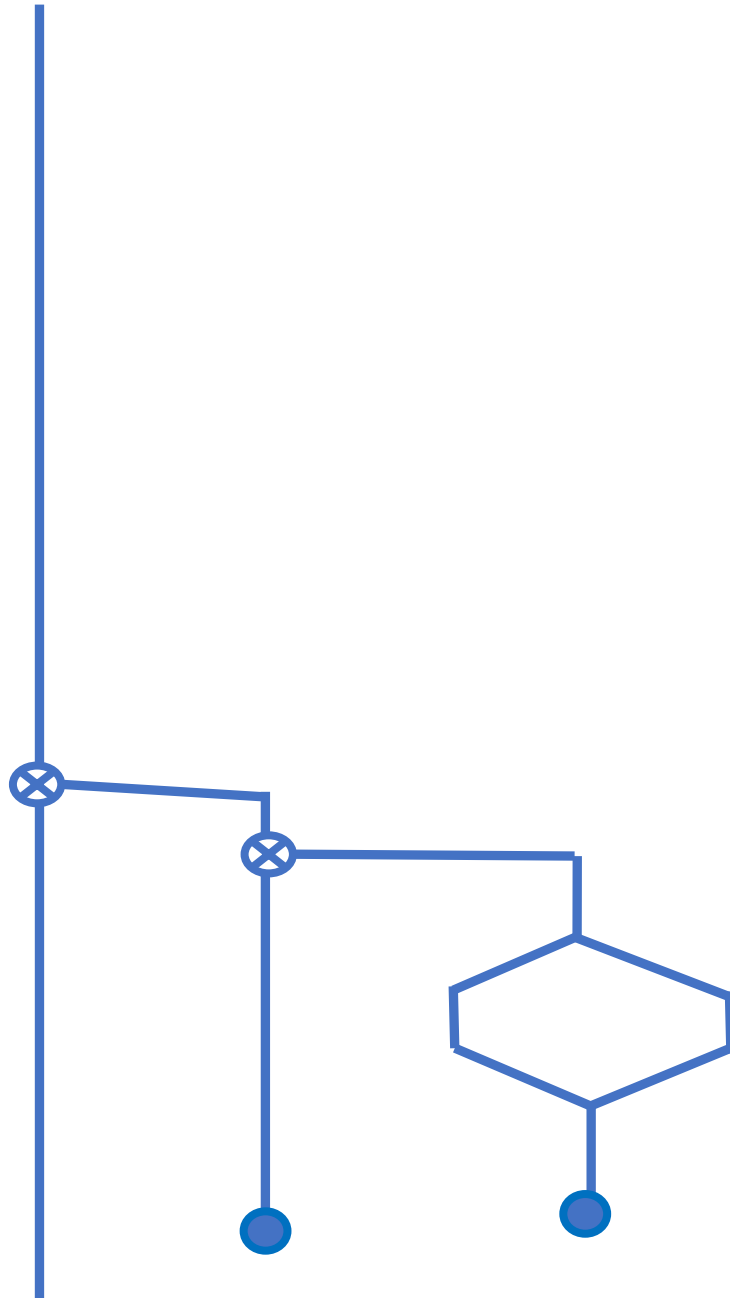


Forth Speaks Roman

Forth Day
Nov. 21 2020
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The Challenge

A Forth program to
convert decimal numbers
into Roman numerals.

The Need

- Roman numerals are based on a biquinary system.

biquinary: a mixed-base system of numbers in which each decimal digit is represented as a pair of symbols xy . e.g. In Roman numerals $5 = V$ and $1 = I$, so $7 = VII$, 11 is XI .

But . . .

- Instead of 4 being IIII, it is IV.
- And instead of 9 being VIIII, it is IX.
- Allowances must be made!

The Process

- For any decimal number ending in 4 substitute the symbol 1 'quintades' ahead, prefixed by the current unit value. [4 = IV]
- For any decimal number ending in 9 substitute the symbol 2 'quintades' ahead, prefixed by the current unit value. [9 = IX]

The Pseudocode

Create a table of Roman symbols to Arabic numbers.

Get the decimal number.

Setup an output buffer.

Over 4 decimal digits DO:

 From the low order digit, noting the conversion decade:

 Use a case statement to select output Roman characters.

