AMERICAN JOURNALS
Open Access, Peer Reviewed Journals

American Journal of Pedagogical and Educational Research
ISSN (E): 2832-9791| Volume 22, | March - 2024

IMPLEMENTATION OF DIVISION SIGNS IN SOME NUMBER SYSTEMS

Kudrat Sapoyevich Jumaniozov
Oriental University Associate Professor

Pulatov Bakhram Nigmatovich
Oriental University Associate Professor

A B S T R A C T	K E Y W O R D S
This article is devoted to signs of division of numbers in some number systems: 3, 4, 5, 6 number systems are divisible by 2, 4, 5, 6 number systems are divided by 3, hexadecimal number system is divided by four.	Technique, method, number, figure, number system, division symbols.

Introduction

The subject of systematic numbers is taught to 3rd-year students in undergraduate programs of higher education institutions. Students get acquainted with systematic numbers, non-positional and positional number systems, performing arithmetic operations on them in the course of mathematical examples and solving problems. However, they do not have information about the signs of division in systematic numbers. This article examines the signs of division in some number systems.

The decimal numbering system used in our daily life has not been as fast as it is now. In different periods, different peoples used sharply different counting systems.

For example, the 12-digit number system is very widely used. In its origin, of course, the natural calculation tool - our hand, is of great importance. Other than the thumb, each of our four fingers consists of 3 joints, totaling 12 joints. Traces of this counting system are still preserved. For example, in English

length unit: 1 foot = 12 inches = 30 cm,

currency: 1 shilling = 12 pence.

We mainly use the decimal number system. However, Arabic numerals are used to designate numbers in smaller number systems than the decimal number system. For example, the numbers 0, 1, 2, 3, 4 are used in the hexadecimal number system, and the numbers 0, 1, 2, 3, 4, 5, 6 are used in the hexadecimal number system.

Number systems with base 2, 8 and 16 are used in computing and programming.

Number system is a way of writing numbers in a way that is convenient for reading and performing arithmetic operations.

Not only 10 and 60, but also an arbitrary natural number p greater than one can be taken for the base of the number system.

The organization of number systems is almost the same. A number p is accepted as the base of the number system, and an arbitrary number N is expressed in the following form:

$$N = a_n p^n + a_{n-1} p^{n-1} + \ldots + a_1 p^1 + a_0 p^0 + a_{-1} p^{-1} + \ldots + a_{-m} p^{-m}$$

This number expressed in polynomial form

$$\left(a_n a_{n-1} \ldots a_1 a_0 a_{-1} \ldots a_{-m}\right)_p$$

it is also possible to write as (n and m are the number of rooms (discharges) of the whole and fractional part of the number).

In this representation of a number, the value of each number is different depending on its place. For example, in the number 98327 in the decimal number system, the number 7 represents one, 2 - tens, 3 - hundreds, 8 - thousands, 9 - ten thousandths (this is the case only in the decimal system):

$$98327 = 9 \cdot 10^4 + 8 \cdot 10^3 + 3 \cdot 10^2 + 2 \cdot 10^1 + 7 \cdot 10^0 .$$

In some other p-based number system, the numbers a_0, a_1, a_2 ... indicate the values a_0, a_1p, a_2p_2, ...

Number systems constructed in this way are called positional number systems.

In the positional number system, integers are formed based on the following rules: the next number is formed by pushing the last digit of the previous number to the right; if a number becomes 0 during the push, then the number to the left of this number is pushed.

Ten characters are used to write numbers in the decimal system. These are 0; 1; 2; 3; 4; 5; 6; 7; 8; It is 9. These characters are called numbers. For example: 8; 18; 8 is both a number and a number. 18 is not a number, it is a combination of 1 (one) and 8 (eight). Each number in the above-mentioned numbers has a different meaning depending on the position it occupies. In particular, in the writing 524 (five hundred and twenty-four), the number 4 means that there are four ones in this number, the number 2 means that there are two tens in this number, and the number 5 means that there are five hundreds in this number. That is

$$524 = 5100 + 210 + 41;\ 62703 = 610000 + 21000 + 7100 + 010 + 31:$$

This method of writing numbers using ten digits is called "decimal number system". It is known that in other counting systems, which have division marks in the decimal system, we have provided information about this based on these rules. Based on this information, it is possible to easily solve examples that are more difficult in teacher counting systems.

Dividing by 2 in the 3-digit number system:

Numbers whose sum is divisible by 2 are divisible by 2 and vice versa. [2]

Proof:

$$N = \overline{a_n a_{n-1} \ldots a_1 a_0} = 3^n a_n + 3^{n-1} a_{n-1} + \ldots + 3a_1 + a_0 =$$
$$= (2+1)^n a_n + (2+1)^{n-1} a_{n-1} + \ldots + (2+1) a_1 + a_0 = \left|(c+1)^n = cm + 1\right| =$$
$$= 2m_n a_n + 2m_{n-1} a_{n-1} + \ldots + 2m_1 a_1 + (a_0 + a_1 + \ldots + a_n)$$

given that each term of the sum from this equation is divisible by 2 must be $(a_0 + a_1 + \ldots + a_n) \vdots 2$.

