ROMAN NUMBERS

We wish in this article to define the standard Roman Numerals and to show how they can be added, subtracted, and multiplied. Although no longer in common use, because of the superiority of the Arabic Numbering System, they still are encountered on clock faces, chapter numberings in books, name of kings(Henry the VIIIs), certain commemorative dates such as WWII or the year of completion of major public works. Also, children during their early public school years are often exposed to Roman Numerals for the purpose of gaining a better understanding of how number systems work. It is amazing to realize that this numbering system, with all its shortcomings, was the one the Romans used in their 500 plus year conquest of most of the known world. I myself learned the system from a neighbor Dr.Dietlind Wegener, the wife of one of the operation paperclip scientists who in 1946 were stationed in Landshut, Germany prior to being brought to the US the following year.

Lets begin by looking at the seven basic symbols of Roman Numbers. Here they are including their Arabic equivalents-

BASIC NUMBER SYMBOLS

Roman	Arabic
I	1
V	5
X	10
L	50
C	100
D	500
M	1000

These symbols were taken over from the Etruscans who thrived in Northern Italy before the Roman arrival. These symbols also had earlier origins with the I representing one finger, V are the five fingers of the hand, and the X the total of ten fingers.
A bar across a given symbol means 1000 times the value (vinculum). So $\bar{V}$=5000 .
A smaller number preceding a larger one means subtract this from the larger. So XIV=10+5-1=14 and XXVII=20+5+2=27. The Arabic number 1936 in Latin reads MCMCCCV1. Any other integer less than several million can be expressed by using the folllowing Arabic-Roman calculator found at-

https://www.calculatorsoup.com/calculators/conversions/roman-numeral-converter.php

Using it we find –
337=300+30+7=CCC+XXX+V II =CCCXXXVII and-
1345=1000+300+40+5=M+CCC+XL+V=MCCCXLV

Except for division, the mathematical operations of addition, subtraction, and multiplication are easy to carry out using Roman numerals as will be demonstrated below. Let us go through these mathematical operations as I use them. The procedure will be to first convert a given Roman expression to Arabic. Next manipulate things and finally convert the answer back to Roman form. Let us begin by considering addition. Here is the addition operation for a specific case-

XXIV+LXXII=204+72=276=XXLXXVII

That is, we first convert things to Arabic Numbers, then carry out the operation in 1s, tens, 100ds, etc, and finally finish by converting the answer back into Roman Numbers. We usually carry out any addition operation in the following form-

P=CLXXXV + Q=CCCXLIII
(185) (343)

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adding up the Arabic components, we get
400+120+8=528 $which\ converts\ to\ R = \ DXXVIII$

Component representations in the Latin Numbering System can often be expressed in multiple forms. Thus, for example, the combinations IXV=XIV is equivalent to 14 in both cases.

Subtraction works in a similar manner to addition. Consider subtracting –

P=CCXV1 - Q=LXIV
(216) (64)

Sum=200-50+2=152 or R=CLII

Next we consider multiplication. Here we start with the well known multiplication algorithm as follows-

P=XVII x Q=XXIII
(17) (23)

8	46
4	92
2	184
1	368

You halve the elements in the first column to the nearest integer and double the numbers in the second column until 1 is reached in column P. Next adding up all Q sub-elements for which P is odd yields R= 23+368=391=CCCXCI . This is the correct answer.

Finally we come to division. This is a rather difficult operation in terms of Roman Numerals since they used a duodecimal (12) base for fractions and did not have the concept of zero (nulla in mediaeval Latin or Null in German) . This means that unless the numbers used in the division operation end in a integer or an integer and a base 12 fraction after the decimal, an exact value is not possible. Fortunately there is almost no evidence that division was a required operation in everyday Roman life. They got along fine with addition and subtraction and the use of an abacus. The symbols used in Latin for fractions went as follows-

Roman	Arabic
.	1/12
..	1/6
...	1/4
....	1/3
S	1/2
S⋯	3/4
I	1

A possible division is XVIII divided by IV equals IV plus S .

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