PATTERNS OF PERFECT MAGIC SQUARES OF THE 4TH AND 8TH ORDER, MAGIC CUBES OF THE 2ND AND 4TH ORDER

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Abstract

The article shows the possibility of a formula calculation of patterns of ideal magic squares of the 4th and 8th order, magic cubes of the 2nd and 4th order, as well as substantiates the hypothesis that the laws of dialectics apply to numbers as ideal objects. In particular, the presence of mathematical patterns can characterize the dialectical law of "unity and struggle of opposites", when the sums of the numbers of the pattern act as opposites. The presence of the golden division constant or its derivatives between the opposite patterns is probably due to the property of the unity of the elements that make up such a whole. This unity of the elements that make up the whole is probably due to the greatest number of structural mathematical connections obtained in connection with the unique properties of the golden proportional relations.

1 Introduction

In the generally accepted definition, the term "pattern" refers to a certain pattern-image that acts as an intermediary representation or sensory concept, thanks to which, in the mode of simultaneous perception and thinking, patterns existing in nature and society are revealed. In this sense, a pattern is understood as a repeating pattern or pattern. The elements of the pattern repeat predictably. So, beautiful patterns are formed from graphic patterns. At the same time, among ideal mathematical objects, such patterns as patterns of the phenomenon of the "golden section" and patterns of fractals can be distinguished. The presence of the golden ratio constant in the patterns is probably due to the largest number of structural mathematical relationships obtained in connection with the unique properties of golden proportional ratios or Fibonacci numbers. In this regard, it is important to find patterns for building a whole from parts-patterns.

2 The main part

Based on practical experience in constructing magic squares and cubes, formulas have been defined for calculating the values of patterns of magic squares of the 4th and 8th order (formulas 1, 2) and cubes of the 2nd and 4th order (formulas 3, 4). Two formulas are used to calculate the patterns of these magic squares and cubes. One of them is for calculating a larger pattern value (formulas 1, 3), and the other is for calculating a smaller one (formulas 2, 4).

$$\sum_{S1} = (1 + n^2) + n \quad (1)$$

$$\sum_{S2} = (1 + n^2) - n \quad (2)$$

$$\sum_{S1} = (1 + n^3) + 2n \quad (3)$$

$$\sum_{S2} = (1 + n^3) - 2n \quad (4)$$

The values of the patterns of ideal magic squares of the 4th and 8th order, and magic cubes of the 2nd and 4th order obtained using the presented formulas are presented in the table.

Table – Numerical patterns of ideal magic squares of the 4th and 8th order, magic cubes of the 2nd and 4th order

A magic square, a cube of order, n	The pattern of 1 magic square, $\sum_{S1}$	The 2 Magic Square pattern, $\sum_{S2}$	Pattern 1 of the magic cube, $\sum_{S1}$	Pattern 2 of the magic cube, $\sum_{S2}$
2	–	–	13	5
4	21	13	73	57
8	73	57	–	–

These patterns of ideal magic squares of the 4th and 8th order, magic cubes of the 2nd and 4th order form peculiar "blocks" (Figures 1, 2). In turn, such "blocks" of the magic square of the 8th order can become the basis for composing magic cubes of the 4th order (Figure 4). Block magic squares of large sizes (the composite squares method) are structured according to a similar universal principle.

Based on the analysis of the obtained patterns of magic squares and cubes, we substantiate the hypothesis that the laws of dialectics apply to ideal objects: as we relate dialectical patterns to material objects, so, accordingly, we relate these laws to selected objects-ideas [2]. In particular, the presence of the mathematical patterns described above can characterize the dialectical law of "unity and struggle of opposites", when the sums of the numbers of the pattern act as opposites. For example, 21 and 13 (Figure 1), 73 and 57 (Figure 2, 4), 13 and 5 (Figure 3). The ratio of opposites is somehow related to the constant of the golden ratio or its derivatives: the value of Φ (Figure 1), the value of $\sqrt{\Phi}$ (Figure 2, 4), the value of Φ^2 (Figure 3). The presence of the golden ratio or its derivatives between opposites (patterns) is probably due to the property of the unity of the elements that make up a single whole. The greatest number of structural mathematical connections to characterize the unity of a whole (for example, a magic square or cube) is obtained only in one case – when a smaller part of it refers to a larger one, as a large part refers to their sum.