Example: 102201121_3 This number is divisible by 2 without a remainder. Because the sum of the numbers (101_3) is divisible by 2 without a remainder.

Zero is considered divisible by all numbers. $a_n a_{n-1} \ldots a_1 a_0$ composed of numbers $n+1$ digit number $N = \overline{a_n a_{n-1} \ldots a_1 a_0}$ we write in the form.

A number is not divided because any number is divisible by itself without a remainder.

4 Divisible by 3 symbols in the number system:

Numbers whose sum is divisible by 3 are divisible by 3 and vice versa.

Proof:

$$N = \overline{a_n a_{n-1} \ldots a_1 a_0} = 4^n a_n + 4^{n-1} a_{n-1} + \ldots + 4a_1 + a_0 =$$
$$= (3+1)^n a_n + (3+1)^{n-1} a_{n-1} + \ldots + (3+1)a_1 + a_0 = \left| (c+1)^n = cm+1 \right| =$$
$$= 3m_n a_n + 3m_{n-1} a_{n-1} + \ldots + 3m_1 a_1 + (a_0 + a_1 + \ldots + a_n)$$

given that each term of the sum from this equation is divisible by 3 $(a_0 + a_1 + \ldots + a_n) \vdots 3$ must be.

Example: Example: 3010220112_4 This number is divisible by 3 without a remainder. Because the sum of the numbers (30_4) is divisible by 3 without a remainder.

Signs of division by 2 in the number system of 4:

Numbers whose last digit ends in 0 or 2 and only those numbers are divisible by 2.

Proof: $N = \overline{a_n a_{n-1} \ldots a_1 a_0} = 4^n a_n + 4^{n-1} a_{n-1} + \ldots + 4a_1 + a_0$

given that each term of the sum from this equation is divisible by 2 $a_0 \vdots 2$ must be.

Example: 3010220112_4 This number is divisible by 2 without a remainder. This conclusion can be said because, since the last number is 2.

Signs of division by 4 in the number system of 5:

Numbers whose sum is divisible by 4 are divisible by 4 and vice versa.

Proof:

$$N = \overline{a_n a_{n-1} \ldots a_1 a_0} = 5^n a_n + 5^{n-1} a_{n-1} + \ldots + 5a_1 + a_0 =$$
$$= (4+1)^n a_n + (4+1)^{n-1} a_{n-1} + \ldots + (4+1)a_1 + a_0 = \left| (c+1)^n = cm+1 \right| =$$
$$= 4m_n a_n + 4m_{n-1} a_{n-1} + \ldots + 4m_1 a_1 + (a_0 + a_1 + \ldots + a_n)$$

given that each term of the sum from this equation is divisible by 4 must be:

$(a_0 + a_1 + \ldots + a_n) \vdots 4$

Example: 1420131_5 This number is divisible by 4 without a remainder. Since the sum of the numbers (202_5) [1] is divisible by 4 without a remainder.

Signs of division by 3 in the number system of 5:

If the sum of the even digits of a number and the odd digit such numbers are divisible by 3 if the difference of the sum of s is divisible by 3.

Proof:

$$N = \overline{a_n a_{n-1} \ldots a_1 a_0} = 5^n a_n + 5^{n-1} a_{n-1} + \ldots + 5a_1 + a_0 = \left| \begin{array}{l} (5^{2n}-1) \vdots 3, (5^{2n-1}+1) \vdots 3 \Rightarrow \\ \Rightarrow \text{If the number of terms is 2 n} \end{array} \right| =$$
$$= (5^{2n}-1)a_{2n} + (5^{2n-1}+1)a_{2n-1} + \ldots (5+1)a_1 + (a_0 + a_2 + \ldots a_{2n}) - (a_1 + a_3 + \ldots + a_{2n-1})$$

given that each term of the sum from this equation is divisible by 3 $(a_0 + a_2 + \ldots a_{2n}) - (a_1 + a_3 + \ldots + a_{2n-1}) \vdots 3$ must be.

Example: 40402202_5 This number is divisible by 3 without a remainder. Because the difference ($20_5 - 4_5$=11_5) from the sum of the even numbers (20_5), and the sum of the odd numbers (4_5) is divisible by 3 without a remainder.

Signs of division by 2 in the number system of 5:

Numbers whose sum is divisible by 2 are divisible by 2 and vice versa.

Proof:

$$N = \overline{a_n a_{n-1} \dots a_1 a_0} = 5^n a_n + 5^{n-1} a_{n-1} + \dots + 5a_1 + a_0 =$$
$$= (4+1)^n a_n + (4+1)^{n-1} a_{n-1} + \dots + (4+1)a_1 + a_0 = \left|(c+1)^n = cm+1\right| =$$
$$= 4m_n a_n + 4m_{n-1} a_{n-1} + \dots + 4m_1 a_1 + (a_0 + a_1 + \dots + a_n)$$

given that each term of the sum from this equation is divisible by 2 $(a_0 + a_1 + \dots + a_n) \vdots 2$ must be.

