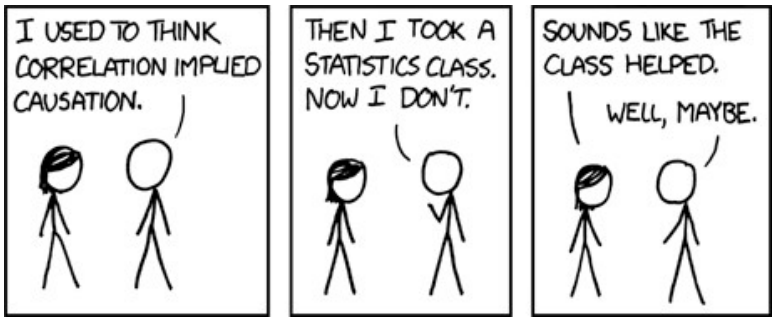
CS 218 – Homework, Asst. #8

Purpose:	Learn assembly language functions. Additionally, become more familiar with program control instructions, function handling, and stacks.
Due:	Tuesday (2/20)
Points:	125

Assignment:

Write four simple assembly language functions described below. You will be provided a main function that calls the following functions (for each set of data).



Source: www.xkcd.com/552

- Write a void function, **shellSort()**, to sort the numbers into descending order (large to small). You **must** use the Shell Sort algorithm (from assignment 7) and modify the sort order.
- Write a void function, **basicStats()**, to find the minimum, median, maximum, sum, and average for a list of numbers. This funciton must call the **listMedian()** function tin find the median.
- Write a value returning function, **listMedian()**, to find the median value of a sorted 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. This function should return a result in the **eax** register in accordance with the standard calling convention.
- Write a value returning function, **corrCoefficient()**, to compute the correlation coefficient[1] for the two data sets. The correlation coefficient formula is as follows:

$$r = \frac{\left(\sum_{i=0}^{n-1} x_i y_i\right)}{\sqrt{\left(\sum_{i=0}^{n-1} x_i^2\right)\left(\sum_{i=0}^{n-1} y_i^2\right)}}$$

  Where ∑ is the summation of the values, and ***n*** is the count of points (length). This function uses the provided square root code function (next page). This function should return a floating point result in the **xmm0** register in accordance with the standard calling convention.

All data should be treated as *unsigned* integers (MUL, and DIV). The functions 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 11:55 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

Floating Point Calculations

The following code will perform the floating point division by converting the double-word integers in **rax** and **r12** into floating point values in **xmm1** and **xmm0**.

```
cvtsi2sd   xmm0, r12            ; x's * y's
cvtsi2sd   xmm1, rax            ; x's^2 * y's^2
sqrtsd     xmm1, xmm1           ; sqrt()
divsd      xmm0, xmm1           ; xmm0 = xmm0 / xmm1
```

The result is left in **xmm0** as required by the standard calling convention.

Updated Compile, Assemble, and Linking Instructions

You will be provided a main function that calls the functions. Your functions should be in a separate file. The files will be assembled individually and linked together.

When compiling, assembling, and linking the files for assignment #8, use the provided compile, assemble, and link script file (**`asm8`**). *Note*, **only** the functions file will be submitted. The script file will require execute privilege (i.e., **`chmod +x asm8`**). The submitted functions file will be assembled and linked with the provided main. As such, do not alter the provided main.

Provided Data Sets:

Do not change the data types of the provided data. You may define additional variables as required.

```
xList1      dd     121,   27,   10,   22,   61
            dd      15,   12,  120,   19,   20
            dd      20,   11,   12
yList1      dd    1230, 1233, 1323, 1241, 1360
            dd    1290, 1118, 1250, 1475, 1423
            dd    1210, 1337, 1226
len1        dd    13
```

The results for data set #1 are shown for reference:

```
xMin1:    0x6010a4:     10
xMed1:    0x6010a8:     20
xMax1:    0x6010ac:     121
xSum1:    0x6010b0:     470
xAve1:    0x6010b4:     36

yMin1:    0x6010b8:     1118
yMed1:    0x6010bc:     1250
yMax1:    0x6010c0:     1475
ySum1:    0x6010c4:     16716
yAve1:    0x6010c8:     1285

r1:       0x6010cc:     0.73181607482401867
```