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A PATH FOR HORIZING YOUR INNOVATIVE WORK

A NEW GENERATING TACTICS OF PRIME NUMBER USING POWER OF THE NUMBERS

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Abstract: There are millions and billions of prime numbers exist in the world. There are hundreds of logics available to check if a number is prime or composite. But, very few logics and formulae are available to generate prime numbers. Here in this paper a new logic has been introduced to generate prime numbers with large number of digits. This will help us to find out more prime numbers using natural numbers. Prime numbers can be generated at exponential rate. That will increase our scope to research in number systems and Internet Security and many more different ways of mathematics and computer science.

Keywords: Prime Number, Prime Number Generation, Prime Number Generation using exponents, Sayantan Khamaru's Power Prime, Power Prime, Multiple Prime.

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INTRODUCTION

Prime numbers are special type of numbers which have only two factors 1 and itself. Therefore, if we use one prime number for encryption of data or use as user name and another prime number for decryption of data or password, this way using prime numbers we can securely transmit data and log in and log out from system. Here in my logic it may look similar to Mersenne Prime or Leyland Prime since, in the following logic exponential terms have been used to generate prime numbers. But, here is an assurance that the following logic differs from them. We can generate huge and enormous size prime numbers. As we will see a growth in digits of every number we will generate. The last found so far largest prime number is only 17,425,170 digits long. Using this new formulae we can generate much bigger than this $2^{57,885,161} – 1$ the largest prime number so far.

2. MATERIALS AND METHODS:

A. Important Definitions:

Prime Number: A prime number is a natural number which can only divided by 1 or the number itself.

Example: 2, 3,5,7,11,23,29,103,227,29,607, etc.

Mersenne Prime: Mersenne Prime is a prime number of the form $M_n=2^n-1$. This is to say that it is a prime number which is one less than a power of two. They are named after the French monk Marin Mersenne who studied them in the early 17th century.

Example: 3, 7, 31, 127, 8191, 131071, 524287, 2147483647, etc.

Leyland Prime: A Leyland number is a number of the form $x^y + y^x$

Where x and y are integers greater than 1. They are named after the mathematician Paul Leyland.

Example: 17, 593, etc.

Fermat's Prime: If a prime number can be written in the form of $2^{(2n)}+1$ is called Fermat's Prime.

Example: 3, 5, 17, 257, 65537

B. The New Policy:

New Definitions:

Sayantan Khamaru's Power Prime: Sayantan Khamaru's Power Prime are those prime numbers which can be generated or represented in the form of $a^{a-1} + (a+1)^a \pm 2$, where a= 1, 2, 3, 4, 5, 6, 7, 8, etc…

For Example:

Taking a=1 we get, $1^0 + 2^1 = 3$, 3±2= 1, 5 Here 5 is prime

Taking a=2 we get, $2^1 + 3^2 = 2+9=11$, 11±2= 9, 13 Here 13 is prime

Taking a=3 we get, $3^2+4^3=9+64=73$, 73±2=71, 75 Here 71 is prime

Taking a= 4 we get, $4^3+5^4=64+625$, 689±2= 687, 691 Here 691 is prime

Taking a=6 we get, $6^5+7^6=125425$, 125425±2= 125423, 125427 Here 125423 is prime

Taking a=10 we get, $10^9+11^{10}=26937424601$, 26937424601±2=26937424603, 26937424599 Here 26937424603 is prime

Taking a=11 we get, $11^{10}+12^{11}=768945795289$, 768945795289±2=768945795287, 768945795291 Here 768945795287 is prime

Taking a=14 we get, $14^{13}+15^{14}=29986640798644769$, 29986640798644769±2=29986640798644767, 29986640798644771 Here 29986640798644771 is prime

Taking a=17 we get, $17^{16}+18^{17}=2234572751614363400449$, 2234572751614363400449±2=2234572751614363400447, 2234572751614363400451

Hence, 5, 13, 71, 691, 125423, 26937424603, 768945795287, 29986640798644771, 2234572751614363400447 are to be said as Sayantan Khamaru's Power Prime.

