as multiples of primes , starting with their equare .[1] Using the tables respecting the above algorithm complexity is much smaller , any multiple of prime number (which represents the number of position) has corresponding number is compound odd number and not divisible by 3 and/or 5 .

Exemple : Determination of prime numbers up to N = 1001

In paranteses are the numbers corresponding to position past according to column .

- divisibility by 7 :

Col.1 : 7 + 7n = 7(217) – 14(427) – 21(637) – 28(847)

Col.2 : 5 + 7n = 5(161) – 12(371) – 19(581) – 26(791) -33(1001)

Col.3 : 4 + 7n = 4(133) – 11(343) – 18(553) – 25(763) – 32(973)

Col.4 : 2 + 7n = 2(77) – 9(287) – 16(497) – 23(707) – 30(917)

Col.5 : 1 + 7n = 1(49) – 8(259) – 15(469) – 22(679) – 29(889)

Col.6 : 6 + 7n = 6(203) – 13(413) – 20(623) – 27(833)

Col.7 = 3 + 7n = 3(119) – 10(329) – 17(539) – 24(749) – 31(959)

Col.8 = 2 + 7n = 2(91) – 9(301) – 16(511) – 23(321) – 30(931)

- divisibility by 11 :

Col.1 = 6 + 11n = 6(187) – 17(517) – 28(847)

Col.2 = 11 + 11n = 11(341) – 22(671) – 33(1001)

Col.3 = 8 + 11n = 8(253) – 19(583) – 30(913)

Col.4 = 2 + 11n = 2(77) – 13(407) – 24(737)

Col.5 = 10 + 11n = 10(319) – 21(649) – 32(979)

Col.6 = 4 + 11n = 4(143) – 15(473) – 26(803)

Col.7 = 6 + 11n = 6(209) – 17(539) – 28(869)

Col.8 = 3 + 11n = 3(121) – 14(451) – 25(781)

- divisibility by 13 :

Col.1 = 8 + 13n = 8(247) – 21(637)

Col.2 = 7 + 13n = 7(221) – 20(611) – 33(1001)

Col.3 = 13 + 13n = 13(403) – 26(793)

Col.4 = 12 + 13n = 12(377) – 25(767)

Col.5 = 5 + 13n = 5(169) – 18(559) – 31(949)

Col.6 = 4 + 13n = 4(143) – 17(533) – 30(923)

Col.7 = 9 + 13n = 9(299) – 22(689)

Col.8 = 2 + 13n = 2(91) – 15(481) – 28(871)

- divisibility by 17 :

Col.1 = 6 + 17n = 6(187) – 23(697)

Col.2 = 7 + 17n = 7(221) – 24(731)

Col.3 = 16 + 17n = 16(493)

Col.4 = 17 + 17n = 17(527)

Col.5 = 9 + 17n = 9(289) – 26(799)

Col.6 = 10 + 17n = 10(323) – 27(833)

Col.7 = 3 + 17n = 3(119) – 20(629)

Col.8 = 12 + 17n = 12(391) – 29(901)

- divisibility by 19 :

Col.1 = 8 + 19n = 8(247) – 27(817)

Col.2 = 18 + 19n = 18(551)

Col.3 = 4 + 19n = 4(133) – 23(703)

Col.4 = 14 + 19n = 14(437)

Col.5 = 19 + 19n = 19(589)

Col.6 = 10 + 19n = 10(323) – 29(893)

Col.7 = 6 + 19n = 6(209) – 25(779)

Col.8 = 11 + 19n = 11(361) – 30(961)

- divisibility by 23 :

Col.1 = 22 + 23n = 22(667)

Col.2 = 5 + 23n = 5(161) – 28(851)

Col.3 = 8 + 23n = 8(253) – 31(943)

Col.4 = 14 + 23n = 14(437)

Col.5 = 17 + 23n = 17(529)

Col.6 = 23 + 23n = 23(713)

Col.7 = 9 + 23n = 9(299) – 32(789)

