**CS215: Introduction to Program Design, Abstraction and Problem Solving**
**(Spring, 2023)**
**Lab Assignment 5**
**(20 points)**
Today's Date: Saturday, February 11
<span style="color:red">**Demonstration Due Date: the end of Lab6 class**</span>
<span style="color:red">**Submission Due Date: Friday, February 24**</span>

The purpose of this lab assignment is
- `to continue practicing how to define your own functions`
- `to help you make big progress with Project 1`

**Problem Statement:**

1. The Roman numerals were adopted to clarify any confusion that may occur because the NFL Championship Game—the **Super Bowl**—is played in the year following a chronologically recorded season. In Project 1, you will write a program to represent the **Super Bowl** in Roman Numeral representation.

This Lab assignment will help you solve one sub-problem of Project 1: complete and test the definition of the function, named `roman_numeral`, shown as follows:

```
/*
   Purpose: convert the integer n to its corresponding Roman Numeral
            n must be between 1 and 3999
            it returns string form of the Roman Numeral
   @param n int: representing the number to convert into Roman Numeral
   @return string: representing the corresponding Roman Numeral for n
*/
string roman_numeral(int n);
```
(Please note that you can define other functions if you think you need to reuse the same block of code more than twice.)

2. Download the source file, named Lab5.cpp, from the following link:
https://www.cs.uky.edu/~yipike/CS215/Lab5.cpp
Complete the definition of the function, named `roman_numeral`. Please note that if you want to define other functions, you always need to follow this rule: "functions cannot be called before they are declared." You may provide the complete definition of the function before calling it, or at least provide the function declaration (in function header) before calling it.
If you have finished this function definition in your Project 1, you can simply copy the definition from Project 1 to Lab 5, and try to compile the program. If you have not done it for Project 1, after you finish Lab 5, you can copy the definition to your Project 1.

After passing the compilation, please test running your program. The output of your program should **<span style="color:blue">EXACTLY</span>** match the following sample output:

```
                     Super Bowl Records
The first Super Bowl was hold at Los Angeles Memorial
Coliseum on January 15, 1967
          Year              Super Bowl

*********************************

          2000     --->     XXXIV
          2001     --->     XXXV
          2002     --->     XXXVI
          2003     --->     XXXVII
          2004     --->     XXXVIII
          2005     --->     XXXIX
          2006     --->     XL
          2007     --->     XLI
          2008     --->     XLII
          2009     --->     XLIII

***********************************

          2010     --->     XLIV
          2011     --->     XLV
          2012     --->     XLVI
          2013     --->     XLVII
          2014     --->     XLVIII
          2015     --->     XLIX
          2016     --->     L
          2017     --->     LI
          2018     --->     LII
          2019     --->     LIII

************************************

          2020     --->     LIV
          2021     --->     LV
          2022     --->     LVI
          2023     --->     LVII
          2024     --->     LVIII
          2025     --->     LIX
          2026     --->     LX
          2027     --->     LXI
          2028     --->     LXII
          2029     --->     LXIII

**********************************

          2030     --->     LXIV
```

```
2031      --->      LXV
2032      --->      LXVI
2033      --->      LXVII
2034      --->      LXVIII
2035      --->      LXIX
2036      --->      LXX
2037      --->      LXXI
2038      --->      LXXII
2039      --->      LXXIII

**********************************

2040      --->      LXXIV
2041      --->      LXXV
2042      --->      LXXVI
2043      --->      LXXVII
2044      --->      LXXVIII
2045      --->      LXXIX
2046      --->      LXXX
2047      --->      LXXXI
2048      --->      LXXXII
2049      --->      LXXXIII

**********************************

2050      --->      LXXXIV
2051      --->      LXXXV
2052      --->      LXXXVI
2053      --->      LXXXVII
2054      --->      LXXXVIII
2055      --->      LXXXIX
2056      --->      XC
2057      --->      XCI
2058      --->      XCII
2059      --->      XCIII

**********************************

2060      --->      XCIV
2061      --->      XCV
2062      --->      XCVI
2063      --->      XCVII
2064      --->      XCVIII
2065      --->      XCIX
2066      --->      C
2067      --->      CI
2068      --->      CII
```

```
        2069      --->     CIII

*********************************

        2070      --->     CIV
        2071      --->     CV
        2072      --->     CVI
        2073      --->     CVII
        2074      --->     CVIII
        2075      --->     CIX
        2076      --->     CX
        2077      --->     CXI
        2078      --->     CXII
        2079      --->     CXIII

***********************************

        2080      --->     CXIV
        2081      --->     CXV
        2082      --->     CXVI
        2083      --->     CXVII
        2084      --->     CXVIII
        2085      --->     CXIX
        2086      --->     CXX
        2087      --->     CXXI
        2088      --->     CXXII
        2089      --->     CXXIII

***********************************

        2090      --->     CXXIV
        2091      --->     CXXV
        2092      --->     CXXVI
        2093      --->     CXXVII
        2094      --->     CXXVIII
        2095      --->     CXXIX
        2096      --->     CXXX
        2097      --->     CXXXI
        2098      --->     CXXXII
        2099      --->     CXXXIII
```

**Demonstration and Submission**

**1.** Each Lab assignment needs to demonstrate to your TA to be graded. You can demonstrate Lab5 during Lab5 class (with possible bonus 3 points) or no later than the end of Lab6 class (this is **the demonstration deadline** for Lab5).

*If you finish Lab5 assignment during Lab5 class, you may demonstrate your program to your TA and answer your TA's questions, you can get up to 3 extra points for this lab assignment. (Note you can also demonstrate your program to your TA during Lab6 class. However, any demonstration later than the end of the Lab5 class cannot get bonus 3 points.)*

*If you need extra time, you can continue working on Lab5 assignment after the Lab class, and try to finish it before the next Lab class. Then demonstrate your Lab5 during Lab6 class.*

**If you do not demonstrate your code, even if you submit it in Canvas, you will receive a grade of 0!!** *The TA may ask you to make some corrections. If so, make the corrections and demonstrate again…repeat until you have 100%!*

2. After the successful demonstration, submit the code in Canvas. Open the link to Course Canvas page (https://www.uky.edu/canvas), and log in to your account using your LinkBlue ID and password. Please submit your source code in a .cpp file through link "**Lab 5**".

**Even if you successfully demonstrated it to the TA, if you do not submit in Canvas by the submission deadline,** *you will receive a grade of 0!*

**Grading (20 points + Bonus 3 points)**

    1. Attend the lab session or have a documented excused absence.     (5 points)
    2. Demonstrate your program to your TA and submit it in Canvas.    (15 points)
       • Include comments as specified in the lecture notes.           (3 points)
       • Provide the correct definition of the function, named roman_numeral().
                                                 (12 points)

Demonstrate your program to your TA and answer TA's questions during Lab class when the same Lab assignment is given. (Bonus 3 points)

**Reference:**

As part of the simpler smaller sub-problem to solve in the given demo program, it can only convert the number at the range of [1, 99] to its corresponding Roman numeral. For example, if you run the demo program with an input number, say 68, and it will convert **68** to Roman numeral, **LXVIII**.

Based on the source code of Demonstration program, you should modify the solution to a smaller problem into the complete solution to the bigger problem in this Lab assignment.

You may refer the solution to Demo program from the following link:
https://www.cs.uky.edu/~yipike/CS215/RomanNumbersKey.cpp