This sheet is to be returned at the conclusion of the lab session.

Student Name:________________________ Student Number:________________

ENG 1D04, Lab 5, Marked Assignment 2, Loops, Friday

This assignment has to be submitted via ELM before 2:10 pm. **Assignments will not be accepted after this time.** As for the practice lab, compress the contents of your project folder, rename it, and submit one zip file. Please remember to submit your work early and resubmit often. **You should not wait until the end of the lab to start submitting.** You must do the assignment on your own. Conversations between students will not be permitted. You cannot bring reference material into the lab or access information through the Internet. You may use the Visual C# help, Notepad, and the Calculator program.

Background

Let n be a natural number. A *divisor* of n is a natural number d with $1 \leq d \leq n$ such that d divides n evenly (i.e., $n \mathsf{~mod~} d = 0$ in mathematical notation and n `%` d `== 0` in C# notation). For example, the divisors of 6 are 1, 2, 3, and 6. The *greatest common divisor (GCD)* of two positive natural numbers m and n is the greatest natural number that is a divisor of both m and n. For example, the GCD of 12 and 16 is 4.

Overview

Your program will compute the greatest common divisor of two positive natural numbers. Design, implement and test the application described in the requirements below. When done, compress the project and rename the zip file

MacID_StudentNumber_LabSection`_Lab5.zip`

where *MacID*, *StudentNumber*, and *LabSection* are your MacID, student number, and lab section (written as `L`*xy*), respectively. Details of what you must submit are specified below.

Requirements

1. A method with the heading

   ```
   int GCD(int m, int n)
   ```

   that, given two positive integers m and n as input, returns the GCD of m and n as output.

2. A graphical user interface (GUI) consisting of a form with the controls described below. The text `Greatest Common Divisor Calculator` is at the top of the form. The form should be very similar to the form used for Marked Assignment 1.

3. One input label box with the label `First natural number =` , followed by a text box to accept the input. Another input label box with the label `Second natural number =` , followed by a text box to accept the input.

4. One output label box with the label `Output`.

5. A `Calculate` button that when clicked replaces the output label `Output` by `The greatest common divisor = X` where `X` is the result of calling the `GCD` method on the two input values. If either input value is nonpositive or either input text box is empty, a message box is created which says `The input values are inadmissible.`

6. A `Clear` button that when clicked causes the input text boxes to be cleared of their values. It also restores the output label box back to the original value of `Output`.

7. When the application starts, the input text box is empty.

Design

In your project folder include a separate text document (using Notepad) with the file name *Name_LabNumber*`_Lab5.txt` where *Name* is your name and *LabNumber* is your lab section. The report will answer two questions, one related to design and the other related to testing. The testing question is given below. The design question is:

> Explain how the `GCD` method could be made more efficient if it considered each i such that $1 \leq i \leq k$ from k to 1 instead of from 1 to k (see **Implementation in Visual C#** below).

Implementation in Visual C#

Implement the requirements listed above. Assume m and n are the input values. Write the `GCD` method using a for loop that successively considers each i such that $1 \leq i \leq k$ where k is the minimum of m and n. The body of the loop checks to see if i is a divisor of both m and n, and if so, processes it appropriately. Your `GCD` method will be marked for correctness, not for efficiency.

Testing

In the *Name_LabNumber*`_Lab5.txt` file, answer the following testing question:

> If (m, n) is a test case, is it necessary for (n, m) to also be a test case? Justify your answer.

Side Remark

Euclid described an efficient algorithm for computing the GCD of two natural numbers in his famous work *Elements* (c. 300 BCE). Known today as the *Euclidean algorithm*, this algorithm is one of earliest great achievements in computing.