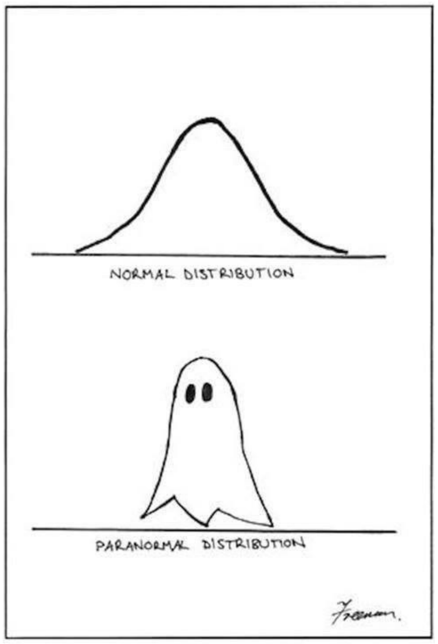
CS 218 – Homework, Asst. #9

Purpose:	Learn assembly language functions and standard calling convention. Additionally, become more familiar with program control instructions, high-level language function interfacing.
Due:	Tuesday (2/27)
Points:	150

Assignment:

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



- Void function, **shellSort()**, to sort the numbers into ascending order (small to large).
- Void function, **basicStats()**, to find the minimum, median, maximum, sum, and average for a list of numbers. This function must call the **listMedian()** function.
- Value returning integer function, **listMedian()**, to find and return an integer median of a sorted list of numbers. 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. An integer function returns the value in ***rax***.
- Value returning, double function, **corrCoefficient()**, to compute the correlation coefficient[1] for the two data sets. *Note*, a double function returns the value in **xmm0**.

In addition, write a function **readB36Num()** that will read an ASCII base-36 number from the user. The routine should use the system service for reading data from the keyboard (into a buffer), convert the ASCII base-36 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 base-36 number).
- INPUTOVERFLOW (2) → User entry character count exceeds maximum length.
- OUTOFRANGE (3) → Valid base-36 number entered, but out of required range.
- ENDOFINPUT (4) → Return entered, no characters (for end of the input).

All functions must 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 functions must be in a separate assembly file. The files will be compiled/assembled individually and linked together.

Submission:

When complete, submit:

- A copy of the ***source file*** via the class web page (assignment submission link) by 11:55 PM. ***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 main
```

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 functions file will be submitted. The submitted functions 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$ ./main
-------------------------------------------------
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Enter X Value (base-36): 1k2a
Enter Y Value (base-36): 2AMT1
Error, number of out of range. Please re-enter.
Enter Y Value (base-36): 1DK
Enter X Value (base-36): G@34
Error, invalid number. Please re-enter.
Enter X Value (base-36): KJ1
Enter Y Value (base-36): 9P2
Enter X Value (base-36): -19
Error, invalid number. Please re-enter.
Enter X Value (base-36): 19-A1
Error, invalid number. Please re-enter.
Enter X Value (base-36): H1
Enter Y Value (base-36): 7W
Enter X Value (base-36): D
Enter Y Value (base-36): 8kh
Enter X Value (base-36): 444444444444444444444444444444444444444444444444444444444444444444
Error, user input exceeded length. Please re-enter.
Enter X Value (base-36): Q1
Enter Y Value (base-36): 1Q
Enter X Value (base-36):
-------------------------------------------------

Program Results

Sorted X List:
13  613  937  26605  72658

   X Minimum =         72658
    X Median =           937
   X Maximum =            13
       X Sum =        100826
   X Average =         20165

Sorted Y List:
62  284  1784  11105  12566

   Y Minimum =         12566
    Y Median =          1784
   Y Maximum =            62
       Y Sum =         25801
   Y Average =          5160

Correlation  Coefficient =  1.743799283716287
```