**Assignment #6**
**Arabic to Roman Numerals**

Develop the MASM Assembly source code required to solve the following problem.

# Problem

Develop a program that prompts the user for a (signed) 32-bit integer (Arabic numerals) and then calculates and prints out to the screen the corresponding Roman numeral.

## Roman Numerals

Roman numerals are created using the following symbols:

| 1 | 5 | 10 | 50 | 100 | 500 | 1000 |
|---|---|---|---|---|---|---|
| I | V | X | L | C | D | M |

These symbols can then be combined as follows:

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| I | II | III | IV | V | VI | VII | VIII | IX |

| 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 | 90 |
|---|---|---|---|---|---|---|---|---|
| X | XX | XXX | XL | L | LX | LXX | LXXX | XC |

| 100 | 200 | 300 | 400 | 500 | 600 | 700 | 800 | 900 |
|---|---|---|---|---|---|---|---|---|
| C | CC | CCC | CD | D | DC | DCC | DCCC | CM |

For the purposes of this program, Roman numerals will abide by the following rules:

1. They are unable to represent negative numbers or zero.
2. The digits `I`, `X` and `C` are only repeated a maximum of three times.
3. The digits `V`, `L` and `D` are never repeated.
4. The digit `M` can be repeated as many times as necessary.
5. When a digit of equal or lower value is written following a digit of higher or equal value, the digits are added. Examples:
   - `VI` = 5 + 1 = 6
   - `XIII` = 10 + 1 + 1 + 1 = 13
   - `XV` = 10 + 5 = 15
   - `LXV` = 50 + 10 + 5 = 65
6. When a digit of lower value is written prior to a digit of higher value, then the value of the lower digit is subtracted from the value of the higher digit. Examples:
   - `IV` = 5 - 1 = 4
   - `IX` = 10 - 1 = 9
   - `CLIX` = 100 + 50 + (10 -1) = 159
7. Keep in mind, rule #6 is not extended beyond the chart above (e.g. `IL` is not used for 49, rather it should be written as `XLIX`).

## Assignment Guidelines

1) Your solution must print out your Name and R Number as the first line of output. This will be considered part of your program's "Correctness".
    a. Keep in mind the example input/output below does not show this line.
2) All user input should be read from the keyboard.
3) All output should be printed to the screen in a clean and legible manner.
4) Your solution should only accept valid (positive) input; incorrect input should trigger an appropriate error message and prompt for the input again.
5) You may not make use of any assembly instructions or concepts we have not yet covered in class.
6) You may not make use of conditional control flow directives.
7) Your solution should continue to prompt for additional Arabic Numerals until given a 0 (zero) as input.
8) Your solution's Roman Numeral output must conform to the rules for Roman Numerals described above in order to be correct. I.E. For each given Arabic Numeral input there is only 1 correct Roman Numeral output.

## Solution Layout

Your MASM assembly source code should have the following elements in this order:

1) Your name, the date, and the assignment commented along the top.
2) A comment giving a brief description of the problem.
3) A comment laying out the algorithm/pseudocode/methodology you used to solve the problem.
4) Your commented MASM source code.

## What to turn in to BlackBoard

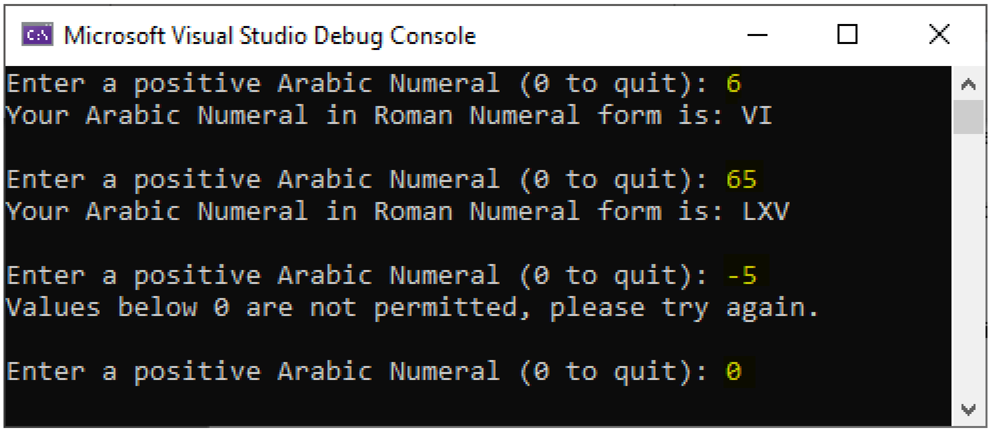
A 'zip' file named "assignment_7.zip" that contains the following:

- Your .asm source code file
- A copy of the assembled executable

## Example Input/Output

The following example input/output has been altered to show the user's input in yellow text. This is purely to make finding the user's input versus the program's output easier to see – your solution will not be required to have differences in color.

Image on next page.



```
Enter a positive Arabic Numeral (0 to quit): 6
Your Arabic Numeral in Roman Numeral form is: VI

Enter a positive Arabic Numeral (0 to quit): 65
Your Arabic Numeral in Roman Numeral form is: LXV

Enter a positive Arabic Numeral (0 to quit): -5
Values below 0 are not permitted, please try again.

Enter a positive Arabic Numeral (0 to quit): 0
```