ON THE INTEGRATION OF THE SCIENCES IN THE TRAINING OF MATHEMATICS AND INFORMATICS TEACHERS

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Abstract
This article discusses the topics that are aimed at the future teachers of mathematics and informatics to achieve the integration of specialized subjects appropriate to their fields in order to acquire excellent knowledge and skills in specialized subjects. goes Teachers of mathematics and computer science study the basics of number theory and the arithmetic of operations included in it in mathematics, and in computer science they consider the history of number systems and the possibilities of performing operations in them.
In this regard, the article presents ideas aimed at students' acquisition of historical knowledge, scientific skills and practical skills related to the arithmetic of numbers and strengthening their interest in studying science. At the same time, some practical tasks are shown.

Keywords: Al-Khorazmi, teacher, integration, positional counting systems, addition, subtraction, multiplication.

MATEMATIKA VA INFORMATIKA O‘QITUVCHILARINI TAYYORLASHDA FANLAR INTEGRATSIYASIGA OID

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Annotatsiya:
Ushbu maqolada bo‘lajak matematika va informatika o‘qituvchilarini mutaxassislik fanlari bo‘yicha mukammal bilim va ko‘nikmalarga ega bo‘lishi uchun o‘z yo‘nalishlariga mos mutaxassislik fanlari integratsiyasiga erishishga yo‘naltirilgan mavzular haqida so‘z boradi. Matematika va informatika o‘qituvchilari matematika fanida sonlar nazariyasi va unda kiritilgan amallar arifmetikasi asoslarini o‘rganadilar, informatika fanida esa sanoq sistemasi tarixi hamda ularda amallar bajarish imkoniyatlarini ko‘rib chiqishadi.
Maqolada shu yo‘nalishda talabalarning sonlar arifmetikasiga oid tarixiy bilim, ilmiy ko‘nikma va amaliy malakaga ega bo‘lishiga va fanlarni qiziqib o‘rganishlarini kuchaytirishga qaratilgan fikrlar keltirilgan. Shu bilan birga ba’zi amaliy vazifalarni bajarish ko‘rsatib o‘tilgan.

Kalit so‘zlar: al-Xorazmiy, o‘qituvchi, integratsiya, pozitsiyali sanoq sistemalari, qo‘shish, ayirish, ko‘paytirish.

Introduction

One of the main tasks for our country is to produce mature specialists for the education system. In general, learners and educators are at the center of these processes, and the obtained results require educators to be highly qualified specialists in their field.

In the training of teachers of mathematics and informatics, the theories of numerical sets are thoroughly studied in the academic subjects of algebra and number theory and mathematical analysis. This theoretical knowledge further develops students' theoretical knowledge of mathematics related to natural, whole, rational, irrational and real numbers. Various issues related to operations are considered in the practical exercises related to these sets of numbers. If these topics are filled with different basic number systems and operations in them, it will be possible to mathematically interpret the number systems such as binary, octal, hexadecimal, which are the foundations of computer science. In general, since computer science is built on the basis of mathematics, such coherence or integration expands the imagination of teachers of mathematics and computer science, helps to connect and expand theoretical and practical knowledge [1].

It is known to all scientists that the great mathematician, astronomer and geographer, the great thinker who lived in the end of the 8th century and the first half of the 9th century, created the great thinker Allama Abu Abdullah Muhammad ibn Musa, who caused the 10-number system to spread to the world as a truly perfect positional number system. recognize al-Khwarizmi [2]. Musa al-Khorazmi, born in Khorezm in 783, acquired his initial education and knowledge in various fields mainly from scientists and thinkers who created in his country in the cities of Central Asia.

Hisab al-Hind (Account of India) brought Al-Khwarazmi the first worldwide fame. This treatise is about practical arithmetic, in which the positional decimal numbering system was developed for the first time. In the treatise, al-Khwarizmi commented on the advantages of the nine Indian numerals in representing numbers, saying that any number can be written briefly and easily with them. In particular, he emphasizes the importance of using zero (0): “If there is nothing left, put a circle so that the career is not empty; but let there be a circle occupying it, for if that place were left empty, the ranks would diminish, and the second would be accepted first, and thus you would be mistaken in your number."

