FORMULAS THAT GENERATES PRIMES NUMBERS

Prof. and Ing. Jose de Jesus Camacho Medina
pepe9mx@yahoo.com.mx
http://matematicofresnillense.blogspot.mx
Fresnillo, Zacatecas, Mexico
Theory of Numbers

"Wherever a number is the beauty"

[Proclo]

Abstract

This article disseminates a series of formulas that generate primes numbers as a product of the investigations of the author since the year 2011. This document describes general patterns on the entities primales and conceived an order in its distribution.

Keywords: Primes, Mathematics, Arithmetic, Number Theory, Mathematical Entity, Primes Numbers, Formulas, New Formulas.

Formulas

1) The following formula produces more than 20 primes numbers between 11 and 113 in the company of zeros, the prime numbers 2, 3, 5, 7 are used precisely to generate this range of cousins. Under this idea it is possible to build a formula that will generate cousins in finite intervals which makes it a kind of sieve, the formula makes use of functions greatest common divisor and residue.

$$a(n)= n\,(\mathrm{GCD}[7,\, n\,((\mathrm{GCD}[5,\, n\,(((\mathrm{GCD}[2,\, n] \bmod n) \bmod 3) \bmod 2)] \bmod 5) \bmod n)] \bmod 7)$$

This is the code in Matemathica for its execution:

Table[Mod[GCD[((Mod[((Mod[GCD[((Mod[Mod[((Mod[GCD[n,6],n])),3],2))*n),5],5]*n)/n),n])*n),7],7]*n ,{n,1,120}]

Which produces:

{0,0,0,0,0,0,0,0,0,0,11,0,13,0,0,0,17,0,19,0,0,0,23,0,0,0,0,0,29,0,31,0,0,0,0,0,37,0,0,0,41,0,43,0,0,0,47,0,0,0,0,0,53,0,0,0,0,0,59,0,61,0,0,0,0,0,67,0,0,0,71,0,73,0,0,0,0,0,79,0,0,0,83,0,0,0,0,0,89,0,0,0,0,0,0,0,97,0,0,0,101,0,103,0,0,0,107,0,109,0,0,0,113,0,0,0,0,0,0,0}

2) The following formula can serve as test primality, makes use of the binomial Combinatorial of the triangle of Pascal and the function greatest common divisor.

$$a(n) = \mathrm{GCD}\left[n,\ \binom{n}{k}\right]$$

This is the code in Matemathica for its execution:

Table[(GCD[Binomial[n,k],n]),{n,1.50},{k,1,n-1}]

Which produces:

{{},{2},{3,3},{4,2,4},{5,5,5,5},{6,3,2,3,6},{7,7,7,7,7,7},{8,4,8,2,8,4,8},{9,9,3,9,9,3,9,9},{10,5,10,10,2,10,10,5,10},{11,11,11,11,11,11,11,11,11,11},{12,6,4,3,12,12,12,3,4,6,12},{13,13,13,13,13,13,13,13,13,13,13,13},{14,7,14,7,14,7,2,7,14,7,14,7,14},{15,15,5,15,3,5,15,15,5,3,15,5,15,15},{16,8,16,4,16,8,16,2,16,8,16,4,16,8,16},{17,17,17,17,17,17,17,17,17,17,17,17,17,17,17,17},{18,9,6,18,18,6,18,18,2,18,18,6,18,18,6,9,18},{19,19,19,19,19,19,19,19,19,19,19,19,19,19,19,19,19,19},{20,10,20,5,4,20,20,10,20,4,20,10,20,20,4,5,20,10,20},{21,21,7,21,21,21,3,21,7,21,21,7,21,3,21,21,21,7,21,21},{22,11,22,11,22,11,22,22,22,22,2,22,22,22,22,11,22,11,22,11,22},{23,23,23,23,23,23,23,23,23,23,23,23,23,23,23,23,23,23,23,23,23,23},{24,12,8,6,24,4,24,3,8,24,24,4,24,24,8,3,24,4,24,6,8,12,24}

3) The following formula produces the first twenty-five numbers cousins and makes use of the concatenation, features floor and residue. Under this idea it is possible to build a formula that will generate cousins in finite intervals.

