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

Student Name:_____   Student Number:_____

ENG 1D04, Lab 3, Marked Assignment 1, Expressions, Friday

   This assignment has to be submitted via ELM before 1:45 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.

Overview

A torus is a donut-shaped solid made by forming a tube into a circle. Your program will calculate the surface area of a torus with a given circle radius and tube radius. The surface area A of a torus with circle radius R and tube radius r is given by the following formula:

$$A = 4\pi^2 Rr.$$

Design, implement and test the application described in the requirements below. When done, compress the project and rename the zip file

   *MacID_StudentNumber_LabSection_*`Lab3.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

Your application form should be modelled on the form below. (Your form will have fewer inputs and outputs.)

1. One input label box with the label `Circle radius =` , followed by a text box to accept the circle radius input, followed by a units label box with the label `meters`. Another input label box with the label `Tube radius =` , followed by a text box to accept the tube radius input, followed by a units label box with the label `meters`.

2. Two output label boxes with the labels `Output1` and `Output2`.

3. A `Calculate` button that is clicked to perform the necessary calculations and update the output label boxes.

4. When the `Calculate` button is clicked, the output label boxes should be updated as follows:

    a. The label `Output1` should be replaced by `The surface area of the torus = X` where `X` is the calculated surface area for a torus whose circle radius and tube radius are the first and second input values, respectively.

    b. The label `Output2` should be replaced by `The surface area of the torus with the circle radius and tube radius doubled = Y` where `Y` is the calculated surface area for a torus whose circle radius and tube radius are twice the first and second input values, respectively.

5. A `Clear` button that when clicked causes the input text boxes to be cleared of their values. It will also restore the output label boxes back to the original values of `Output1` and `Output2`. The face of the button is blue, and the text is white.

6. The text `Name of the Form` on the Graphical User Interface (GUI) displayed above should be replaced by `Torus Surface Area Calculator`.

7. When the applications starts, the input text boxes are empty.

8. You do not need to protect against "inadmissible inputs" such as a negative input value or an empty input text box.

Design

In your project folder include a separate text document (using Notepad) with the file name *Name_LabNumber_*`Lab3.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:

> What are the advantages of coding the formula for the surface area of a torus just once (using a separate method) instead of once for each output?

Implementation in Visual C#

Implement the requirements listed above. Use the constant `Math.PI` from the C# `Math` class to represent the value π.

Testing

In the *Name_LabNumber_*`Lab3.txt` file, answer the following testing question:

> What set of inputs, along with expected outputs, would provide a good test of your application?