Scientia Magna
Vol. 1 (2005), No. 2, 176-178

Recursive Palindromic Smarandache Values

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Abstract In [1] Recursive Prime Numbers were studied and shown to be finite. This article deals with the same "recursive" topic, but applies the method to numbers whose Smarandache value, $S(n)$, gives a palindromic number. Here, $S(n)$ denotes the Smarandache function of least m such that n divides $m!$, and a palindrome is an integer that reads the same forwards and backwards (23432, for example). This sequence of recursive palindromic Smarandache values is shown to be finite with 1514384 being the last term.

Recursive palindromic Smarandache values (RPSV) are integers $n > 0$, such that $S(n)$ gives a palindromic value, and repeatedly deleting the rightmost digits of n and taking $S(n)$ at each step also gives a palindromic value until only a single digit remains. (Note that the numbers are not permitted to have zeroes.) Example:

n	S(n)
94649	1514384
373	151438
797	15143
1514	757
151	151
15	5
1	1

The same algorithm outlined in [1] was used to generate all RPSV sets beginning with each digit 1 through 9. To summarize the basic algorithm, two arrays are defined: A_1, contains only the initial digit, then A_2 is filled with any integers that give palindromic Smarandache values after multiplying the integers in A_1 by 10 and adding y, with $1 \leq y \leq 9$. A_1 is then updated with the A_2 values. This process is repeated until no solutions are found and thus A_2 is empty.

This is enough to prove that the sequence is finite. And using this algorithm, RPSVs were found to be finite with 1514384 being the last term.

As in [1], genetic trees can be constructed from each digit for visualization and comparison purposes. Below, only the genetic tree for the digit 5 is produced. It is left to readers so inclined to construct the other trees. (However, the full sequence of RPSV numbers is given at the end of this article.)

Tree of recursive palindromic Smarandache values with starting digit 5:

5

54 55 56

543 567

5436

54362 54365

543654

To show that the numbers in the genetic tree above are recursively palindromic when $S(n)$ is applied, let us demonstrate with 54365:

n	$S(n)$
54365	131
5436	151
543	181
54	9
5	5

Unsolved Questions: What is the sequence of RPSVs when the leftmost digits are repeatedly deleted? Is the sequence finite?

Full Sequence of RPSVs: 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 14, 15, 16, 18, 21, 22, 24, 27, 28, 32, 33, 35, 36, 42, 44, 45, 48, 54, 55, 56, 63, 64, 66, 72, 77, 81, 84, 88, 96, 99, 112, 121, 126, 128, 144, 151, 154, 162, 165, 168, 181, 189, 216, 224, 242, 275, 288, 324, 336, 352, 353, 362, 363, 448, 453, 484, 543, 567, 648, 724, 726, 727, 847, 968, 1212, 1267, 1441, 1448, 1512, 1514, 1515, 1629, 1812, 1815, 1818, 2424, 2751, 2757, 2882, 3247, 3535, 3537, 3624, 3629, 3635,

3636, 4536, 4847, 4848, 4849, 5436, 7248, 7272, 7277, 8472, 12127, 12672, 15125, 15143, 18154, 18181, 24245, 27512, 27573, 27576, 32476, 35353, 36359, 36362, 48471, 54362, 54365, 72724, 72727, 72771, 126723, 151436, 151437, 151438, 181542, 181543, 275127, 275762, 363594, 363629, 484718, 543654, 1514384.

References

[1] S. Tabirca and K. Reynolds, Recursive prime numbers, Smarandache Notions Journal **14**(2004), 133-138.