In his work, al-Khwarazmi explained the perfect rules for performing arithmetic operations of adding, subtracting, multiplying and dividing in the 10-digit number system (column) and reinforced it with various examples. The treatise begins with the phrase "al-Khwarizmi said." In 1120, when the treatise was translated into Latin, the phrase was translated into Latin as "Algorism of Dixit". It should be noted that on this basis the term algorithm spread to the world. Because people forgot the phrase "al-Khwarizmi said" related to the author of the rules and used the phrase "algorithm says" when thinking only about the rules [3]. After the translation, al-Khwarizmi's treatise was used as the first textbook for all European cities. This arithmetic, which spread all over the world and caused the rapid development of arithmetic and mathematics, can also be called al-Khwarizmi's arithmetic.

George Sarton, an American historian of science, assessed Allama al-Khwarizmi as "the greatest mathematician of his time, if all the circumstances are taken into account, one of the

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greatest mathematicians of all time." The reason for this assessment is, of course, al-Khwarizmi's incomparable place in the history of mathematics. Because another work of Al-Khorazmi, "Kitab al-Jabr wa al-muqabala" (Book of Reconciliation and Comparison) was the basis for the origin of the term algebra and the science of algebra. "Perhaps, one of the most important achievements of Arabic mathematics began during this period with the work of al-Khwarizmi, that is, with the emergence of algebra. … It was a revolutionary departure from the Greek concept of mathematics, essentially geometry. Algebra was a unifying theory that allowed rational numbers, irrational numbers, geometric quantities, etc. to be treated as "algebraic objects". … It gave mathematics a completely new way of development, much broader in concept than it had previously existed, and became a tool for the future development of science. ... Another important aspect of the introduction of algebraic ideas is that it allowed him to apply mathematics in a way that he never had before," a group of scientists noted [4].
Al-Khwarazmi tells the rule for determining the rank of the product when multiplying sixty fractions. When multiplying fractions and mixed numbers, it is emphasized that the product is in the power of the number in the lower power. In the act of division in the work, both the divisor and the divisor are expressed in their lowest rank, if the number of the divisor in this rank is smaller than that of the divisor, it is transferred to one lower rank. Then al-Khwarazmi, after describing the operations of adding, subtracting, doubling and doubling sixty fractions, moves on to perform operations on simple fractions.

MAIN PART

Now we will consider how to perform addition, subtraction and multiplication operations related to whole numbers and decimals according to al-Khwarizmi method.

ADDITION OPERATION

Positional counting systems are sharply distinguished from non-positional counting systems by the appearance of short writing in the representation of numbers and the ease of performing arithmetic operations, the efficiency of performing calculations.
To perform the addition operation in positional number systems with the same base, numbers are written in a column corresponding to their rooms (digits). A convenient algorithm for performing the addition operation is as follows:
1) from right to left, the corresponding numbers are added in the decimal system;
2) the result of adding numbers is divided by the remainder based on the number system;
3) the remainder is written under the appropriate ranks, the division (number in language) is added to the number of the next rank.
Examples:

$1011011_2+11101_2=1111000_2$	$3022,32_4+2320,31_4=12003,23_4$
$+1011011_2$	$+\ 3022,32_4$
11101_2	$2320,31_4$
1111000_2	$12003,23_4$
$1+1=2=1\cdot2+0$	$2+1=3=0\cdot4+3$
$1+0+1=2=1\cdot2+0$	$3+3+0=6=1\cdot4+2$
$0+1+1=2=1\cdot2+0$	$2+0+1=3=0\cdot4+3$
$1+1+1=3=1\cdot2+1$	$2+2+0=4=1\cdot4+0$
$1+1+1=3=1\cdot2+1$	$0+3+1=4=1\cdot4+0$
$0+1=1=0\cdot2+1$	$3+2+1=6=1\cdot4+2$
$1+0=1=0\cdot2+1$	$0+1=1=0\cdot4+1$