Col.8 = 12 + 23n = 12(391)

- divisibility by 29 :

Col.1 = 22 + 29n = 22(667)

Col.2 = 18 + 29n = 18(551)

Col.3 = 16 + 29n = 16(493)

Col.4 = 12 + 29n = 12(377)

Col.5 = 10 + 29n = 10(319)

Col.6 = 6 + 29n = 6(203)

Col.7 = 29 + 29n = 29(899)

Col.8 = 27 + 29n = 27(841)

- divisibility by 31 :

Col.1 =7 + 31 = 7(217)

Col.2 = 11 + 31 = 11(341)

Col.3 = 13 + 31n = 13(403)

Col.4 = 17 + 31n = 17(527)

Col.5 = 19 = 31n = 19(589)

Col.6 = 23 + 31n = 23(713)

Col.7 = 29 + 31n = 29(899)

Col.8 = 31 + 31n = 31(961)

Numbers not eliminated are prime numbers .

Application : The factorial multiplying or the metod of determining if a numbers is prime up to a given number .

The method of grouping odd numbers according to Table 1 , allows checking whether a number is prime according to the last two or five digits of position the number .

A . For termination two digits

The calculation algorithm is :

Step 1 : Determine the position number and column it belongs ;

Step 2 : Last two digits of the calculated number indicates the termination position of tested number ;

Step 3 : Determine factors for termination and column number tested . I have illustrated the calculation of factors termination 10 , column 1 . Once calculated these factors can be used to determine of any prime numbers that belongs to the column 1 , termination 10 .

Step 4 : It performs testing divisibility of a number with multiples of 3 000 plus pairs of numbers factorial group to which it belongs termination corresponding column number tested .

We assing factorial group for multiplying operation positions from 0 – 99 , as in table 1 , numbers between 7 – 3.001 grouped in columns . The positions occupied by the result of the multiplication between any two numbers in the factorial group is a maximum six digit number . The last two digits of the number shows the termination , the rest of maximum four digits is the factor an wich the position will be calculated for those termination belonging to specific column .

I1 and I2 are two numbers higher than the numbers belonging to factorial group .

Position obtained by multiplying the numbers is determined by formula :

P = n2 x i1(f) + n1 x i2 + F , followed by T

Or , = n1 x i2(f) + n2 x i1 + F , followed by T

where :

n1 , n2 - represents multiples of 3000 corresponding of i1(f) , respectively i2(f) ;

i1(f) , i2(f) - represents the corresponding numbers of i1 and i2 in factorial group ;

F – factor

T – termination

Be : 32 999 x 32 693 = 1 078 836 307

P = (1 078 836 307 – 7) : 30 = 35 961 210   col.1   T = 10   p(without T) = 359 612

Or using the formula :

32 999 = (3000x10)+2 999   col.7   ;   32 693 = (3000x10)+2 693   col.6

Factor calculation and termination :

2 999 x 2 693 = (8 076 307 – 7) : 30 = 269 210   ;   F = 2 692   T = 10

P = 10 x 2 999 + 10 x 32 693 + F , followed by T

= 10 x 2 693 + 10 x 32 999 + F , followed by T

We calculate all the factors column 1 , termination 10 .

The four types of multiplication corresponding col. 1 between numbers belonging to factor group , generates 400 factors with T.10 , as follows :

7 x 901 = 2	37 x 1 711 = 21	67 x 721 = 16
307 x 3 001 = 307	337 x 811 = 91	367 x 2 821 = 345
607 x 2 101 = 425	637 x 2 911 = 618	667 x 1 921 = 427
....	....	....
2 707 x 1 801 = 1 625	2 737 x 2 611 = 2 382	2 767 x 1 621 = 1 495

97 x 931 = 30	127 x 2 341 = 99	157 x 1 951 = 102
397 x 31 = 4	427 x 1 441 = 205	457 x 1 051 = 160
697 x 2 131 = 495	727 x 541 = 131	757 x 151 = 38
....	....	....
2 797 x 1 831 = 1 707	2 827 x 241 = 227	2 857 x 2 851 = 2 715