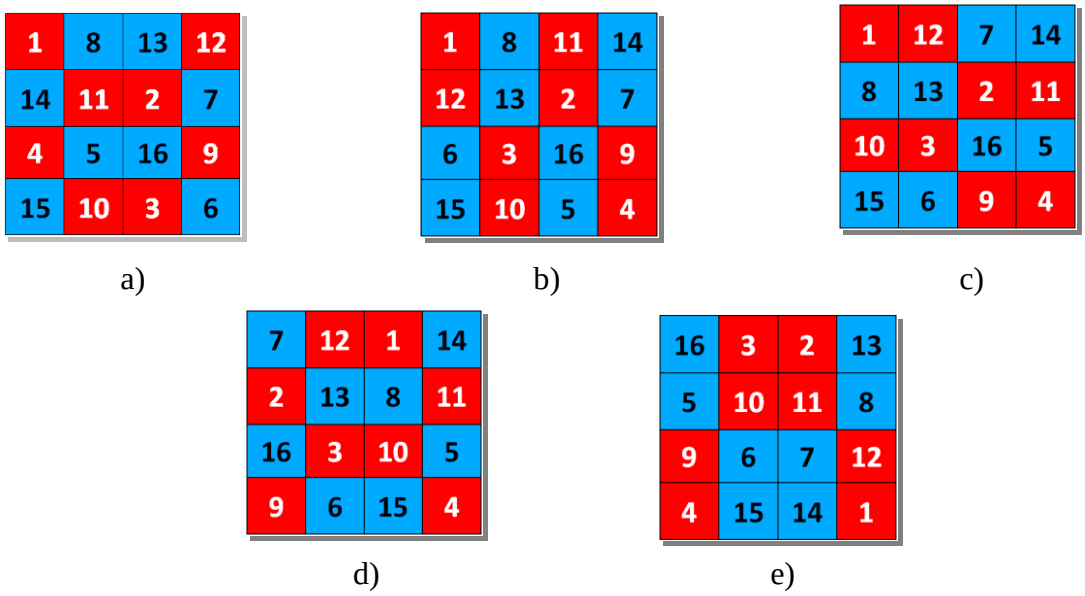

Figure 1 – Magic 4×4 squares: a, b, c are the main variants of 4×4 squares; d is Khajuraho square; e is Durer square [1]. The ratio of the sum of two numbers in the pattern as 21 and 13. 21/13=1.615... (≈Φ)

8	58	59	5	4	62	63	1
49	15	14	52	53	11	10	56
41	23	22	44	45	19	18	48
32	34	35	29	28	38	39	25
40	26	27	37	36	30	31	33
17	47	46	20	21	43	42	24
9	55	54	12	13	51	50	16
64	2	3	61	60	6	7	57

Figure 2 is an 8x8 magic square. The ratio of the sum of two numbers in the pattern as 73 and 57. 73/57=1.28... ($\approx\sqrt{\Phi}$)

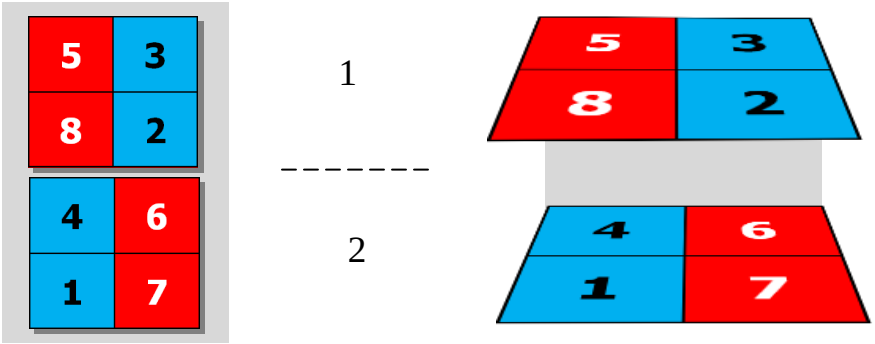

Figure 3 is a magic cube of the 2nd order. The ratio of the sum of two numbers in the pattern is 13 and 5. 13/5=2.6 ($\approx\Phi^2$)

