# CDA3100

Assignment 5

Sum, Min, Max, Mean, and Variance

**Objectives**: Learn how to write an assembly program that uses integer arithmetic, FP arithmetic, data transfer, transfer of control, and FP conversion assembly instructions. Also learn how to use an assembly simulator with basic I/O system calls. Submit your assignment through the Blackboard portal for Assignment #5.

Your assignment is to write a MIPS program that successfully executes on the *QtSpim* simulator. Your program should prompt the user to enter a list of integer values, one per line, with the last value being negative. Your program should read in this sequence of nonnegative integer values until the negative value is encountered. Afterwards your program should print the (1) sum, (2) minimum value, (3) maximum value, (4) mean, and (5) variance. You should test your solution using the *QtSpim* simulator. You can assume that there is between one and 100 nonnegative values in the list, only the last value entered is negative, and this negative value should not be considered when calculating the five items above. Below is an example session, where the values 2, 1, 3, and -1 are entered by the user. As much as possible, you should make your output use a similar format.

```
Enter integer values, one per
line, terminated by a negative
value.
1
2
3
4
5
6
7
8
9
-1
     Sum is: 45
     Min is: 1
     Max is: 9
    Mean is: 5.00000000
Variance is: 6.66666651
```

Note the variance is:

$$\sigma^2 = \sum (X_i - \bar{X})^2 / N$$

$\sigma^2$ = *variance*
$X_i$ = *the value of the ith element*
$\bar{X}$ = *the mean of X*
$N$ = *the number of elements*

All of the calculated output should be preceded by appropriate text identifying what is being printed.

NOTE: You may read in the integer values and store them into an array or you may calculate the average and variance as you read in the values.

You should have a comment beside each instruction in the assembly program (or at a minimum a comment for a small group of related instructions) to help make your code more understandable. You should also have comments at the top of the file indicating your name, this course, and the assignment. For example:

```
#########################################################
#                                                       #
#  Name:  Assignment5                                   #
#  Description: Calculates the sum, mean, min, max      #
#    and variance of a series of numbers.               #
#  Date:  October 1st, 2021                             #
#  Author:  Dr. John Q. Student                         #
#########################################################
```

Submission: Submit your plain ASCII text file (with the extension of **.s**) on the Canvas site under the Assignment #5 portal.

Grading: NOTE: Your program cannot be graded if it is submitted with syntax errors and cannot be Assembled.

(1) 10% - Proper MIPS instructions that assemble with no warnings.

(2) 10% - Appropriate QtSpim prompt for input.

(3) 10% - Reading integer values into an array or calculate the values in a running total.

(4) 10% - Calculating the sum of the values.

(5) 10% - Calculating the minimum value.

(6) 10% - Calculating the maximum value.

(7) 10% - Calculating the mean.

(8) 10% - Calculating the variance.

(9) 10% - Appropriate output format and messages.

(10) 10% - Appropriate comments in the code.

It is strongly suggested that you implement and test this assignment in stages, where each of the five values to be calculated is implemented and tested before proceeding to the next stage. By implementing and testing the assignment in stages, you are more likely to receive partial credit if you are unable to entirely complete the assignment.