PIC 10A Section 2 - Homework # 3 (due Monday, January 24, by 11:59 pm)

You should upload each .cpp (and .h file) separately and submit them to CCLE before the due date/time! Your work will otherwise not be considered for grading. Do not submit a zipped up folder or any other type of file besides .h and .cpp.

Be sure you upload files with the precise name that you used in your editor environment otherwise there may be linker and other errors when your homeworks are compiled on a different machine. Also be sure your code compiles and runs on Visual Studio 2022.

TABLE FORMATTING

This homework will give some practice in math operations, strings, and formatting output. You should submit a single file **table.cpp**.

In this homework, we will allow the user to enter 3 data points, to choose labels for the x- and y-values, and to set a level of precision. The program will then display the data in a table, display the line of best fit equation (don't worry, it is provided below), and the correlation coefficient (also provided below). Here when we speak about "precision" we mean: all numbers will be displayed with as many digits after the decimal as precision specifies, without an exponent.

Please refer to the syllabus for how the work will be graded. The program should execute in the following manner. You must make sure the output matches the format demonstrated perfectly.

Important notes and assumptions:

- The table is delineated with dashes (-) and pipes (|). The width of the table with the dashes *is precisely, no more and no less, the number of characters in total between the x- and y-labels plus one for the pipe.*
- The x- and y-values touch the very centre of the table.
- You *may assume the labels themselves will be the widest part of the table, not the numbers.*
- If the intercept is negative, it is okay to have a "+ -" appear **as we have not studied if-statements yet**.

- Loops are not required as **we have not studied loops yet**.

Enter your first x- and y-values separated by a space: [USER ENTERS TWO NUMBERS]
Enter your second x- and y-values separated by a space: [USER ENTERS TWO NUMBERS]
Enter your third x- and y-values separated by a space: [USER ENTERS TWO NUMBERS]
Enter your x-label: [USER ENTERS A LABEL THAT MAY CONTAIN WHITE SPACE]
Enter your y-label: [USER ENTERS A LABEL THAT MAY CONTAIN WHITE SPACE]
What level of precision would you like? [USER ENTERS VALUE]
[*THE XLABEL WILL APPEAR HEERE*]|[*THE YLABEL WILL APPEAR HERE*]
——-
[*X1 TOUCHES TABLE CENTRE*]|[*Y1 TOUCHES TABLE CENTRE*]
[*X2 TOUCHES TABLE CENTRE*]|[*Y2 TOUCHES TABLE CENTRE*]
[*X3 TOUCHES TABLE CENTRE*]|[*Y3 TOUCHES TABLE CENTRE*]
The best fitting equation is: $y =$ [*SLOPE*]$x +$ [*INTERCEPT*]
The correlation coefficient is: [*ITS VALUE*]

You may assume the user always enters valid answers with distinct x-values.

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Enter your first x- and y-values separated by a space: 65 1.7
Enter your second x- and y-values separated by a space: 70 3.3
Enter your third x- and y-values separated by a space: 80 12.8
Enter your x-label: Age [years]
Enter your y-label: Alzheimer's Prevalence [%]
What level of precision would you like? 3
Age [years]|Alzheimer's Prevalence [%]
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     65.000|1.700
     70.000|3.300
     80.000|12.800
The best fitting equation is: y = 0.770x + -49.250
The correlation coefficient is: 0.980
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Some relevant formulas: denote the points $x_1, y_1, x_2, y_2, x_3, y_3$. Define

$$\bar{x} = (x_1 + x_2 + x_3)/3$$

$$\bar{y} = (y_1 + y_2 + y_3)/3.$$

The best fit slope m is given by

$$m = \frac{(x_1 - \bar{x})(y_1 - \bar{y}) + (x_2 - \bar{x})(y_2 - \bar{y}) + (x_3 - \bar{x})(y_3 - \bar{y})}{(x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + (x_3 - \bar{x})^2}$$

The best fit intercept b is given by

$$b = \bar{y} - m\bar{x}.$$

The correlation coefficient is given by

$$\frac{(x_1 - \bar{x})(y_1 - \bar{y}) + (x_2 - \bar{x})(y_2 - \bar{y}) + (x_3 - \bar{x})(y_3 - \bar{y})}{\sqrt{\big((x_1 - \bar{x})^2 + (x_2 - \bar{x})^2 + (x_3 - \bar{x})^2\big)\big((y_1 - \bar{y})^2 + (y_2 - \bar{y})^2 + (y_3 - \bar{y})^2\big)}}.$$