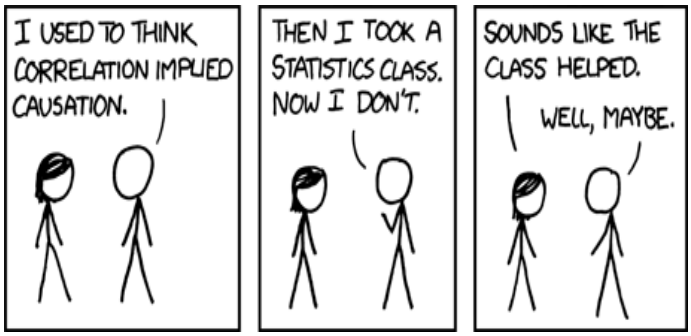
CS 218
Homework, Asst. #9

Purpose:	Learn assembly language procedures and standard calling convention. Additionally, become more familiar with program control instructions, high-level language function interfacing.
Due:	Tuesday (10/07)
Points:	150

Assignment:
Write the assembly language procedures described below. You will be provided a C main program that calls the procedures from assignment #8.



Source: www.xkcd.com/552

- Function, **bucketSort()**, to sort the numbers into ascending order (small to large).
- Function, **basicStats()**, to find the minimum, median, maximum, sum, and average for a list of numbers.
  Note, for an odd number of items, the median value is defined as the middle value. For an even number of values, it is the integer average of the two middle values.
- Integer function, **intSqrt()**, to calculate and return an integer estimate of the square root of a given number. *Note*, a function returns the value in ***rax***.
- Double function, **corrCoefficient()**, to compute the correlation coefficient[1] for the two data sets. *Note*, a function returns the value in **xmm0**.

In addition, write a function **readHexNumber()** that will read an ASCII hex number from the user. The routine should use the system service for reading data from the keyboard (into a buffer), convert the ASCII hex input (from the buffer) into an integer, return the integer, and a status code. The number must be between MIN and MAX (inclusive). If the value is correct and within range, the function should return a status code (in EAX) and, if successful, the numeric value (via call-by-reference). The function must return one of the following status codes:

- SUCCESS (0) → Successful conversion and number within required range.
- BADNUMBER (1) → Invalid input entered (i.e., not a valid hex number).
- INPUTOVERFLOW (2) → User entry character count exceeds maximum length.
- OUTOFRANGE (3) → Valid hex number entered, but out of required range.
- ENDOFINPUT (4) → Return entered, no characters (for end of the input).

All procedures should use the stack for the storage of local variables. No static variables should be declared. All data items are *unsigned* integers (MUL and DIV instructions). The procedures must be in a separate assembly file. The files will be assembled individually and linked together.

Submission:
When complete, submit:

- A copy of the ***source file*** via the class web page (assignment submission link) by 11:59:59pm. ***Assignments received after the allotted time will not be accepted!***

1 For more information, refer to: http://en.wikipedia.org/wiki/Pearson_product-moment_correlation_coefficient

Testing

A script file to execute the program on a series of predefined inputs will be provided. *Note*, please follow the I/O examples. The test utility should be downloaded into an empty directory and the program executable placed in that directory. The test script, named **`a9tst`**, can be executed as follows:

```
ed@ubuntu~/cs218/ast9$ ./a9tst ast9
```

The test script compares the program output to predefined expected output (based on the example I/O).

Updated Compile, Assemble, and Linking Instructions

When compiling, assembling, and linking the files for assignment #9, use the provided compile, assemble, and link script file. *Note*, **only** the procedures file will be submitted. The submitted procedures file will be assembled (as noted above) with the provided main.

Example Execution:

The following is an example execution demonstrating various error handling:

```
ed@ubuntu~/cs218/ast9$ ./ast9
------------------------------------------------
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Enter X Value (hex): 1a
Enter Y Value (hex): 2c
Enter X Value (hex):       a2
Enter Y Value (hex):     000000000000)CA
Error, invalid number. Please re-enter.
Enter Y Value (hex): 000000000000000CA
Enter X Value (hex): three
Error, invalid number. Please re-enter.
Enter X Value (hex): f
Enter X Value (hex): 00000000000000000000000000000000000000000000000000000000000000000
0000000000000000000000000000000
Error, user input exceeded length. Please re-enter.
Enter Y Value (hex): four
Error, invalid number. Please re-enter.
Enter Y Value (hex): 4
Enter X Value (hex):
------------------------------------------------

Program Results

Sorted X List:
15  26  162

   X Minimum =            15
    X Median =            26
   X Maximum =           162
       X Sum =           203
   X Average =            67

Sorted Y List:
4  44  202

   Y Minimum =             4
    Y Median =            44
   Y Maximum =           202
       Y Sum =           250
   Y Average =            83

Correlation  Coefficient =  0.995919805089970
```