C. Making it Flawless and Drawback Correction:

Now, taking some natural numbers and applying them as per told we might not be able to generate a prime number. Then you may think this logic have some flaw. Therefore the following examples are given to show them:

Taking a=8 we get, 8^7+9^8=2097152+43046721=45143873, 45143873±2=45143871, 45143875

Taking a=9 we get, 9^8+10^9=1043046721, 1043046721±2=1043046719, 1043046723

Taking a=12 we get, $12^{11}+13^{12}$=24041093493169, 24041093493169±2=24041093493171, 24041093493167

Taking a=13 we get, $13^{12}+14^{13}$=817012858376625, 817012858376625±2=817012858376623, 817012858376627

Taking a=15 we get, $15^{14}+16^{15}$=1182114430632237601, 1182114430632237601±2= 1182114430632237599, 1182114430632237603

Taking a=16 we get, $16^{15}+17^{16}$=49814113380273715457, 49814113380273715457±2=49814113380273715455, 49814113380273715459

Taking a=18 we get, $18^{17}+19^{18}$= 106313261857649938064809, 106313261857649938064809±2=106313261857649938064807, 106313261857649938064811

From the above examples we can see for some natural numbers for which there is no prime numbers are being generated and there are also some numbers for which we don't need to apply the '±2' operations.

D. For examples without using '±2' operations:

Taking a=8 we get, 8^7+9^8=2097152+43046721=45143873, 45143873±2=45143871, 45143875 here 45143873 is a prime number

Taking a=9 we get, 9^8+10^9=1043046721, 1043046721±2=1043046719, 1043046723 here 1043046721 is prime number
Taking a=15 we get, $15^{14}+16^{15}$=1182114430632237601, 1182114430632237601±2= 1182114430632237599, 1182114430632237603

Taking a=16 we get, $16^{15}+17^{16}$=49814113380273715457, 49814113380273715457±2=49814113380273715455, 49814113380273715459

From here we can say or I may define another type of Sayantan Khamaru's Power Prime.

E. Examples where none of the above 2 ways are working:

Taking a=5 we get, 5^4+6^5=625+7776= 8401, 8401±2=8399, 8403

Taking a=7 we get, 7^6+8^7=2214801, 2214801±2=2214799, 22141803

Taking a=12 we get, $12^{11}+13^{12}$=24041093493169, 24041093493169±2=24041093493171, 24041093493167

Taking a=13 we get, $13^{12}+14^{13}$=817012858376625, 817012858376625±2=817012858376623, 817012858376627

Taking a=15 we get, $15^{14}+16^{15}$=1182114430632237601, 1182114430632237601±2= 1182114430632237599, 1182114430632237603

Taking a=18 we get, $18^{17}+19^{18}$= 106313261857649938064809, 106313261857649938064809±2=106313261857649938064807, 106313261857649938064811

Here we may seem to have a thought that my logic is failing, but, I have a simple and effective solution for that.

The solution is applying the old tactics $6n\times2^m\pm1$.

Here we should take the 1st addition result of the numbers which had been generated by taking as 'a' and 'a+1'.

Therefore, we may denote the logic as the following:

$a^{a-1}+(a+1)^a=a_x$

Let, a_x=n.

So, the new prime number will be $6a_x\times2^m\pm1$ by this.

Hence, the example follows:

Taking a=5 we get, 5^4+6^5=625+7776= 8401

$6\times8401\times2^0\pm1$=50405, 50407 both are composite. Here m=0.

$6\times8401\times2^1\pm1$=100811, 100813 Here 100811 is prime and m=1.

Taking a=7 we get, 7^6+8^7=2214801

$6\times2214801\times2^0\pm1$=13288805, 13288807 both are composite. Here m=0.

$6\times2214801\times2^1\pm1$=26577611, 26577613 both are composite. Here m=1.

$6 \times 2214801 \times 2^2 \pm 1$=53155223, 53155225 both are composite. Here m=2.

