

2. Binary Systems and Codes

2.2. Positional Numeral Systems

Assignments

1. Write short notes and explain in your own words what are the major disadvantages of Roman numerals. What makes them impractical and limiting for scientific calculations?
2. * Learn [Maya numerals](#). It's an extremely easy and fun thing to do :-) Try some simple math with them e.g., calculate $17 + 45$.
3. * Recognize Maya numerals carved on the left side of [La Mojarra Stela 1](#). Which number do they form if we interpret them as a single number?
4. Write short notes and explain in your own words the meaning and the difference between the terms *digit*, *numeral*, and *number* in a positional numeral system. Give an example in a non-decimal system of your choice.
5. Define your own numeral system. Let its radix be smaller than five. Define your own digits. Be creative, the craziest the system, the better :-) Do some simple math in that numeral system e.g., calculate $13 + 34$. Does the choice of the symbols help you in doing calculations?

In the remaining assignments you will be using [NumbersAPI](#) to generate numbers, in particular, its [trivia](#) API. Open the following link in an internet browser of your choice to get a random number between 42 and 555: <http://numbersapi.com/random/trivia?min=42&max=555>

(For the record, 42 is the angle in degrees for which a rainbow appears or the critical angle. 555 is the number of seats of the airliner A380-800. :-)) To generate a new number, just refresh the page. Make sure to learn by heart the trivia you especially like :-)

6. Generate a couple of numbers using [NumbersAPI trivia](#). Treat each of them not as a decimal numeral but as a numeral in a particular base which you will choose. If the generated numeral does not contain the digit 9 pick the smallest possible base as the chosen base of that numeral. If the digit 9 appears in the numeral pick any base between 11 and 20. Afterwards, convert all of those numerals into their decimal equivalent.
E.g., 62 is the number which Sigmund Freud has an irrational fear of.
 $(62)_7 = \text{<do the math here>} = (44)_{10}$
E.g., 159 is the number of isomers of C₁₁H₂₄.
 $(159)_{18} = \text{<do the math here>} = (???)_{10}$
7. Generate a couple of numbers using [NumbersAPI trivia](#). Treat each of them as what they are, decimal numerals, and convert each of them into their binary, octal, hexadecimal, and vigesimal representations.