187 x 2 761 = 172	217 x 1 771 = 128	247 x 1 981 = 163
487 x 1 861 = 302	517 x 871 = 150	547 x 1 081 = 197
787 x 961 = 252	817 x 2 971 = 809	847 x 181 = 51

………………………………	………………………………	………………………………
2 887 x 661 = 636	2 917 x 2 671 = 2 597	2 947 x 2 881 = 2 830

277 x 391 = 36

577 x 2 491 = 476

877 x 1 591 = 465

………………………………

2 977 x 1 291 = 1 281

Or ,

11 x 1 937 = 7	41 x 227 = 3	71 x 2 117 = 50
311 x 2 837 = 294	341 x 1 127 = 128	371 x 17 = 2
611 x 737 = 150	641 x 2 027 = 433	671 x 917 = 205
………………………………	………………………………	………………………………
2 711 x 1 037 = 937	2 741 x 2 327 = 2 126	2 771 x 1 217 = 1 124
101 x 1 607 = 54	131 x 1 697 = 74	161 x 2 387 = 128
401 x 2 507 = 335	431 x 2 597 = 374	461 x 287 = 44
701 x 407 = 95	731 x 497 = 121	761 x 1 187 = 3 011
………………………………	………………………………	………………………………
2 801 x 707 = 660	2 831 x 797 = 752	2 861 x 1 487 = 1 418
191 x 677 = 43	221 x 2 567 = 189	251 x 2 057 = 172
491 x 1 577 = 258	521 x 467 = 81	551 x 2 957 = 543
791 x 2 477 = 653	821 x 1 367 = 374	851 x 857 = 243
………………………………	………………………………	………………………………
2 891 x 2 777 = 2 676	2 921 x 1 667 = 1 623	2 951 x 1 157 = 1 138

281 x 2 147 = 201

581 x 47 = 9

881 x 947 = 278

....

2 981 x 1 247 = 1 239

Or ,

19 x 1 753 = 11	49 x 1 843 = 30	79 x 1 333 = 35
319 x 2 653 = 282	349 x 2 743 = 319	379 x 2 233 = 282
619 x 553 = 114	649 x 643 = 139	679 x 133 = 30
....	....	....
2 719 x 853 = 773	2 749 x 943 = 864	2 779 x 433 = 401
109 x 223 = 8	139 x 1 513 = 70	169 x 2 203 = 124
409 x 1 123 = 153	439 x 2 413 = 353	469 x 103 = 16
709 x 2 023 = 478	739 x 313 = 7	769 x 1 003 = 257
....	....	....
2 809 x 2 323 = 2 175	2 839 x 613 = 580	2 869 x 1 303 = 1 246
199 x 2 293 = 152	229 x 1 783 = 136	259 x 673 = 58
499 x 193 = 32	529 x 2 683 = 473	559 x 1 573 = 293
799 x 1 093 = 291	829 x 583 = 161	859 x 2 473 = 708
....	....	....
2 899 x 1 393 = 1 346	2 929 x 883 = 862	2 959 x 2 773 = 2 735

289 x 1 963 = 189

589 x 2 863 = 562

889 x 763 = 226

....

2 989 x 1 063 = 1 059

Or ,

29 x 2 183 = 21	59 x 1 073 = 21	89 x 2 363 = 70
329 x 83 = 9	359 x 1 973 = 236	389 x 263 = 34
629 x 983 = 206	659 x 2 873 = 631	689 x 1 163 = 267
....	....	....
2 729 x 1 283 = 1 167	2 759 x 173 = 159	2 789 x 1 463 = 1 360
119 x 53 = 2	149 x 143 = 7	179 x 2 633 = 157
419 x 953 = 133	449 x 1 043 = 156	479 x 533 = 85
719 x 1 853 = 444	749 x 1 943 = 485	779 x 1 433 = 372
....	....	....
2 819 x 2 153 = 2 023	2 849 x 2 243 = 2 130	2 879 x 1 733 = 1 663
209 x 1 523 = 106	239 x 2 813 = 224	269 x 503 = 45
509 x 2 423 = 411	539 x 713 = 128	569 x 1 403 = 266
809 x 323 = 87	839 x 1 613 = 451	869 x 2 303 = 667
....	....	....
2 909 x 623 = 604	2 939 x 1 913 = 1 874	2 969 x 2 603 = 2 576

299 x 593 = 59

599 x 1 493 = 298

899 x 2 393 = 717

....