Example: 1420131_5 This number is divisible by 2 without a remainder. Since the sum of the numbers (202_5 is divisible by 2 without a remainder.

Signs of division by 5 in the number system of 6:

Numbers whose sum is divisible by 5 are divisible by 5 and vice versa

Proof:

$$N = \overline{a_n a_{n-1} \dots a_1 a_0} = 6^n a_n + 6^{n-1} a_{n-1} + \dots + 6a_1 + a_0 =$$
$$= (5+1)^n a_n + (5+1)^{n-1} a_{n-1} + \dots + (5+1)a_1 + a_0 = \left|(c+1)^n = cm+1\right| =$$
$$= 5m_n a_n + 5m_{n-1} a_{n-1} + \dots + 5m_1 a_1 + (a_0 + a_1 + \dots + a_n)$$

given that each term of the sum from this equation is divisible by 5 $(a_0 + a_1 + \dots + a_n) \vdots 5$ must be.

Example: 54501343_6 This number is divisible by 5 without a remainder. Since the sum of the numbers (41_6 is divisible by 5 without a remainder.

Signs of division by 4 in the number system of 6:

A two-digit number consisting of the last two digits is divided by 4

the number itself is divisible by 4.

Proof: $N = \overline{a_n a_{n-1} \dots a_1 a_0} = 6^n a_n + 6^{n-1} a_{n-1} + \dots + 6a_1 + a_0 = \left|6^2 \vdots 4\right| = 6^n a_n + 6^{n-1} a_{n-1} + \dots + 6^2 a_2 + \overline{a_1 a_0}$

given that each term of the sum from this equation is divisible by 4 $\overline{a_1 a_0} \vdots 4$ must be.

Example: 504032_6 This number is divisible by 4 without a remainder. Because the last 2-digit number is divisible by 4, this conclusion can be said.

Signs of division by 3 in the number system of 6:

Numbers ending in 0 or 3, and only those numbers, are divisible by 3.

Proof:

$N = \overline{a_n a_{n-1} \dots a_1 a_0} = 6^n a_n + 6^{n-1} a_{n-1} + \dots + 6a_1 + a_0$ given that each term of the sum from this equation is divisible by 3 $a_0 = 0$ or $a_0 = 3$ must be.

Example: 504033_6 This number is divisible by 3 without a remainder. Because the last number is 3, we can say this conclusion. Another example is that a number 30542130_6 is divisible by 3 without a remainder in this number system. This conclusion can be said since the last number is 0.

Signs of division by 2 in the number system of 6:

Numbers ending in 0, 2 or 4 and only those numbers are divisible by 2.

Proof:

$N = \overline{a_n a_{n-1} \ldots a_1 a_0} = 6^n a_n + 6^{n-1} a_{n-1} + \ldots + 6a_1 + a_0$ sum from this equation

given that each term is divisible by 2 $a_0 = 0$, $a_0 = 2$ or $a_0 = 4$ must be.

Example: 504032_6 This number is divisible by 2 without a remainder. Because, since the last last number is 2, this conclusion can be said. Another example 30542130_6 is that a number is divisible by 2 without a remainder in this number system. Since the last number is 0, this conclusion can be said.

In conclusion,

The sign of division by g-1 in the g number system:

Numbers whose sum is divisible by g-1 are divisible by g-1 and vice versa. [3]

Proof:

$$N = \overline{a_n a_{n-1} \ldots a_1 a_0} = g^n a_n + g^{n-1} a_{n-1} + \ldots + g a_1 + a_0 =$$
$$= (g-1+1)^n a_n + (g-1+1)^{n-1} a_{n-1} + \ldots + (g-1+1) a_1 + a_0 = \left|(c+1)^n = cm+1\right| =$$
$$= (g-1) m_n a_n + (g-1) m_{n-1} a_{n-1} + \ldots + (g-1) m_1 a_1 + (a_0 + a_1 + \ldots + a_n)$$

given that each term of the sum from this equation is divisible by g-1 $(a_0 + a_1 + \ldots + a_n) \vdots (g-1)$ must be.

The signs of division of the remaining number systems are also determined in this way. Studying signs of division in such number systems is aimed at making students interested in mathematics, in mathematical circles, mathematical evenings, faculty training, and developing students' mathematical thinking.

References

1. Q.Jumaniyozov, G.Muhammedova "Matematikadan misol va masalalar yechish metodikasi" O'quvqo'llanma T: «Brok class servis».2014 y

2. R.N.Nazarov. B.T.Toshpulatov. A.D.Do'simbetov. "Algebra va sonlar nazariyasi" 2-qism T. O'qtuvchi 1996 y.

3. Iskandarov R.I. Nazarov .R "Algebra vasonlar nazariyasi" 2-qism T. O'qiyuvchi 1976y.

4. Куликов Л.Я. "Алгебра И теорий чисел " Высшая школа 1976й.