$6 \times 2214801 \times 2^3 \pm 1$=106310447, 106310449 Here 106310447 is prime and m=3.

Taking a=12 we get, $12^{11}+13^{12}$=24041093493169

$6 \times 24041093493169 \times 2^0 \pm 1$=144246560959013, 144246560959015 both are composite. Here m=0.

$6 \times 24041093493169 \times 2^1 \pm 1$=288493121918027, 288493121918029 both are composite. Here m=1.

$6 \times 24041093493169 \times 2^2 \pm 1$=576986243836055, 576986243836057 both are composite. Here m=2.

$6 \times 22148012214801 \times 2^3 \pm 1$=1153972487672111, 1153972487672113 here both are prime and m=3, it is a Twin Prime.

Taking a=13 we get, $13^{12}+14^{13}$=817012858376625

$6 \times 817012858376625 \times 2^0 \pm 1$=4902077150259749, 4902077150259751 both are composite. Here m=0.

$6 \times 817012858376625 \times 2^1 \pm 1$=9804154300519501, 9804154300519499 both are composite. Here m=1.

$6 \times 817012858376625 \times 2^2 \pm 1$=19608308601039001, 19608308601038999 both are composite. Here m=2.

$6 \times 817012858376625 \times 2^3 \pm 1$= 39216617202078001, 39216617202077999 here both are composite and m=3
$6 \times 817012858376625 \times 2^4 \pm 1$= 78433234404156001, 78433234404155999 here 78433234404155999 is prime and m=4

Taking a=15 we get, $15^{14}+16^{15}$=1182114430632237601

$6 \times 1182114430632237601 \times 2^0 \pm 1$=7092686583793425605, 7092686583793425607 both are composite. Here m=0.

$6 \times 1182114430632237601 \times 2^1 \pm 1$= 14185373167586851211, 14185373167586851213 both are composite. Here m=1

$6\times11821144306322376 01\times2^{2}\pm1$=28370746335173702423, 28370746335173702425 both are composite. Here m=2

$6\times118211443063223760 1\times2^{3}\pm1$=56741492670347404847, 56741492670347404849 here 56741492670347404849 is a prime number and m=3

Taking a=18 we get, $18^{17}+19^{18}$= 1063132618576499380648O9

$6\times1063132618576499380648 09\times2^{0}\pm1$=6378795711458996283888 53, 637879571145899628388855 both are composite. Here m=0.

$6\times106313261857649938064809\times2^{1}\pm1$=1275759142291799256777707, 1275759142291799256777709 both are composite. Here m=1.

$6\times106313261857649938064809\times2^{2}\pm1$=2551518284583598513555415, 2551518284583598513555417 both are composite. Here m=2.

$6\times106313261857649938064809\times2^{3}\pm1$=5103036569167197027110831, 5103036569167197027110833 both are composite. Here m=3.

$6\times106313261857649938064809\times2^{4}\pm1$=10206073138334394054221663, 10206073138334394054221665 both are composite. Here m=4

$6\times106313261857649938064809\times2^{5}\pm1$=20412146276668788108443327, 20412146276668788108443329 both are composite. Here m=5

$6\times106313261857649938064809\times2^{6}\pm1$=40824292553337576216886655, 40824292553337576216886657 both are composite. Here m=6

$6\times106313261857649938064809\times2^{7}\pm1$=81648585106675152433773311, 81648585106675152433773313 both are composite. Here m=7

$6\times106313261857649938064809\times2^{8}\pm1$=163297170213350304867546623, 163297170213350304867546625 both are composite. Here m=8

$6\times106313261857649938064809\times2^{9}\pm1$=326594340426700609735093247, 326594340426700609735093249 both are composite. Here m=9

$6\times106313261857649938064809\times2^{10}\pm1$=653188680853401219470186495, 653188680853401219470186497 both are composite. Here m=10

$6\times 106313261857649938064809\times 2^{11}\pm 1=1306377361706802438940372991$, 1306377361706802438940372993 both are composite. Here m=11

