Smarandache magic square

S. M. Khairnar[†], Anant W. Vyawahare[‡] and J. N. Salunke[♯]

[†]Departmrnt of Mathematics, Maharashtra Academy of Engineering, Alandi, Pune, India
[‡]Gajanan Nagar, Wardha Road, Nagpur-440015, India
[♯]Departmrnt of Mathematics, North Maharashtra University, Jalgoan, India
E-mail: vishwesh_a81@bsnl.in

Abstract This paper contains a magic square. A square array of natural numbers in which the sum of each row and each column is same is a magic square. Smarandache magic square has been defined by Sabin Tabirca [1].

Keywords Magic square.

A Smarandache magic square(SMS) is a square array containing $S(i)$, the Smarandache numbers, only in n rows and m columns such that the sum of each row and each column is same.

The difference between ordinary magic square and SMS is that the elements of SMS are of the form: $S(1)$, $S(2)$, $S(3)$, ..., $S(n^2)$.

Let (a_{ij}) form the SMS, defined as:

1. $[(a_{ij}), i = 1 \text{ to } n, j = 1 \text{ to } n] = [\text{S(i)}, i = 1 \text{ to } n^2]$;

2. $\sum a_{ij} = C$, $j = 1$ to n;

3. $\sum a_{ij} = C, i = 1$ to n;

4. $\sum S(i) = n \cdot C$, where C is the value of the determinant formed by this SMS.

S. Tabirca has claimed that the SMS exists only for the numbers $6, 7, 9, 58$ and 59. The other numbers from $n = 2$ to 100 do not form the SMS. The reason is that the fourth criterion above, i.e. $\sum S(i) = n \cdot C$ is not satisfied.

The following is the table for n and $\sum S(i)$ for which the SMS exists.

n	$\sum S(i)$
6	330
7	602
9	1413
58	1310162
69	2506080

SMS does not exist for $n = 2, 4, 5 \ldots$ because for $n = 4, \sum S(i)$, for $i = 1$ to 16 is 85, and 4 does not divide 85. Similarly for other values of n.

Here is an example of Smarandache magic square. It is of order 6.

							Sum of row elements
	3	4	11	11	23	3	55
	5	29	5	4	5	7	55
	4	13	11	9	5	13	55
	5	2	17	6	6	19	55
	7	7	7	17	10	7	55
	31	0	4	8	6	6	55
Sum of column elements	55	55	55	55	55	55	330

Now following is the magic square in the form of Smarandache functions.

$$
\begin{array}{cccccc}
S(3) & S(4) & S(11) & S(22) & S(23) & S(6) \\
S(5) & S(29) & S(10) & S(8) & S(15) & S(7) \\
S(12) & S(13) & S(33) & S(27) & S(20) & S(26) \\
S(30) & S(2) & S(17) & S(18) & S(36) & S(19) \\
S(14) & S(21) & S(35) & S(34) & S(25) & S(28) \\
S(31) & S(1) & S(24) & S(23) & S(16) & S(9)
\end{array}
$$

Here, $\sum\limits_{i=1}^{36} S(i) = 330$, $n = 6$ and $K =$ Value of each row/ column of magic square $= 55$, and $330 = 6 \times 55$. Hence the condition $\sum\limits_{i=1}^{36} S(i) = n.K$ is satisfied.

Therefore the above square is Smarandache magic square.

References

[1] Sabin Tabirca, Smarandache Magic Squares, Smarandache Notions Journal, Vol. **10**(1999), 100-104.