1. Why doesn't the unary (only one symbol) numbering system exists?

Answer: Actually, unary system exists. We may may seen it (hope not personally!), for example, at the wall of prison cell, where people draw lines for each day spent there: ||||||||||||||

Nevertheless, this kind of record is not convenient as using too much space and resources.

2. What the numbering system does the number 1011101 present?

Answer: Number 1011101 could belong to any numeric system (except unary). However, in Exercise 5 it is a binary number.

3. Convert number %$@$%%@ presented in the numbering system with three symbols % - 2; @ - 0; $ - 1 to the system with Arabic numbers (0 – 5).

Answer: Number %$@$%%@ can be represented as 2101220_3 (according to a given key). In decimal it is = $2*3^6 + 2*3^5 + 2*3^4 + 2*3^3 + 2*3^2 + 2*3^1 + 2*3^0 = 1458 + 243 + 27 + 18 + 6 + 0 = \mathbf{1752}_{10}$

Let's convert decimal to base 6: 1752 % 6 = **0**, 292 % 6 = **4**, 48 % 6 = **0**, 8 % 6 = **2**, 1 % 6 = **1**

= $\mathbf{12040}_6$

4. Think of common method for conversations from any numbering system to any.

Answer: As it seems there is no common direct method of conversion from any numeric system to any. However, using, for example, decimal system as intermediary it is quite simple.

Converting to decimal using algorithm of summing up digits of a number multiplied to numeric system base in power from null to n-1, which is digits position from right to left (hm, maybe Jewish people invented this method…):

Decimal 123 to base 5 system (wherever it is called): $123_{10} = 1*5^2 + 2*5^1 + 3*5^0 = 25+10+3= \mathbf{38}_5$

And common algorithm of converting decimal number to any other base system is dividing it to base number and looking on remainder:

38 % 5 = **3**

7 % 5 = **2**

1 % 5 = **1** (as 1 left and no need to divide number less than base of numeric system)

=> $\mathbf{123}_{10}$

5. Convert binary number 1011101 into the quarto numbering system.

Answer:

1011101_2 in decimal is $\mathbf{93}_{10}$: = $1*2^6 + 0*2^5 + 1*2^4 + 1*2^3 + 1*2^2 + 0*2^1 + 1*2^0 = 64 + 0 + 16 + 8 + 4 + 0 + 1$

Now 93 % 4 = **1**, 23 % 4 = **3**, 5 % 4 = **1**, 1 % 5 = **1** **= $\mathbf{1131}_4$**

6. Convert following impulse diagram into binary, octal, hexadecimal and decimal number.

Answer:

- 101101001011 in binary system is **5513**.

101101001011
cutting binary number into groups of three, and accordingly to special table find octal number for each triple:

101	5
101	5
001	1
011	3
The number is:	5513

- 101101001011 in hexadecimal system is **B4B.**

Using same algorithm but cutting into groups of four digits (1011)(0100)(1011) let's convert each group using power of 2 raised each number from last digit:

1011 = $1^8 + 0^4 + 1^2 + 1^1 = 8 + 0 + 2 + 1 = 11$ (after 9 goes, A as 10 and **B** as 11)

0100 = $0^8 + 1^4 + 0^2 + 0^1 = 0 + 4 + 0 + 0 =$ **4**

1011 = **B** (as calculated above)

- 101101001011 in decimal system is **2891**

101101001011 = $1*2^{11} + 0*2^{10} + 1*2^9 + 1*2^8 + 0*2^7 + 1*2^6 + 0*2^5 + 0*2^4 + 1*2^3 + 0*2^2 + 1*2^1 + 1*2^0 = 2048 + 0 + 512 + 256 + 0 + 64 + 0 + 0 + 8 + 0 + 2 + 1 =$ **2891**