$6\times 106313261857649938064809\times 2^{12}\pm 1=2612754723413604877880745983$, 2612754723413604877880745985 both are composite. Here m=12

$6\times 106313261857649938064809\times 2^{13}\pm 1=5225509446827209755761491967$, 5225509446827209755761491969 both are composite. Here m=13

$6\times 106313261857649938064809\times 2^{14}\pm 1=10451018893654419511522983935$, 10451018893654419511522983937 both are composite. Here m=14

$6\times 106313261857649938064809\times 2^{15}\pm 1=20902037787308839023045967871$, 20902037787308839023045967873 both are composite. Here m=15

$6\times 106313261857649938064809\times 2^{16}\pm 1=41804075574617678046091935743$, 41804075574617678046091935745 both are composite. Here m=16

$6\times 106313261857649938064809\times 2^{17}\pm 1=83608151149235356092183871487$, 83608151149235356092183871489 both are composite. Here m=17

$6\times 106313261857649938064809\times 2^{18}\pm 1=167216302298470712184367742975$, 1672163022984707121843677429777 both are composite. Here m=18

$6\times 106313261857649938064809\times 2^{19}\pm 1=334432604596941424368735485951$, 334432604596941424368735485953 both are composite. Here m=19

$6\times 106313261857649938064809\times 2^{20}\pm 1=668865209193882848737470971903$, 668865209193882848737470971905 both are composite. Here m=20

$6\times 106313261857649938064809\times 2^{21}\pm 1=1337730418387765697474941943807$, 1337730418387765697474941943809 both are composite. Here m=21

$6\times 106313261857649938064809\times 2^{22}\pm 1=2675460836775531394949883887615$, 2675460836775531394949883887617 both are composite. Here m=22

$6\times 106313261857649938064809\times 2^{23}\pm 1=5350921673551062789899767775231$, 5350921673551062789899767775233 both are composite. Here m=23

$6\times 106313261857649938064809\times 2^{24}\pm 1=10701843347102125579799535550463$, 10701843347102125579799535550465 both are composite. Here m=24

$6\times10631326185764993806480 9\times2^{25}\pm1$=2140368669420425115959907110092 7, 21403686694204251159599071100929 both are composite. Here m=25

$6\times106313261857649938064809\times2^{26}\pm1$=42807373388408502319198142201855, 42807373388408502319198142201857 both are composite. Here m=26

$6\times106313261857649938064809\times2^{27}\pm1$=85614746776817004638396284403711, 85614746776817004638396284403713 both are composite. Here m=27

$6\times106313261857649938064809\times2^{28}\pm1$=171229493553634009276792568807423, 171229493553634009276792568807425 both are composite. Here m=28

$6\times106313261857649938064809\times2^{29}\pm1$= 342458987107268018553585137614847, 342458987107268018553585137614849 both are composite. Here m=29

$6\times106313261857649938064809\times2^{30}\pm1$=684917974214536037107170275229695, 684917974214536037107170275229697 both are composite. Here m=30

$6\times106313261857649938064809\times2^{31}\pm1$=1369835948429072074214340550459391, 1369835948429072074214340550459393 both are composite. Here m=31

$6\times106313261857649938064809\times2^{32}\pm1$=2739671896858144148428681100918783, 2739671896858144148428681100918785 both are composite. Here m=32

$6\times106313261857649938064809\times2^{33}\pm1$=5479343793716288296857362201837567, 5479343793716288296857362201837569 both are composite. Here m=33

$6\times106313261857649938064809\times2^{34}\pm1$=10958687587432576593714724403675135, 10958687587432576593714724403675137 both are composite. Here m=34

$6\times106313261857649938064809\times2^{35}\pm1$= 21917375174865153187429448807350271, 21917375174865153187429448807350273 both are composite. Here m=35

$6\times106313261857649938064809\times2^{36}\pm1$=43834750349730306374858897614700543, 43834750349730306374858897614700545 both are composite. Here m=36

