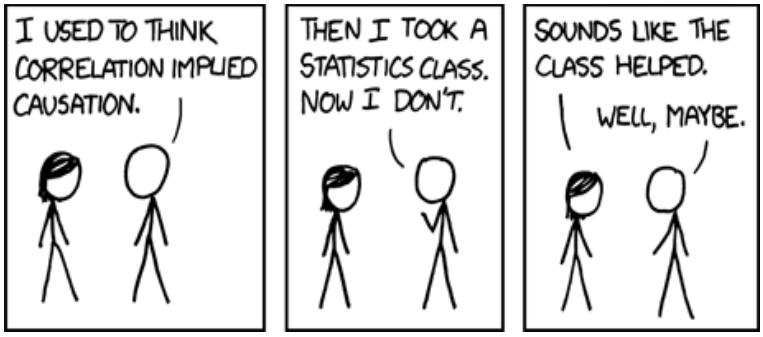
CS 218
Homework, Asst. #8

Purpose:	Learn assembly language functions. Additionally, become more familiar with program control instructions, function handling, and stacks.
Due:	Monday (6/19)
Points:	125

Assignment:

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



Source: www.xkcd.com/552

- Void function, **bubbleSort()**, to sort the passed array of numbers into descending order (large to small). You **must** use the bubble sort algorithm from assignment 7, modified to sort in descending order.

- Void function, **simpleStats()**, to find the minimum, median, maximum 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.

- Value returning function, **iAverage()**, to compute and return the integer average for a list of numbers. A 32-bit integer function returns the result in ***eax***.

- Value returning function, **variance()**, to compute and return the variance for a list of numbers. The formula for variance is as follows:

$$variance = \sum_{i=0}^{len-1} \left(list[i] - average\right)^2$$

  The **variance()** function must call the **iAverage()** function to find the average. A 64-bit integer function returns the result in ***rax***. *Note*, due to the data sizes, the variance summation must be performed as a quad-word.

All data should be treated as *signed* integers (IMUL, IDIV, and CDQ instructions). 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 start of class.
  Assignments received after the allotted time will not be accepted!

Updated Linking Instructions

You should use the provided script file, **asm8**, to perform the assemble and link commands. For example, assuming the provided main is named **ast8main.asm** and the functions file is named **ast8procs.asm** the following command;

```
ed-vm% ./asm8 ast8main ast8procs
```

will produce the executable file **ast8** (which can be executed by typing **./ast8**). You can change the file names as desired. *Note*, only the functions file will be submitted. The submitted function file will be assembled (as noted above) with the provided main.

Refer to the text for more information regarding functions and more information regarding controlling program execution to find logic errors.

Provided Data Sets:

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

```
; -----
;  Data Sets for Assignment #8.

list1        dd        21,    27,    10,    22,    31
             dd        13,    12,    17,    19,    20
             dd        24,    11,    14,    30,    33
             dd        27,    34,    23,    37,    40
             dd        38,    18,    15,    25,    16
             dd        26,    39,    36
len1         dd     28
min1         dd     0
med1         dd     0
max1         dd     0
ave1         dd     0
var1         dq     0
```

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

```
-----------------------------------
display data set #1

0x804a010 <list1>:              40        39        38        37
0x804a020 <list1+16>:           36        34        33        31
0x804a030 <list1+32>:           30        27        27        26
0x804a040 <list1+48>:           25        24        23        22
0x804a050 <list1+64>:           21        20        19        18
0x804a060 <list1+80>:           17        16        15        14
0x804a070 <list1+96>:           13        12        11        10

0x804a080 <len1>:               28

0x804a084 <min1>:    10
0x804a08c <max1>:    40
0x804a088 <med1>:    23
0x804a090 <ave1>:    24
0x804a094 <var1>:    2294
```