

# ENG TECH 1PR3 Programming Principles

## Selection Structures

### Lab 02

Be sure to assign all input to appropriate variables. Do NOT use the textbox control name directly in the calculations. Instead, assign the value of a textbox control to a variable and use the variable in the calculations. Assign the result of the calculations to an appropriate form control. Ensure the forms are well-behaved. A form must contain an Exit button, sensible tabbing and alt-shortcuts where appropriate.

1. A force **F** is acting on a body whose x & y-components ( $F_x \neq 0$  and  $F_y \neq 0$ ) are known. We want to determine the magnitude ( $|F|$ ) and direction ( $\theta$ ) of the force. Create a VB application that will allow the user to enter non-zero x & y-components of a force and calculate the magnitude and direction of the force.

$$|F| = \sqrt{(F_x)^2 + (F_y)^2}, \quad \theta_a = \tan^{-1} \left| \frac{F_y}{F_x} \right|$$

$$\theta = \begin{cases} \theta_a, & \text{if } F_x > 0, F_y > 0 \\ \pi - \theta_a, & \text{if } F_x < 0, F_y > 0 \\ \pi + \theta_a, & \text{if } F_x < 0, F_y < 0 \\ 2\pi - \theta_a, & \text{if } F_x > 0, F_y < 0 \end{cases}$$

Display the magnitude and angle to one decimal place and angle ( $\theta$ ) in degree. Include a checkbox in your application. If the checkbox is selected, display  $\theta_a$  to one decimal place and in degree.

2. The weight of an object on or above the planet is the gravitational force that the planet exerts on the object. The weight always acts downward, toward the center of the planet. The relation between weight ( $W$ ) and mass ( $m$ ) of an object is defined as

$$W = G \frac{M m}{r^2}$$

where,  $G = 6.674 \times 10^{-11} \text{ N} \cdot \text{m}^2 / \text{kg}^2$  is the universal gravitational constant,  $M$  is the mass (in kg) of the planet and  $r$  is the distance (in m) from the center of planet to the center of an object.

Create a VB application that will calculate the weight of an object for given  $M$ ,  $m$  and  $r$ . Provide two TextBox controls to let the user enter the value for  $M$  and  $m$ . Use the TryParse method for validating user input. Include three radio buttons for the distance ( $r$ ), if the object is (a) on the planet (b) 100 km above the planet (c) 500 km above the planet. On the planet, the value of  $r$  is  $6.38 \times 10^6 \text{ m}$ . Second option button must be selected by default (set as run time property). When the user clicks calculate button, the application should display input and output values in a label control. Display all numbers in exponential notation. Use the following input values for screen capture,

$$M = 5.98 \times 10^{24} \text{ kg}, \quad m = 1.16 \times 10^4 \text{ kg}, \quad \text{for } r, \text{ select option 3}$$

## **Submitting the Lab**

In order for your Lab/Assignment to be eligible for grading you must submit the following:

- The code must contain your Full Name and Student ID in a comment block at the top of each form module.
- A .zip compressed file containing the entire VB.NET project to AVENUE. Use .zip compression only (no RAR, TAR etc). If there is more than one project, create a separate .zip file for each individual project. Be sure to add all project files and folders to the .zip file. If the compressed file is missing files/folders such that the project will not open or run, the lab/assignment will receive a grade of 0.
- A Word .doc (or .docx) file containing:
  - A cover page that includes your name, Student ID, and MAC ID
  - The form code (event and other subprocedures and functions) including programmer's block
  - Screen captures of the form showing sample input and output.

Upload the Word file and .zip file(s) **separately** to the appropriate assignment drop-box on AVENUE.

Labs and assignments will not be accepted for evaluation if any of the above items are omitted and will result in a grade of 0.