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$53406,6_7+346,63_7=54056,53_7$ $+53406,60_7$ $346,63_7$ $54056,53_7$ 0+3=3=0·7+3 6+6+0=12=1·7+5 6+6+1=13=1·7+6 0+4+1=5=0·7+5 4+3+0=7=1·7+0 3+1=4=0·7+4 5+0=5=0·7+5	$735246_8+66557_8=1024025_8$ $+\ 735246_8$ 66557_8 1024025_8 6+7=13=1·8+5 4+5+1=10=1·8+2 2+5+1=8=1·8+0 5+6+1=1=1·8+4 3+6+1=10=1·8+2 7+1=8=1·8+0 0+1=1=0·8+1
$3AA0C_{13}+ABCA9_{13}=1199B8_{13}$ $+\ 3AA0C_{13}$ A=10 $ABCA9_{13}$ B=11 $1199B8_{13}$ C=12 C+9=21=1·13+8 0+A+1=11=0·13+B A+C+0=22=1·13+9 A+B+1=22=1·13+9 3+A+1=14=1·13+1 0+1=1=0·13+1	$2DA1DA_{16}+E0AD7A_{16}=10E4F54_{16}$ $+\ 2DA1DA_{16}$ A=10 B=11 $E0AD7A_{16}$ C=12 D=13 $10E4F54_{16}$ E=14 F=15 A+A=20=1·16+4 D+7+1=21=1·16+5 1+D+1=15=0·16+F A+A+0=20=1·16+4 D+0+1=14=0·16+E 2+E+0=16=1·16+0 0+1=1=0·16+1

If the addends in the sum expression are given in a different base number system, then depending on the content of the problem, operations are performed after transferring the numbers to the same base number system.

Adding three or four numbers is also done in the same way as above:

$21AA7_{11}+1963_{11}+2016_{11}=25975_{11}$ $21AA7_{11}$ A=10 $+\ 1963_{11}$ 2016_{11} 25975_{11} 7+3+6=16=1·11+5 A+6+1+1=18=1·11+7 A+9+0+1=20=1·11+9 1+1+2+1=5=0·11+5 2+0=2=0·11+2	$19BB2_{12}+1950_{12}+2016_{12}=21958_{12}$ $19BB2_{12}$ A=10 B=11 $+\ 1950_{12}$ 2016_{12} 21958_{12} 2+0+6=8=0·12+8 B+5+0+1=17=1·12+5 B+9+0+1=21=1·12+9 9+1+2+1=13=1·12+1 1+1=2=0·12+2

To strengthen students' knowledge, the following tasks can be given:

1. Determine the unknown numbers x, y, z and w in the smallest base number system in which numbers can be written: 5x55+y327=z16w4.
2. There are 1110 students in the group, 220 of them are girls and 120 are boys. Determine the result of the operation of 121+212 in the number system in which the calculation was performed.
3. There are 88 trees in the garden, of which 32 are apple trees, 24 are pear trees, 16 are plum trees, and 17 are cherry trees. Determine the result of the operation of 565+656 in the number system in which the calculation was performed.

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4. Determine the sum of these numbers in the smallest base number system in which the integers 3A7, CB9, 7B6, 394 can be written.
5. In the five-point system, do the following:
120344+3·56+2·55+4·51+1·50.

SUBTRACT OPERATION

In order to perform the subtraction operation in the number systems with the same base, the numbers are written in columns corresponding to their ranks. A convenient algorithm for performing the subtraction operation is as follows:
1) from right to left, the numbers corresponding to the ranks are subtracted in the decimal system;
2) subtraction is performed if the number to be subtracted is not less than the number of the denominator, otherwise, that is, the number to be subtracted is less than the number of the denominator, then a value equal to the base of the counting system is taken from the higher rank and added to the denominator, and the subtraction operation is done;
3) the difference is recorded under the appropriate rank, higher ranks are changed due to the received "debt".

Examples:

$1011011_2-11101_2=111110_2$ 0 1 2 0 2 0 2 -1011011_2 11101_2 0111110_2 1−1=0 1−0=1 0+**2**−1=1 0+**2**−1=1 0+**2**−1=1 0+**1**−0=1	$3022{,}32_4-2323{,}1_4=33{,}22_4$ 2 3 4 1 4 $-3022{,}32_4$ $2323{,}10_4$ $0033{,}22_4$ 2−0=2 3−1=2 2+**4**−3=3 1+**4**−2=3 0+**3**−3=0 2−2=0
$300025_7-24663_7=242032_7$ 2 6 6 6 7 -300025_7 24663_7 242032_7 5−3=2 2+7−6=2 0+**6**−6=0 0+**6**−4=2 0+**6**−2=4 2−0=2	$103142_8-66557_8=14363_8$ 0 7 8 2 8 0 8 3 8 -103142_8 66557_8 014363_8 2+**8**−7=3 3+**8**−5=6 0+**8**−5=3 2+**8**−6=4 0+7−6=1

