ON SMARANDACHE CONCATENATED SEQUENCES I: PRIME POWER SEQUENCES

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Abstract. Let $A=\{p^n\}_{n=1}^{\infty}$, where p is a prime. Let $C(A)=\{c_n\}$ denote the Smarandache concatenated sequence of A. In this paper we prove that if $n>1$ and $p\neq 2$ or 5, then c_n does not belong to A.

Let $A=\{a_n\}_{n=1}^{\infty}$ be an infinite increasing sequence of positive integers. For any positive integer n, let c_n be the decimal integer such that

$$(1) \qquad c_n=\overline{a_1\ a_2\ \ldots a_n}\ .$$

Then sequence $C(A)=\{c_n\}_{n=1}^{\infty}$ is called the Smarandache concatenated sequence of A. In [1], Marimutha posed a generalquestions as follows:

Question. How many terms of C(A) belong to A?

In this serial paper, we shall consider some intersting cases for the above question. In this part we prove the following result.

Theorem. Let $A=\{p^n\}_{n=1}^{\infty}$,where p is a prime. If $n>1$ and $p\neq 2$ or 5, then c_n does not belong to A.

Proof. For any pisitive integer a, let d(a) denote the figure number of a in the decimal system.

If $A=\{p^n\}_{n=1}^{\infty}$, then from(1) we get

$$2)\ c_n=p^n+p^{n-1}*10^{d(p^n)}+\ldots+p^2*10^{d(p^n)+\ldots+d(p^3)}+p*10^{d(p^n)+\ldots+d(p^2)}$$

Further, if c_n belongs to A, then we have

$$(3) \qquad c_n=p^m\ ,$$

where m is a positive integer with $m\geq n$. It implies that

$$(4) \qquad p^2\mid c_n,$$

if $n>1$. Hoever, if $p\neq 2$ Or 5, then $p\nmid 10^k$ for any positive integer k . Therefore, by (2), we get

(5) $$p^2 \nmid c_n,$$

wich contradicts (4). Thus, c_n does not belong to A in this case. The theorem is proved.

Reference

1.H.Marimutha, Smarandache concatenated type sequences, Bull. Pure Appl. Sci.Sect. E 16(19970, No.2, 225-226.