2 999 x 2 693 = 2 692

Grouping numbers from left of multiplying operation according to the above model , in this case numbers on the right have a constant growth rate , which allows for relatively simple determination of them .

Perform tests to see if number N is prime or not , using position calculation formulas , as follows :

Divisibility by :

[(3 000 x n) + 7] x [(3 000 x n) + 901] F = 2

7 x n ; 901 x n ; 901 + 3 007xn ; 901x2 + 6 007xn ; 901x3 + 9 007xn ; ....

7xn correspond to : 7 x [(3 000 x n) + 901] ; 901xn correspond to : 901 x [(3 000 x n) + 7] ;

901 + 3 007xn correspond to : 3 007 x [(3 000 x n) + 901] ;

901x2 + 6 007xn correspond to : 6 007 x [(3 000 x n) + 901] ;

901x3 + 9 007xn correspond to : 9 007 x [(3 000 x n) + 901] ; .....

If not results indicate position of N decreased by the factor F = 2 , the number studied does not divide with multiples of 3 000 plus pair of numbers 7 - 901

[(3 000 x n) + 307] x [(3 000 x n) + 3001] F = 307

307 x n ; 3 001 x n ; 3 001 + 3 307xn ; 3 001x2 + 6 307xn ; 3 001x3 + 9 307xn ; ....

307 x n correspond to : 307 x [(3 000 x n) + 3 001] ; 3 001 x n correspond to : 3 001 x [(3 000 x n) + 307] ;

3 001 + 3 307 x n correspond to : 3 307 x [(3 000 x n) + 3 001] ;

3 001x2 + 6 307xn correspond to : 6 307 x [(3 000 x n) + 3 001] ;

3 001x3 + 9 307xn correspond to : 9 307 x [(3 000 x n) + 3 001] ; ...

Extract factor F = 307 out of the position number of N than check calculation above .

[(3 000 x n) + 607] x [(3 000 x n) + 2 101]   F = 425

607 x n ; 2 101 x n ; 2 101 + 3 607xn ; 2 101x2 + 6 607xn ; 2 101x3 + 9 607xn ; ....

Or ,

[(3 000 x n) + 2 707] x [(3 000 x n) + 1 801]   F = 1 625

2 707 x n ; 1 801 x n ; 1 801 + 5 707xn ; 1 801x2 + 8 707xn ; 1 801x3 + 11 707xn ; ....

If none of the operations related to 400 factors do not give as results the position of studied number , this number is prime .

For this example we check these calculations :

Divisibility by :

[(3 000 x n) + 7] x [(3 000 x n) + 901]   F = 2   P – F = 359 610

7 x 51 372 = 359 604	not divisible by	7 x [(3 000 x n) + 901]
901 x 399 = 359 499	not divisible by	901 x [(3 000 x n) + 7]
901 + 3 007x119 = 358 734	-//-	3 007 x [(3 000 x n) + 901]
901x2 + 6 007x59 = 356 215	-//-	6 007 x [(3 000 x n) + 901]
901x3 + 9 007x39 = 353 976	-//-	9 007 x [(3 000 x n) + 901]
901x4 + 12 007x29 = 351 807	-//-	12 007 x [(3 000 x n) + 901]
901x5 + 15 007x23 = 349 666	-//-	15 007 x [(3 000 x n) + 901]
901x6 + 18 007x20 = 365 546	-//-	18 007 x [(3 000 x n) + 901]
901x7 + 21 007x16 = 342 419	-//-	21 007 x [(3 000 x n) + 901]
901x8 + 24 007x14 = 343 306	-//-	24 007 x [(3 000 x n) + 901]
901x9 + 27 007x13 = 359 200	-//-	27 007 x [(3 000 x n) + 901]
901x10 + 30 007x11 = 339 087	-//-	30 007 x [(3 000 x n) + 901]
....		
901x20 + 60 007x5 = 318 055	-//-	60 007 x [(3 000 x n) + 901]
....		