$DDA99C_{14}–DADA1_{14}=CDD9DB_{14}$ C 14 C 14 9 14 8 14 $–DDA99C_{14}$ A=10 B=11 $DADA1_{14}$ C=12 D=13 $CDD9DB_{14}$ 12–1=11=B 9+**14**–10=13=D 8+**14**–13=9 9+**14**–10=13=D 12+**14**–13=13=D	$E0AD7A_{16}–2DA1DA_{16}=B30BA0_{16}$ D 16 C 16 $–E0AD7A_{16}$ A=10 B=11 $2DA1DA_{16}$ C=12 D=13 $B30BA0_{16}$ E=14 F=15 A–A=0 7+**16**–13=10=A 12–1=11=B A–A=0 0+**16**–13=3 13–2=11=B

When subtracting a large number from a small number, the small number is subtracted from the large number and a sign is placed in front of the resulting number.
To strengthen the performance of subtraction, it is advisable to give the following tasks:
1. Calculate the difference 555555–12345 in the 6-digit number system.
2. Calculate the difference CADA1–DAD9 in the 14-digit number system.
3. Determine the unknown numbers x and y in the smallest base number system in which numbers can be written: 4x5–136=y56.
4. 100 people participated in the Olympics. 45 of them are boys and 22 are girls. Determine the result of operation 433–344 in the number system in which the calculation is performed.
5. How many 1's are there as a result of the expression 111011–11001–10101 in the 2-digit number system?

MULTIPLICATION OPERATION

Multiplication in a positional number system is like multiplication in a 10 number system, except that the remainder is used to determine the numbers stored in the "language". In general, the multiplication operation determines "how many times to perform the addition".

$1011011_2 \cdot 101_2=111000111_2$ $\times 1011011_2$ 101_2 1011011 + 0000000 1011011 111000111_2 1+0=1 1+0=1 0+0+1=1 1+0+1=2=1·2+0 1+0+0+1=2=1·2+0 1+0+0+1=2=1·2+0 1+0+1+1=3=1·2+1 0+0+1=1=0·2+1 1+0=1=0·2+1	$40{,}42_5 \cdot 22{,}2_5=2013{,}424_5$ $\times 40{,}42_5$ $\times 4042_5$ $22{,}2_5$ 2_5 13134 13134_5 4·2=8=1·5+3 0·2+1=1=0·5+1 4·2+0=8=1·5+3 + 13134 13134 $2013{,}424_5$ 4+0=4 3+4=7=1·5+2 1+3+4+1=9=1·5+4 3+1+3+1=8=1·5+3 1+3+1+1=6=1·5+1 1+3+1=5=1·5+0 1+1=2=0·5+2

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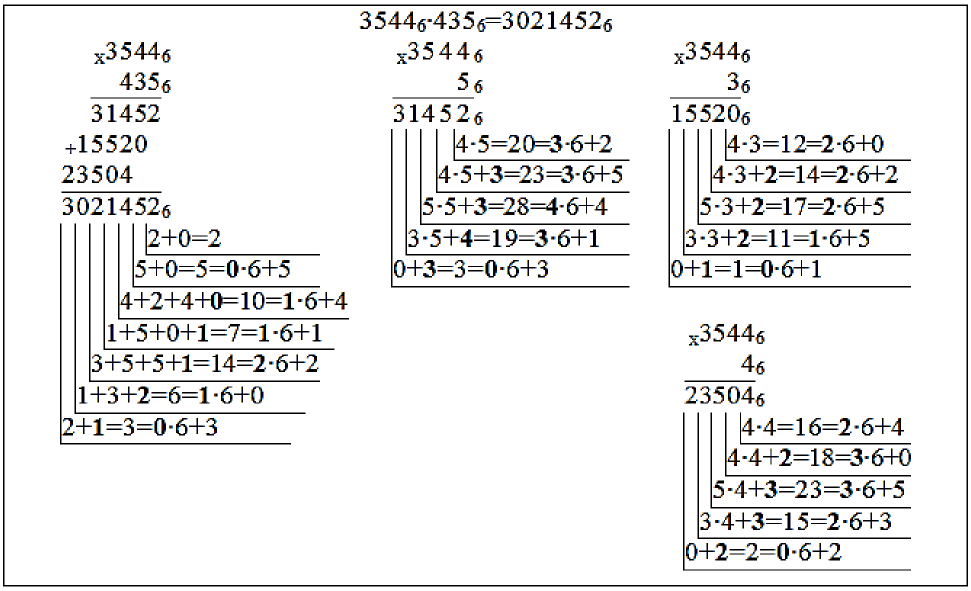