$$\mathbf{a(n)}=\left\lfloor 10^{1-n}\left(7939317193731719397317532 \bmod 10^{n}\right)\right\rfloor+10^{\left\lfloor \frac{\log\left(\left\lfloor 10^{1-n}\left(7939317193731719397317532 \bmod 10^{n}\right)\right\rfloor\right)}{\log(10)}+1\right\rfloor}\left\lfloor 10^{1-n}\left(9887776655444332211110000 \bmod 10^{n}\right)\right\rfloor$$

This is the code in Matemathica for its execution:

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Table[((Floor[Mod[ 9887776655444332211110000,10^(n) ]/10^(n-1)]*10^(Floor[Log[10,Floor[Mod[ 7939317193731719397317532,10^(n) ]/10^(n-1)]]+1])+ Floor[Mod[ 7939317193731719397317532,10^(n) ]/10^(n-1)])),{n,1.25}]
```

Which produces:
{2,3,5,7,11,13,17,19,23,29,31,37,41,43,47,53,59,61,67,71,73,79,83,89,97}

4) The following formula produces more than 200 prime numbers between 2 and 1381 in the company of zeros. Under this idea it is possible to build a formula that will generate cousins in finite intervals which makes it a kind of sieve, the formula makes use of functions greatest common divisor, residue, floor and ceiling.

$$\text{a(n)}= n\left\lceil \frac{\left(n\left\lceil \frac{\left(x\left\lfloor \frac{GCD[-2+2^{x},x] \bmod (x+1)}{x}\right\rfloor\right) \bmod 11}{x}\right\rceil\right) \bmod 5}{n}\right\rceil$$

This is the code in Matemathica for its execution:

Table[(Ceiling[Mod[(Ceiling[(Mod[((Floor[(((Mod[(GCD[((2^n)-2),n]) ,n+1]))/n)])*n) , 11]
/n)]*n),5]/n])*n,{n,2,1381}]

Which produces:

{2,3,0,0,0,7,0,0,0,0,0,13,0,0,0,17,0,19,0,0,0,23,0,0,0,0,0,29,0,31,0,0,0,0,0,37,0,0,0,41,0,43,0,0,0,47,0,0,0,0,
0,53,0,0,0,0,0,59,0,61,0,0,0,0,0,67,0,0,0,71,0,73,0,0,0,0,0,79,0,0,0,83,0,0,0,0,0,89,0,0,0,0,0,0,0,97,0,0,0,101
,0,103,0,0,0,107,0,109,0,0,0,113,0,0,0,0,0,0,0,0,0,0,0,0,0,127,0,0,0,131,0,0,0,0,0,137,0,139,0,0,0,0,0,0,0,0,0,
149,0,151,0,0,0,0,0,157,0,0,0,0,0,163,0,0,0,167,0,0,0,0,0,173,0,0,0,0,0,179,0,181,0,0,0,0,0,0,0,0,0,191,0,193
,0,0,0,197,0,199,0,0,0,0,0,0,0,0,0,0,0,211,0,0,0,0,0,0,0,0,0,0,0,223,0,0,0,227,0,229,0,0,0,233,0,0,0,0,0,239,0,
241,0,0,0,0,0,0,0,0,0,251,0,0,0,0,0,257,0,0,0,0,0,263,0,0,0,0,0,269,0,271,0,0,0,0,0,277,0,0,0,281,0,283,0,0,0,
0,0,0,0,0,0,293,0,0,0,0,0,0,0,0,0,0,0,0,0,307,0,0,0,311,0,313,0,0,0,317,0,0,0,0,0,0,0,0,0,0,0,0,0,331,0,0,0,0,0
,337,0,0,0,0,0,0,0,0,0,347,0,349,0,0,0,353,0,0,0,0,0,359,0,0,0,0,0,0,0,367,0,0,0,0,0,373,0,0,0,0,0,379,0,0,0,3
83,0,0,0,0,0,389,0,0,0,0,0,0,0,397,0,0,0,401,0,0,0,0,0,0,0,409,0,0,0,0,0,0,0,0,0,419,0,421,0,0,0,0,0,0,0,0,0,43
1,0,433,0,0,0,0,0,439,0,0,0,443,0,0,0,0,0,449,0,0,0,0,0,0,0,457,0,0,0,461,0,463,0,0,0,467,0,0,0,0,0,0,0,0,0,0,0,