901x30 + 90 007x3 = 297 054 -//- 90 007 x [(3 000 x n) + 901]

....

901x40 + 120 007x2 = 276 054 -//- 120 007 x [(3 000 x n) + 901]

....

901x50 + 150 007x2 = 345 064 -//- 150 007 x [(3 000 x n) + 901]

....

901x60 + 180 007x1 = 234 067 -//- 180 007 x [(3 000 x n) + 901]

....

901x92 + 276 007 = 358 899 -//- 276 007 x [(3 000 x n) + 901]

Last calculation can be performed .

Testing for number N continues with :

Divisibility by :

[(3 000 x n) + 37]x [(3 000 x n) + 1 711]   F = 21   P – F = 359 591

[(3 000 x n) + 67] x [(3 000 x n) + 721]   F = 16   P – F = 359 596

...

Divisibility by :

[(3 000 x n) + 2999] x [(3 000 x n) + 2693]   F = 2 692   P – F = 356 920

2 999 x 119 = 356 881 -//- 2 999 x [(3 000 x n) + 2 693]

2 693 x 132 = 355 476 -//- 2 693 x [(3 000 x n) + 2 999]

2 693 + 5 999x59 = 356 634 -//- 5 999 x [(3 000 x n) + 2 693]

2 693x2 + 8 999x39 = 356 347 -//- 8 999 x [(3 000 x n) + 2 693]

....

2 693x10 + 32 999x10 = 356 920 **,** number identical to P – F ,

So N is divisible by 32 999 .

B . For termination five digits

The calculation algorithm is :

Pas. 1 : Determine the position number and column it belongs ;

Pas.2 : Last five digits of the calculated number indicates the termination position of tested number ;

Pas 3 : Determine factors for termination and column number tested . I have illustrated the calculation of factors termination 001 10 , column 1 ;

Pas.4 : We divisibility test the formulas for calculating factorial .

Positions calculated results do not contain termination 001 10

31 x [(3n) 000 000 + 1 161 397]	p = 12 + 31 x n ; n = 0,1,2,3, ...	divisibility by	31
3 031 x [(3n) 000 000 + 1 800 397]	p = 1 819 + 3 031 x n	-//-	3 031
6 031 x [(3n) 000 000 + 2 439 397]	p = 1 819 + 3 085 + 6 031 x n	-//-	6 031
9 031 x [(3n) 000 000 + 3 078 397]	p = 1 819 + 3 085 x 2 + 1 278 + 9 031 x n	-//-	9 031
12 031 x [(3n) 000 000 + 3 717 397]	p = 1 819 + 3 085 x 3 + 1 278 x (2)! + 12 031 x n	-//-	12 031
15 031 x [(3n) 000 000 + 4 356 379]	p = 1 819 + 3 085 x 4 + 1 278 x (3)! + 15 031 x n	-//-	15 031
18 031 x [(3n) 000 000 + 4 995 379]	p = 1 819 + 3 085 x 5 + 1 278 x (4)! + 18 031 x n	-//-	18 031

....