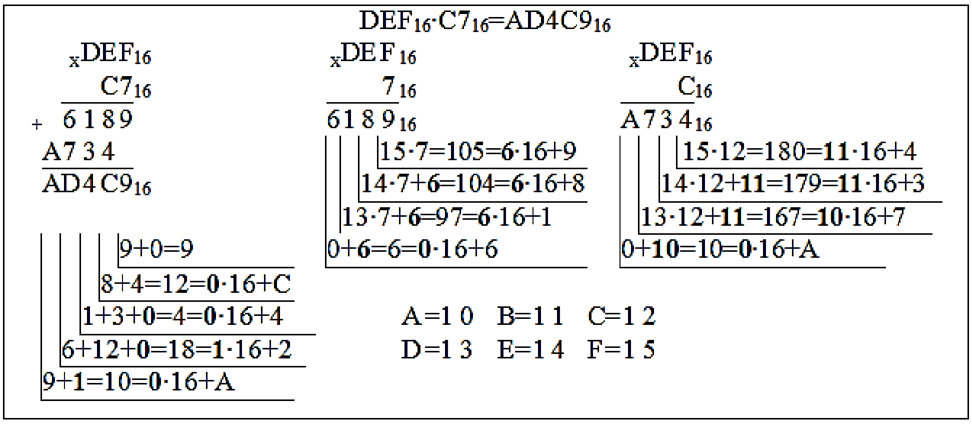

1. Calculate the multiplication of 1001·111 in the number system of 3.
2. Calculate the expression 9A8A0·7–6A7A0·8 in the number system of 11.
3. Determine the base of the number system in which the equality is appropriate: 5x6x=(22)x.
4. As a result of the multiplication of 10224·422 in the 6-digit number system, which number in the 5-digit number system does not participate?
5. In the five-point system, do the following:
$320344–(2·5^2+4·5^1+1·5^0)·(((1·5+0)·5+3)·5+1)$.

DIVISION OPERATION

Division in positional number systems is like division in column 10, except that multiplication and subtraction are performed only in the appropriate number system. As you know, the division operation determines "how many times to perform the subtraction". If necessary, it is advisable to make a multiplication table suitable for the divisor when performing division.

$94281CF_{16}:DEF_{16}=AA21_{16}$

A=10	DEF · 2=1BDE	DEF · 9=7D67	-94281CF | DEF
B=11	DEF · 3=29CD	DEF · A=8B56	8B56 | AA21
C=12	DEF · 4=37BC	DEF · B=9945	-8D21
D=13	DEF · 5=45AB	DEF · C=A734	8B56
E=14	DEF · 6=539A	DEF · D=B523	-1CBC
F=15	DEF · 7=6189	DEF · E=C312	1BDE
	DEF · 8=6F78	DEF · F=D101	-DEF
			DEF
			0

At this point, it is worth mentioning that it would be appropriate to recommend for students to study or develop a method of performing the act of being in different number systems. In this case, students are educated in the spirit of independent research and creativity. Consequently, this internship will serve as a basis for training a highly qualified specialist.

CONCLUSION

Future teachers of mathematics and informatics should know that these two subjects are inextricably linked, that mathematics complements informatics, that informatics is a fast and convenient assistant in various calculations in the theoretical and practical development of mathematics, and that it is the main factor in the application of mathematics to life processes. it is important that they know that there will be a weapon. In this case, it is necessary for them to fully understand the connection between these two sciences: mathematics and computer science. For this, it is necessary to perform mathematical calculations using the possibilities of computer science, to perfect the theoretical foundations of computer science through mathematics. It is clear from the above examples that one of such integral connections is the positional number system.

It is known that the applied counting systems do not end with the above counting systems. Such wonderful number systems have been developed that make it very easy to solve certain mathematical problems. This once again shows the need for integrated study of mathematics and computer science.

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