## Assignment #2 – Load Moment on a Beam

Overview

In this assignment, you will write a program to find the moments on a statically-loaded beam as the beam is raised in fixed angular steps from horizontal to some final angle. A load moment is calculated at each position. The mass of the load in kilograms, the length of the beam in meters, and the incremental steps of the angle in degrees, are to be entered as inputs. In addition, while the angle changes at each step, the beam position changes, which results in a change in the load moment; thus, you also need to enter how many positions you want to include in your calculations. The results of load moments are to be displayed in a list box.

Length

Weight

Angle

Moment = Weight x Length x Cos(Angle)
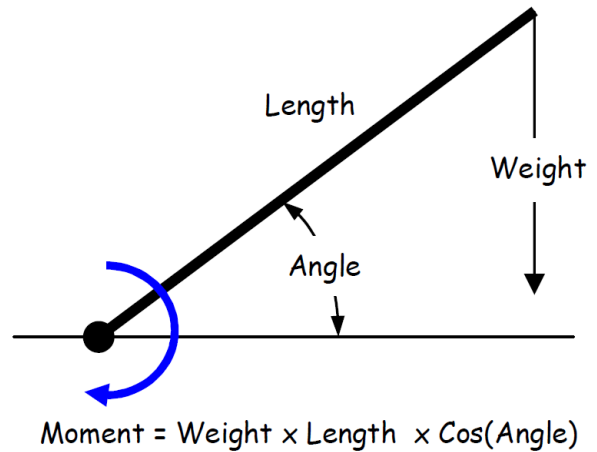
This assignment must be done individually, and it is worth 5% of the course grade.

Design and Coding

1. Task Analysis and Program Design:

    1.1. Let's reinforce the "IPOD" model to develop this program.

    1.2. Based on the assignment description, there are four inputs to be entered at runtime, which are:

    - The load's mass (in kilograms)
    - The beam's length (in meters)
    - The incremental steps of the angle (in degrees)
    - The number of beam positions
    - You can use 4 textboxes for the inputs, along with 4 labels as identifiers.
    - As Input Statements, you need to store the 4 entered values into 4 variables.

    1.3. The processing involves a few steps to find the load moment at each angle.

    - Calculate the weight of a mass:
      weight = mass * G, where G is the constant of gravity acceleration and is 9.81 m/s^2.

    - Calculate the moment at a given angle:
      moment = weight * length * cos (angle * PI / 180)

      Note that $\frac{angle}{180} \times \pi$ is to convert an angle in degree into radians, as required by the cosine function.

    - Calculate the next angle:
      angle = angle + incremental step (or change)

    - Repeat the above 3 steps, until the number of positions is reached.

    1.4. The two outputs are displayed in two list boxes, one for the incremented angles in degree, and the other for the calculated moments. Two more labels are also necessary as the headers of listboxes.

    1.5. The list of calculated moments is displayed, once a button is clicked.

    1.6. The program will be ended by a quit button.

2. Launch Visual Studio 2019 and create a Visual Basic Windows Forms App (.NET Framework).

    2.1.Project Name: **A2_LoadMoments_YourCollegeUsername**

       ➢ Your College username is the username you use to log into eConestoga.

    2.2. Project Location: your Visual Studio 2019 projects folder on your College OneDrive

3. Based on the task analysis, design a graphical user interface (GUI) to include the following controls with property settings:

CONTROL	PROPERTY	SETTING
Form1	Text	Load Moments on a Beam
	FormBorderStyle	FixedToolWindow
	StartPosition	CenterScreen
Label1	Text	Mass (kg):
Label2	Text	Length (m):
Label3	Text	Angle Change (deg):
Label4	Text	Number of Positions:
Label5	Text	Angle (deg)
Label6	Text	Moment (N-m)
TextBox1	(Name)	txtMass
	TextAlign	Right
TextBox2	(Name)	txtLength
	TextAlign	Right
TextBox3	(Name)	txtAngleChange
	TextAlign	Right
TextBox4	(Name)	txtNumOfPos
	TextAlign	Right
ListBox1	(Name)	LstAngles
ListBox2	(Name)	LstMoments
Button1	(Name)	btnCalculate
	Text	Calculate
Button2	(Name)	btnQuit
	Text	Quit

Here is a sample GUI:

4. Here are the detailed requirements for this assignment:

4.1. Follow the "IPOD" coding model that was discussed and practiced before.

4.2. The calculation process is initiated by clicking the `Calculate` button.

4.3. Declare two constants, `PI = 3.1415926` and `G = 9.81`

4.4. Declare variables that you'll need to perform the calculations, with proper data types.

4.5. Keep <u>two</u> decimal places for the results of moment displayed in the ListBox `LstMoment`, and keep <u>zero</u> decimal place for the listed angles in the other list box `LstAngle`.

4.6. The calculations repeat at each incremented angle value, so you need to add a looping structure to calculate all the calculated moments at all the positions along with corresponding angles, and displaying the results in the two list boxes. A sample calculation result is shown below, with a *Mass* of 10Kg, a *Length* of 10m, an *Angle Change* of $2°$, and a *Number of Positions* of 5.

Angle (deg)	Moment (N-m)
0	981.00
2	980.40
4	978.61
6	975.63
8	971.45

Note: math Round method may not keep any trailing zero(s), so you will need to consider using other method, such as ToString, in order to maintain 2 decimal places for ALL calculations.

4.7. The program will terminate, once the `Quit` button is clicked.

4.8. Use the **TextChange** event of each textbox to clear all the items (if any) in both list boxes, anytime a new value is entered in any one of the textboxes.

Assignment Submissions

You need to submit a PDF file of your source code with a title page, as well as uploading the zipped file of your VB project to Assignment #2 dropbox.

a. For the PDF file, you must include your **<u>full name</u>**, course number, course name, etc. on the title page and on the FIRST line of your source code, as a comment.

b. For the zipped file, refer to Tutorial #04 (available in Week 04 syllabus) on how to compress a Visual Basic 2019 project for the detailed instructions.

c. The due date of Assignment #2 is shown on eConestoga. Both files must be submitted by the due date – **late submission will NOT be accepted**.