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, Tuesday

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., $n \bmod d = 0$ in mathematical notation and n % d == 0 in C# notation). For example, the divisors of 6 are 1, 2, 3, and 6.

Overview

Your program will sum the divisors of a natural number. 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 SumOfDivisors(int n)
   ```

   that, given a nonnegative integer n as input, returns the sum of the divisors of n as output.

2. A graphical user interface (GUI) consisting of a form with the controls described below. The text `Sum of the Divisors 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 `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 sum of the divisors = X` where X is the result of calling the `SumOfDivisors` method on the input value. If the input value is negative or the input text box is empty, a message box is created which says `The input value is inadmissible.`

6. A `Clear` button that when clicked causes the input text box to be cleared of its value. 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:

> Which method should create the message box for inadmissible input values, the `SumOfDivisors` method or the click method for the Calculate button? Justify your answer.

Implementation in Visual C#

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

Testing

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

> Would it be appropriate to test only prime numbers? Justify your answer.

Side Remark

A natural number $n + 1$ is a perfect number if the sum of the divisors of n equals $n + 1$. For example, 6 is perfect because $1 + 2 + 3 = 6$. Thus the `SumOfDivisors` method can be used to check whether or not a natural number is perfect. The first four perfect numbers (6, 28, 496, 8128) were discovered by Euclid (c. 300 BCE). There are 47 known even perfect numbers, but no odd perfect number has ever been discovered.