Florentin Smarandache has posed many problems that deal with perfect powers. See [1] for example. Perfect powers of the form $N^N$ are aesthetically pleasing because of their symmetry. But in my opinion they would be more agreeable if their number of decimal digits (their "length" in base-10 representation) were equal to $N$. In this note we will consider numbers of the form $N^N$ and $N - 1^{N+1}$ that have been "chopped off" to have $N$ decimal digits. We will refer to these numbers as Smarandache Chopped $N^N$ numbers, and Smarandache Chopped $N - 1^{N+1}$ numbers; and we will investigate them to see if 1) they are prime, 2) they are automorphic.

§1 Smarandache Chopped $N^N$ Numbers

There are only three numbers of the form $N^N$ that do not need to be chopped. That is, their decimal length is already equal to $N$: $11 = 1$, $88 = 16777216$, and $99 = 387420489$. It is easy to see that there will be no more naturally equal to $N$. For example, 613613 has 1709 digits, 12341234 has 3815 digits; as we progress the decimal lengths continue to increase.

Definition: Smarandache Chopped $N^N$ numbers are numbers formed from the first $N$ digits of $N^N$. We will call this sequence $SC(n)$:

\[
\begin{align*}
    n &= 1, 2, 3, 4, 5, 6, 7, 8, 9, \\
    SC(n) &= 1, \quad x, \quad x, \quad x, \quad x, \quad x, \quad 1677216, \quad 387420489, \\
    n &= 10, 11, 12, \\
    SC(n) &= 1000000000, \quad 28531167061, \quad 891610044825, \\
    n &= 13, \cdots \\
    SC(n) &= 3028751065922, \cdots
\end{align*}
\]

For $n = 2$ through 7, $SC(n)$ is not defined, since those values lack one digit of being the proper length. Now we shall consider whether any terms of the

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$SC(n)$ sequence are prime, and automorphic. A prime number surely requires no definition here, but perhaps an automorphic number[2] does. The term automorphic is usually applied to squares, but here we broaden the definition a bit. An automorphic number is a positive integer defined by some function, $f$, whose functional value terminates with the digits of $n$. For example, if $f(n) = n^2$, then 76 is automorphic because $76^2 = 5776$ ends with 76.

Concerning the question of which Smarandache Chopped $N^N$ numbers are prime, a computer program was written, and $SC(65)$ and $SC(603)$ were discovered and proved to be prime. No more were found up to $n = 3000$. Question: Are there infinitely many $SC$ primes?

Concerning the question of which Smarandache Chopped $N^N$ numbers are automorphic, a computer program was written, and when $n = 1, 9, 66, \text{ and } 6051$, $SC(n)$ is automorphic. No more were found up to $n = 20000$. Question: Are there infinitely many $SC$ automorphic numbers?

Here is $SC(66)$ to demonstrate that it is automorphic:

$$SC(66) = 122998480353523742535746057982495245384860995389682130228631906566$$

§2 Smarandache Chopped $N - 1^{N+1}$ Numbers

Numbers formed from the first $N$ digits of $N - 1^{N+1}$ also have an intriguing symmetry. There are only three numbers of the form $N - 1^{N+1}$ that do not need to be chopped: $0^2 = 0$, $6^8 = 1679616$, and $7^8 = 40353607$. It is easy to see that there will be no more that are naturally equal to $N$. We will call this sequence $SC2(n)$.

\[
\begin{align*}
&n = 1, \ 2, \ 3, \ 4, \ 5, \ 6, \ 7, \ 8, \\
&SC2(n) = 0, \ x, \ x, \ x, \ x, \ x, \ \ 1679616, \ 40353607, \\
&n = \ 9, \ 10, \ 11, \ldots \\
&SC2(n) = \ 107374182, \ 3138105960, \ 10000000000, \ldots
\end{align*}
\]

Primes: A program was written, and $SC2(44)$, $SC2(64)$, and $SC2(1453)$ were discovered and proved to be prime. No more were found up to $n = 3000$. Question: Are there infinitely many $SC2$ primes?

Automorphics: A program was written, and $SC2(9416)$ was the only term discovered to be automorphic. No more were found up to $n = 20000$. Question: Are there infinitely many $SC2$ automorphic numbers?

§3 Additional Questions

1. Do these sequences, $SC(n)$ and $SC2(n)$, defy basic analysis because of their "chopped" property?
2. What other properties do the $SC(n)$ and $SC2(n)$ sequences have?
References