0,479,0,0,0,0,0,0,0,487,0,0,0,491,0,0,0,0,0,0,0,499,0,0,0,503,0,0,0,0,0,509,0,0,0,0,0,0,0,0,0,0,0,521,0,523,0,
0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,541,0,0,0,0,0,547,0,0,0,0,0,0,0,0,0,557,0,0,0,0,0,563,0,0,0,0,0,569,0,571,0,0,0
,0,0,577,0,0,0,0,0,0,0,0,0,587,0,0,0,0,0,593,0,0,0,0,0,599,0,601,0,0,0,0,0,607,0,0,0,0,0,613,0,0,0,617,0,619,0
,0,0,0,0,0,0,0,0,0,0,631,0,0,0,0,0,0,0,0,0,641,0,643,0,0,0,647,0,0,0,0,0,653,0,0,0,0,0,659,0,661,0,0,0,0,0,0,0,
0,0,0,0,673,0,0,0,677,0,0,0,0,0,683,0,0,0,0,0,0,0,691,0,0,0,0,0,0,0,0,0,701,0,0,0,0,0,0,0,709,0,0,0,0,0,0,0,0,0
,719,0,0,0,0,0,0,0,727,0,0,0,0,0,733,0,0,0,0,0,739,0,0,0,743,0,0,0,0,0,0,0,751,0,0,0,0,0,757,0,0,0,761,0,0,0,0,0,
0,0,0,769,0,0,0,773,0,0,0,0,0,0,0,0,0,0,0,0,0,787,0,0,0,0,0,0,0,0,0,797,0,0,0,0,0,0,0,0,0,0,0,809,0,811,0,0,0,0
,0,0,0,0,0,821,0,823,0,0,0,827,0,829,0,0,0,0,0,0,0,0,0,839,0,0,0,0,0,0,0,0,0,0,0,0,0,853,0,0,0,857,0,859,0,0,0,
863,0,0,0,0,0,0,0,0,0,0,0,0,0,877,0,0,0,881,0,883,0,0,0,887,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,907,0,0,0,911
,0,0,0,0,0,0,0,919,0,0,0,0,0,0,0,0,0,929,0,0,0,0,0,0,0,937,0,0,0,941,0,0,0,0,0,947,0,0,0,0,0,953,0,0,0,0,0,0,0,
0,0,0,0,0,0,967,0,0,0,971,0,0,0,0,0,977,0,0,0,0,0,983,0,0,0,0,0,0,0,991,0,0,0,0,0,997,0,0,0,0,0,0,0,0,0,0,0,100
9,0,0,0,1013,0,0,0,0,0,1019,0,1021,0,0,0,0,0,0,0,0,0,1031,0,1033,0,0,0,0,0,1039,0,0,0,0,0,0,0,0,0,1049,0,105
1,0,0,0,0,0,0,0,0,0,1061,0,1063,0,0,0,0,0,1069,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1087,0,0,0,1091,0,1093,0,0,0,
1097,0,0,0,0,0,1103,0,0,0,0,0,1109,0,0,0,0,0,0,0,1117,0,0,0,0,0,1123,0,0,0,0,0,1129,0,0,0,0,0,0,0,0,0,0,0,0,0,
0,0,0,0,0,0,0,0,1151,0,1153,0,0,0,0,0,0,0,0,0,1163,0,0,0,0,0,0,0,1171,0,0,0,0,0,0,0,0,0,1181,0,0,0,0,0,1187,0,
0,0,0,0,1193,0,0,0,0,0,0,0,1201,0,0,0,0,0,0,0,0,0,0,0,1213,0,0,0,1217,0,0,0,0,0,1223,0,0,0,0,0,1229,0,1231,0,
0,0,0,0,1237,0,0,0,0,0,0,0,0,0,0,0,1249,0,0,0,0,0,0,0,0,0,1259,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1277,0,1279,0,
0,0,1283,0,0,0,0,0,1289,0,1291,0,0,0,0,0,1297,0,0,0,1301,0,1303,0,0,0,1307,0,0,0,0,0,0,0,0,0,0,0,1319,0,132
1,0,0,0,0,0,1327,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1361,0,0,0,0,0,1367,0,0,0,0,0
,1373,0,0,0,0,0,0,0,1381}

5) The following formula produces prime numbers always and when the value inserted (f) is a perfect number as: 6, 28, 496,....

Uses feature floor, residue, sum and logarithms.

$$a(f) = \sum_{n=0}^{\left\lfloor \frac{\log(f)}{\log(2)} \right\rfloor} \left\lfloor (2^{-n} f) \bmod 2 \right\rfloor$$

This is the code in Matemathica for its execution:

