

CEG 220 Laboratory 4

Name _____ Lecture Sect (circle) 01 02 Lab Instructor (circle) A. Lieb S. Guo

Lab Section (circle one) -05: F(10:25 am) -06: F(12:20 pm) -07: F(2:15 pm) -08: F(4:10 pm)

1. (40 pts) Write a program that calculates the user's body mass index (BMI) and categorizes it as underweight, normal, overweight, or obese, based on the following table from the United States Centers for Disease Control:

| <u>BMI</u> | <u>Weight Status</u> |
|----------------|----------------------|
| below 18.5 | underweight |
| 18.5 – 24.9 | normal |
| 25.0 – 29.9 | overweight |
| 30.0 and above | obese |

To calculate BMI based on a weight in pounds, and a height in inches use the following equation,

$$\text{BMI} = \frac{FW}{H^2}$$

where W = weight in pounds, H = height in inches, and F is a constant unit conversion factor = 703.

You must use separate functions to get an input weight in pounds, and an input height in inches. These functions should prompt the user to enter the input, echo it to the screen, and return it.

You must use a function to calculate body mass index for the given weight and height, and return it.

You must use a function that prints the weight status for the given body mass input to the screen. Use if statements, as needed to perform this task. Don't hard code the conversion factor, F; treat it as a fixed constant using the const keyword. Do not use switch statements.

2. (60 pts)

Write a program that prints the solution to the a general quadratic equation

$$ax^2 + bx + c = 0$$

The general solution is

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Prompt the user to enter the coefficients a, b, and c, and then print out the solutions.

Note that there are several special cases to consider.

If a and b are zero, the equation is invalid. If a is zero, the general formula doesn't work (but there is a root).

if $b^2 - 4ac = 0$ the solution is a double root with only one value.

if $b^2 - 4ac < 0$ the roots are complex, and should be printed out in complex form: $x_1 = x_{\text{real}} + x_{\text{imag}}i$, and $x_2 = x_{\text{real}} - x_{\text{imag}}i$.

Your program should efficiently use **if** statements (nested if appropriate) as needed to print the correct solution for any possible case.

You must use functions to get the coefficients. Use separate functions for each coefficient. The functions should prompt the user to enter a coefficient, echo it to the screen, and return the value.

Since the coefficients may not yield a valid solution, your program must test for this condition. If the equation is invalid, print a message, and exit; otherwise print the correct solution to the screen. You must use function that returns a boolean true or false to test the validity of the coefficients, you must use a function to determine the correct solution and you must use a function to print the correct solution to the screen.

You should also use a function to calculate the discriminant, $b^2 - 4ac$, wherever you need to.