2 997 031 x [(3n) 000 000 + 639 522 379]	p = 1 819 + 3 085 x 998 + 1 278 x (997)! + 2 997 031 x n	-//-	2 997 031
3 000 031 x [(3n) 000 000 + 640 161 379]	p = 1 819 + 3 085 x 999 + 1 278 x (998)! + 3 000 031 x n	-//-	3 000 031
3 003 031 x [(3n) 000 000 + 640 800 379]	p = 1 819 + 3 085 x 1 000 + 1 278 x (999)! + 3 003 031 x n	-//-	3 003 031

And ,

397 x [(3n) 000 000 + 2 403 031]	p = 318 + 397 x n	-//-	397
3 397 x [(3n) 000 000 + 234 031]	p = 265 + 3 397 x n	-//-	3 397
6 397 x [(3n) 000 000 + 1 065 031]	p = 265 + 2 006 + 6 397 x n	-//-	6 397
9 397 x [(3n) 000 000 + 1 896 031]	p = 265 + 2006 x 2 + 1 662 + 9 397 x n	-//-	9 397
12 397 x [(3n) 000 000 + 2 727 031]	p = 265 + 2006 x 3 + 1 662 x (2)! + 12 397 x n	-//-	12 397
15 397 x [(3n) 000 000 + 3 558 031]	p = 265 + 2 006 x 4 + 1 662 x (3)! + 15 397 x n	-//-	15 397
18 397 x [(3n) 000 000 + 4 389 031]	p = 265 + 2 006 x 5 + 1 662 x (4)! + 18 397 x n	-//-	18 397

....

2 997 397 x [(3n) 000 000 + 829 572 031] p = 265 + 2 006 x 998 + 1 662 x (997)! + 2 997 397 x n -//- 2 997 397

3 000 397 x [(3n) 000 000 + 830 403 031] p = 265 + 2 006 x 999 + 1 662 x (998)! + 3 000 397 x n -//- 3 000 397

3 003 397 x [(3n) 000 000 + 831 234 031] p = 265 + 2 006 x 1 000 + 1 662 x (999)! + 3 003 397 x n -//- 3 003 397

Or ,

331 x [(3n) 000 000 + 2 755 297] p = 304 + 331 x n -//- 331

3 331 x [(3n) 000 000 + 994 297] p = 1 104 + 3 331 x n -//- 3 331

6 331 x [(3n) 000 000 + 2 233 297] p = 1 104 + 3 609 + 6 331 x n -//- 6 331

9 331 x [(3n) 000 000 + 3 472 297] p = 1 104 + 3 609 x 2 + 2 478 + 9 331 x n -//- 9 331

12 331 x [(3n) 000 000 + 4 711 297] p = 1 104 + 3 609 x 3 + 2 478 x (2)! + 12 331 x n -//- 12 331

15 331 x [(3n) 000 000 + 5 950 297] p = 1 104 + 3 609 x 4 + 2 478 x (3)! + 15 331 x n -//- 15 331

18 331 x [(3n) 000 000 + 7 189 297] p = 1 104 + 3 609 x 5 + 2 478 x (4)! + 18 331 x n -//- 18 331

....

And ,

1 297 x [(3n) 000 000 + 342 331] p = 148 + 1 297 x n -//- 1 297

4 297 x [(3n) 000 000 + 1 773 331] p = 2 540 + 4 297 x n -//- 4 297

7 297 x [(3n) 000 000 + 3 204 331] p = 2 540 + 5 254 + 7 297 x n -//- 7 297

10 297 x [(3n) 000 000 + 4 635 331] p = 2 540 + 5 254 x 2 + 2 862 + 10 297 x n -//- 10 297

13 297 x [(3n) 000 000 + 6 066 331] p = 2 540 + 5 254 x 3 + 2 862 x (2)! + 13 297 x n -//- 13 297

16 297 x [(3n) 000 000 + 7 497 331] p = 2 540 + 5 254 x 4 + 2 862 x (3)! + 16 297 x n -//- 16 297

19 297 x [(3n) 000 000 + 8 928 331] p = 2 540 + 5 254 x 5 + 2 862 x (4)! + 19 297 x n -//- 19 297

....

Number testing is done with all the 400 pairs of numbers in the group factorial .

Factorial multiplication process has as principle of calculation pairs of numbers that belong to the factorial group unique to each termination and column .

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