$6\times106313261857649938064809\times2^{37}\pm1$=87669500699460612749717795229401087, 87669500699460612749717795229401089 both are composite. Here m=37

$6\times106313261857649938064809\times2^{38}\pm1$=175339001398921225499435590458802175, 175339001398921225499435590458802177 both are composite. Here m=38

$6 \times 1063132618576499380648\,09 \times 2^{39} \pm 1$=35067800279784245099887118091760 4351, 35067800279784245099887118091760 4353 both are composite. Here m=39

$6 \times 106313261857649938064809 \times 2^{40} \pm 1$=70135600559568490199774236183520 8703, 70135600559568490199774236183520 8705 both are composite. Here m=40

$6 \times 106313261857649938064809 \times 2^{41} \pm 1$=14027120111913698039954847236704 17407, 14027120111913698039954847236704 17409 both are composite. Here m=41

$6 \times 106313261857649938064809 \times 2^{42} \pm 1$=28054240223827396079909694473408 34815, 28054240223827396079909694473408 34817 here 28054240223827396079909694473408 34817 is prime and m=42.

3. CONCLUSION:

From above calculations we can determine there are three types of Sayantan Khamaru's Power Prime. Their definitions and examples are following:

A. Sayantan Khamaru's Power Prime Type 1: Sayantan Khamaru's Power Prime Type 1 are those prime numbers which can be generated or represented in the form of $a^{a-1}+ (a+1)^{a} \pm 2$, where a= 1, 2, 3, 4, 5, 6, 7, 8, etc…

Example:

Taking a=1 we get, $1^{0} + 2^{1}= 3$, $3\pm2= 1, 5$ Here 5 is prime

Taking a=2 we get, $2^{1} + 3^{2}= 2+9=11$, $11\pm2= 9, 13$ Here 13 is prime

B. Sayantan Khamaru's Power Prime Type 2: Sayantan Khamaru's Power Prime Type 2 are those prime numbers which can be generated or represented in the form of $a^{a-1}+ (a+1)^{a}$ (where a= 1, 2, 3, 4, 5, 6, 7, 8, etc.)

Here we not even need to use the '±2' operator.

Example:

Taking a=8 we get, $8^{7}+9^{8}$=2097152+43046721=45143873, 45143873±2=45143871, 45143875 here 45143873 is a prime number

Taking a=9 we get, $9^{8}+10^{9}$=1043046721, 1043046721±2=1043046719, 1043046723 here 1043046721 is prime number

C. Sayantan Khamaru's Power Prime Type 3: Sayantan Khamaru's Power Prime Type 3 are those prime numbers which cannot be generated or represented in the form previous form of type 1 and type 2, respectively $a^{a-1}+(a+1)^{a} \pm 2$ and $a^{a-1}+(a+1)^{a}$ where a= 1, 2, 3, 4, 5, 6, 7, 8, etc… Therefore, we may denote the logic as the following:

$a^{a-1}+(a+1)^{a}=a_x$

Let, $a_x=n$.

So, the new prime number will be $6a_x \times 2^m \pm 1$ by this. This is called Saynatan Khamaru's Power Prime Type 3.

Example:

Taking a=5 we get, 54+65=625+7776= 8401

6×8401×20±1=50405, 50407 both are composite. Here m=0.

6×8401×21±1=100811, 100813 Here 100811 is prime and m=1.

Taking a=7 we get, 76+87=2214801

6×2214801×20±1=13288805, 13288807 both are composite. Here m=0.

6×2214801×21±1=26577611, 26577613 both are composite. Here m=1.

6×2214801×22±1=53155223, 53155225 both are composite. Here m=2.

6×2214801×23±1=106310447, 106310449 Here 106310447 is prime and m=3.

4. SCOPE FOR FUTURE WORK:

There are many institutions and research laboratories are there where the scientists working on large sized prime numbers. They always keep on searching new ways to generate prime numbers. I hope this will help and support them well. The network administrators also hunt for new ways to generate prime numbers. This may let them to take a break for few days, I hope as many new and huge sized prime numbers can be generated from this.

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