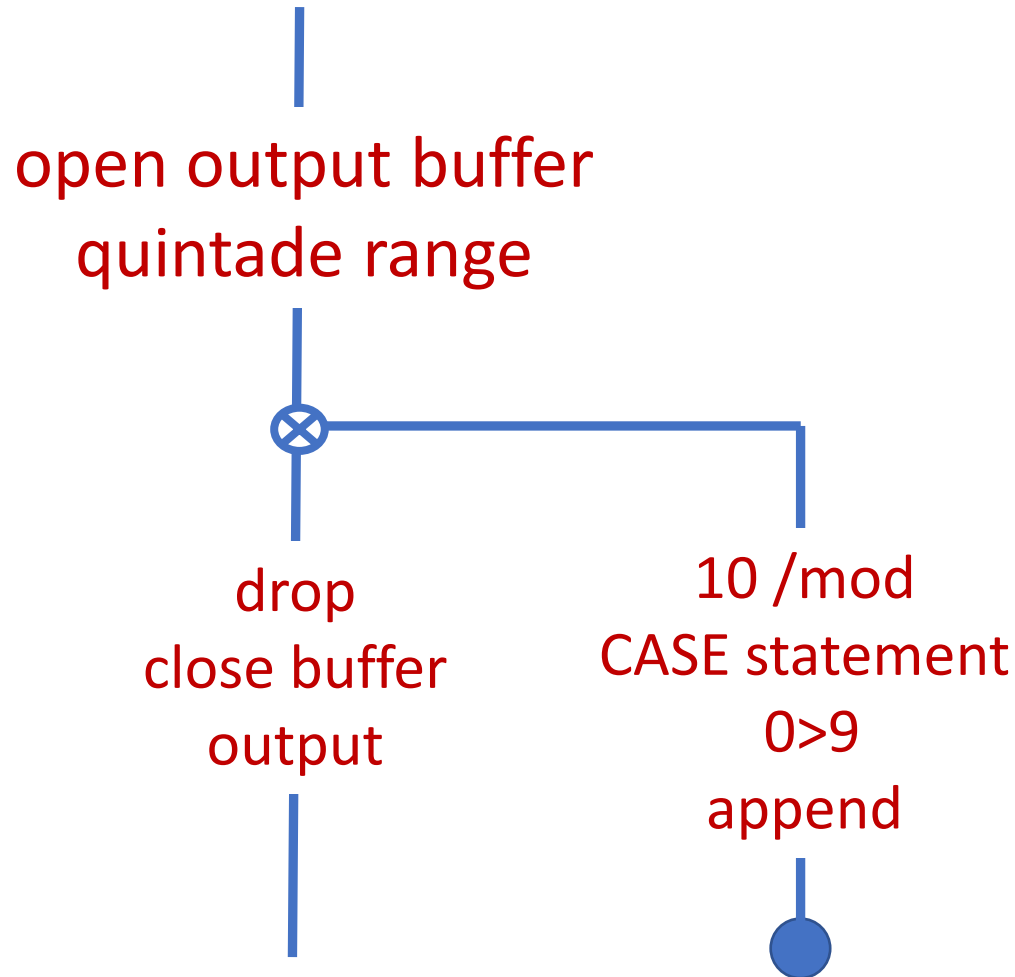
 Add the characters to the output buffer.

LOOP until 4 digits have been processed.

Close the output buffer leaving the buffer address and count.

Display the Roman text.

The D-Chart



ASCII Table

```
CREATE r-table
\ ASCII values by quintade
  CHAR I c,  CHAR U c,
  CHAR X c,  CHAR L c,
  CHAR C c,  CHAR D c,
  CHAR M c,
```


The Case Statement

CASE (for each decimal decade, right to left)

If 0, to nothing

If 1, 2 or 3, add the same current character(s).

If 4, add character higher and one current character. [i.e. IV]

If 5, add one character higher. [i.e. V]

If 6, 7 or 8, add 1, 2 or 3 of current character(s) and one character higher. [i.e. VII]

If 9, add two characters higher and one current. [i.e. IX]

The CASE statement

: SELECTOR

CASE

```
0  OF drop  ( skip zero value)                ENDOF  
4  OF dup 1+  1 hold-char      1 hold-char    ENDOF  
5  OF                                1+ 1 hold-char ENDOF  
6  OF dup      1 hold-char 1+ 1 hold-char    ENDOF  
7  OF dup      2 hold-char 1+ 1 hold-char    ENDOF  
8  OF dup      3 hold-char 1+ 1 hold-char    ENDOF  
9  OF dup 2 + 1 hold-char      1 hold-char    ENDOF  
( for 1 2 3)      hold-char                1 ENDCASE
```

;

The 'wrapper' code.

```
: >roman
  <#          \ output buffer
  r-table 7 + r-table \ loop range
DO
  10 /mod i rot SELECTOR
  2 +LOOP drop
  #> type \ close buffer & output
;
```

Demonstration

	I	II	III	IV
V	VI	VII	VIII	IX
X	XI	XII	XIII	XIV
XV	XVI	XVII	XVIII	XIX
XX	XXI	XXII	XXIII	XXIV
XXV	XXVI	XXVII	XXVIII	XXIX
XXX	XXXI	XXXII	XXXIII	XXXIV
XXXV	XXXVI	XXXVII	XXXVIII	XXXIX
XL	XLI	XLII	XLIII	XLIV
XLV	XLVI	XLVII	XLVIII	XLIX
L	LI	LII	LIII	LIV
LV	LVI	LVII	LVIII	LIX
LX	LXI	LXII	LXIII	LXIV
LXV	LXVI	LXVII	LXVIII	LXIX
LXX	LXXI	LXXII	LXXIII	LXXIV
LXXV	LXXVI	LXXVII	LXXVIII	LXXIX
LXXX	LXXXI	LXXXII	LXXXIII	LXXXIV
LXXXV	LXXXVI	LXXXVII	LXXXVIII	LXXXIX
XC	XCI	XCII	XCIII	XCV
XCV	XCVI	XCVII	XCVIII	XCIX
C	CI	CII	CIII	CIV ok