ON A NEW CLASS OF SMARANDACHE PRIME NUMBERS

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Abstract The purpose of this note is to report on the discovery of some new prime numbers that were built from factorials, the Smarandache Consecutive Sequence, and the Smarandache Reverse Sequence.

Consider numbers of the form $n! \times S_m(n) + 1$, where $S_m(n)$ gives the Smarandache Consecutive Sequence [1]:$1, 12, 123, 1234, 12345, \cdots$ and $n!$ is the factorial of n. If any of these numbers pass a simple, probable primality test, then proving them prime will be easy since $n! \times S_m(n)$ will contain a lot of small prime factors. That is, we will be able to use software programs that implement the classical tests to prove that numbers of this form are prime. See [2] for an introduction to primality proving using the classical tests.

The purpose of this note is to report on the discovery of some new prime numbers that were built from factorials, the Smarandache Consecutive Sequence, and the Smarandache Reverse Sequence[3].

Using the freely available primality-testing program PrimeFormGW[4], a computer search was performed for primes of the form $n! \times S_m(n) + 1$, and when $n = 1, 3, 6, 31$, and 302, $n! \times S_m(n) + 1$ is prime. No more primes were found up through n = 2000. The Brillhart-Lehmer-Selfridge test implemented in PrimeFormGW was used to prove primality. See [5] for more information on this test.

When $n = 9, 17$, and 25, $n! \times S_m(n) - 1$ is prime. No more primes were found up through $n = 2000$.

When $n = 1, 2, 10, 17, 18, 33, 63, 127, 482, 528, 1042, 1506$, and 1609, $n! \times S_{mr}(n) + 1$ is prime, where $S_{mr}(n)$ gives the Smarandache Reverse Sequence: $1, 21, 321, 4321, \cdots$ No more primes were found up through $n = 2000$. The largest value found, $1609! \times S_m(1609) + 1$, has $9,791$ digits.

When $n = 2, 4, 7, 14, 247, 341$, and 1799, $n! \times S_{mr}(n) - 1$ is prime. No more primes were found up through 2000. The largest prime found, $1799! \times S_{mr}(1799) - 1$has $11,165$ digits, qualifying it as a ąŕgigantic primeąś since it has more than 10000 decimal digits[6]. Here is the PFGW primality certificate for this number:

PFGW Version 20041001. Win Stable (v1.2 RC1b) [FFT v23.8]

Primality testing $1799! \times S_{mr}(1799) - 1$ [$N + 1$, Brillhart - Lehmer - Selfridge].

Running $N + 1$ test using discriminant 1811, base $1 + \sqrt{1811}$.

Running $N + 1$ test using discriminant 1811, base $2 + \sqrt{1811}$.

Calling Brillhart-Lehmer-Selfridge with factored part 33.44 percent, $1799! \times S_{mr}(1799) - 1$ is prime! (133.1834s+0.0695s)

Questions: Why are there more primes of the form $n! \times S_{mr}(n) \pm 1$ than there are of the form $n! \times S_m(n) \pm 1$? Are there infinitely many primes of the forms mentioned in this note? When will mathematics be able to handle questions such as the preceding one?

References

1. Smarandache Sequences, http://www.gallup.unm.edu/ smarandache /SNAQINT.txt

2. Chris Caldwell, Finding Primes and Proving Primality, Chapter 3: The Classical Tests. http://www.utm.edu/research/primes/prove/prove3.html

3. Smarandache Sequences, http://www.gallup.unm.edu/ smarandache /SNAQINT2.TXT

4. PrimeFormGW (PFGW), Primality-Testing Program Discussion Group. http://groups.yahoo.com/group/primeform/

5. R. Crandall and C. Pomerance, Prime Numbers: A Computational Perspective, NY, Springer, 2001; see Chapter 4, Primality Proving

6. Eric W. Weisstein. "Gigantic Prime." From MathWorld–A Wolfram Web Resource. http://mathworld.wolfram.com/GiganticPrime.html