```
Sum[(Floor[(Mod[496/2 ^n,2])]) ,{n,0,Floor[Log[2,496]]}]
In the case of 496 produces:
{5}
```

6) The following formula produces the prime numbers that you want in the company of zeros, formula based on the theorem of Wilson. The function is used greatest common divisor, floor and factorial.

$$a(n) = n \left\lfloor \mathrm{GCD}\left[2, \frac{(n-1)!+1}{n}\right] \right\rfloor$$

This is the code in Matemathica for its execution:

```
Table[n*Floor[GCD[((n-1)!+1)/n,2]],{n,2200}]
For the first 200 values produces:
{2,3,0,5,0,7,0,0,0,11,0,13,0,0,0,17,0,19,0,0,0,23,0,0,0,0,0,29,0,31,0,0,0,0,0,37,0,0,0,41,0,43,0,0,0,47,0,0,0,0
,0,53,0,0,0,0,0,59,0,61,0,0,0,0,0,67,0,0,0,71,0,73,0,0,0,0,0,79,0,0,0,83,0,0,0,0,0,89,0,0,0,0,0,0,0,97,0,0,0,10
1,0,103,0,0,0,107,0,109,0,0,0,113,0,0,0,0,0,0,0,0,0,0,0,0,0,127,0,0,0,131,0,0,0,0,0,137,0,139,0,0,0,0,0,0,0,0,0,
0,149,0,151,0,0,0,0,0,157,0,0,0,0,0,163,0,0,0,167,0,0,0,0,0,173,0,0,0,0,0,179,0,181,0,0,0,0,0,0,0,0,0,191,0,1
93,0,0,0,197,0,199,0}
```

7) These formulas use the Fibonacci sequence to produce primes in the company of zeros and can prepare to be a kind of sieve and generate cousins in finite intervals, makes use of function greatest common divisor, residue ceil and floor.

$$a(n)= n\left\lceil \frac{\left(n\left\lceil \frac{\left(n\left\lfloor \frac{GCD[n,F_{n+1}] \bmod (n+1)}{n} \right\rfloor \right) \bmod 13}{n} \right\rceil \right) \bmod 17}{n} \right\rceil$$

$$a(n)= n\left\lceil \frac{\left(n\left\lceil \frac{\left(n\left\lfloor \frac{GCD[n,F_{n-1}] \bmod (n+1)}{n} \right\rfloor \right) \bmod 13}{n} \right\rceil \right) \bmod 17}{n} \right\rceil$$

This is the code in Matemathica for its execution:

```
Table[ ((Ceiling[Mod[((Ceiling[Mod[((Floor[(((Mod[(GCD[( Fibonacci[n+1]),n]) ,n+1] ) )/n)])*n),13]/n]*n)),17]/n])*n) ,{n,2,100} ]
Table[ ((Ceiling[Mod[((Ceiling[Mod[((Floor[(((Mod[ (GCD[( Fibonacci[n-1]),n]) ,n+1] ) )/n)])*n),13]/n]*n)),17]/n])*n),{n,2,100}]
```

For the first 100 values produce:

{2,3,0,0,0,7,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,23,0,0,0,0,0,0,0,0,0,0,0,0,0,37,0,0,0,0,0,43,0,0,0,47,0,0,0,0,0,53,0,0,0,0,0,0,0,0,0,0,0,0,0,67,0,0,0,0,0,73,0,0,0,0,0,0,0,0,0,83,0,0,0,0,0,0,0,0,0,0,0,0,0,97,0,0,0}

{0,0,0,0,0,0,0,0,0,11,0,0,0,0,0,0,0,19,0,0,0,0,0,0,0,0,0,29,0,31,0,0,0,0,0,0,0,0,0,41,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,59,0,61,0,0,0,0,0,0,0,0,0,71,0,0,0,0,0,0,0,79,0,0,0,0,0,0,0,0,0,89,0,0,0,0,0,0,0,0,0,0,0}