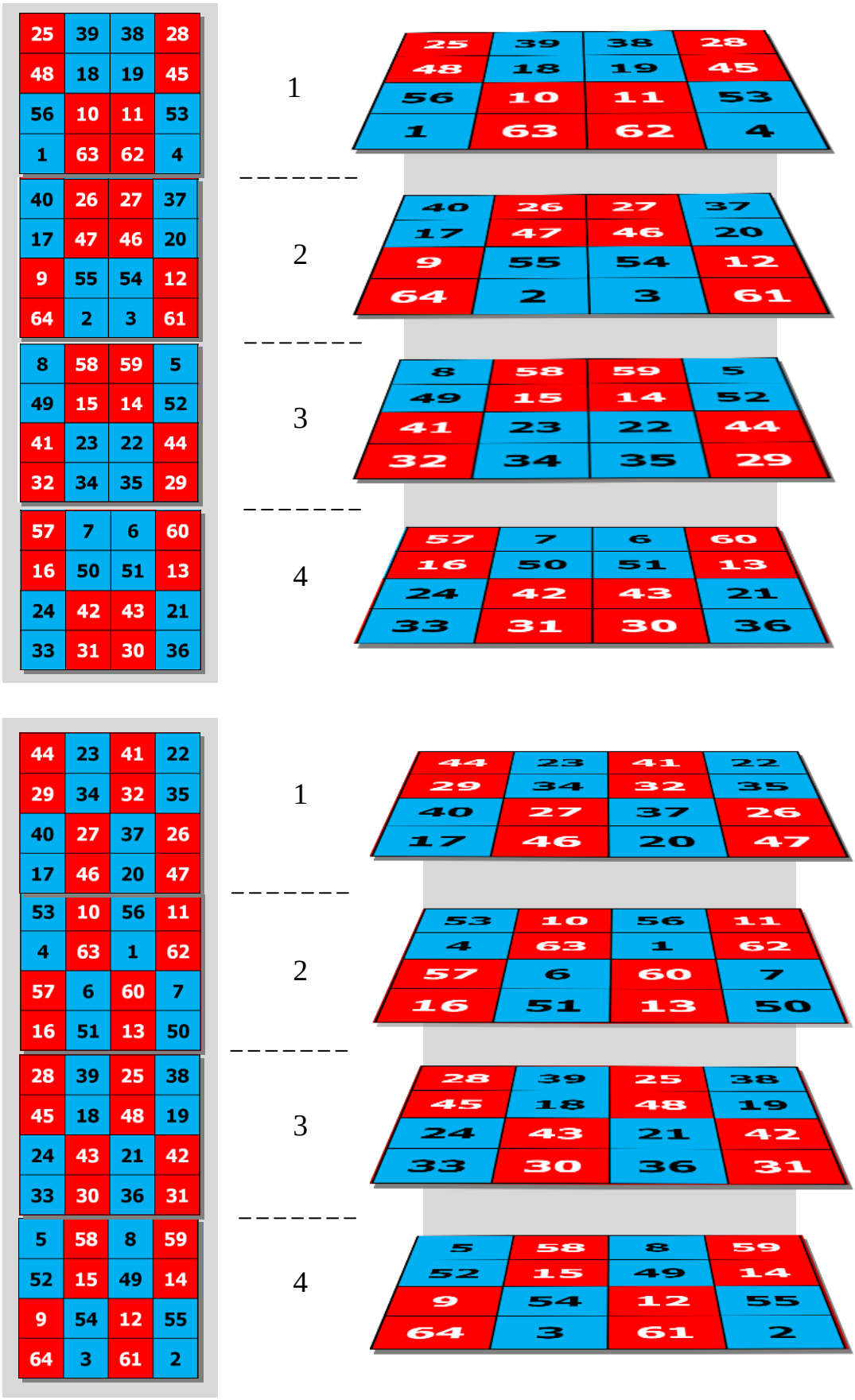

Figure 4 – Magic cubes of the 4th order: from above – built by us on the basis of a square of the 8th order (Figure 1), from below – built by Hendricks J.R. [3]. The ratio of the sum of two numbers in the pattern of both cubes as 73 and 57. 73/57=1.28... (≈√Φ)

3 Conclusion

The possibility of a formula calculation of patterns of ideal magic squares of the 4th and 8th order, magic cubes of the 2nd and 4th order is shown, as well as the hypothesis is substantiated, according to which the laws of dialectics apply to numbers as ideal objects. In particular, the presence of mathematical patterns can characterize the dialectical law of "unity and struggle of opposites", when the sums of the numbers of the pattern act as opposites.

The presence of the golden division constant or its derivatives between opposite patterns is probably due to the property of the unity of the elements that make up such a whole. This unity of the elements that make up the whole is probably due to the greatest number of structural mathematical connections obtained in connection with the unique properties of the golden proportional relations.

References

[1] Ворон, А.В. Магические квадраты 4×4 и золотое сечение // «Академия Тринитаризма», М., Эл № 77-6567, публ.24149, 03.01.2018.

[2] Ворон, А.В. Мера длины «Королевский кубит» и позиционная система счисления с иррациональным основанием // «Академия Тринитаризма», М., Эл № 77-6567, публ.25842, 01.11.2019.

[3] Hendricks J.R. Magic Squares to Tesseract by Computer, Self-published, 1998.