Programming Assignment 9 - Due Wednesday 19 November

Problem: You have been hired as a quality assurance monitor in a plant that manufactures widgets.
Part of the quality assurance program is to assure that all widgets that leave the factory are within
specified weight limits.

Background: The *variance* of a set of data is an indication of the *spread* within the data. The
variance, s^2, is defined as

$$s^2 = \frac{1}{n-1}\left[\left(\sum_{i=1}^{n} x_i{}^2\right) - n\,\bar{x}^2\right]$$

where $\bar{x}$ is the mean, defined as

$$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

The standard deviation can be found by taking the square root of the variance. Information that is
required to determine whether the widgets leaving the factory are within the specifications includes the
average weight of a batch of widgets, the median weight of the batch (the weight of the widget that is
in the middle of the rank-ordered weights of the batch), the variance of the weights and the standard
deviation of the weights.

Assignment: Design and code a C program, called **statsxxx.cpp** (where **xxx** are the group
    initials), that will perform the following:
       a) Read a set of floating point data of <u>unknown length</u> from a data file to be specified by the user
          (i.e., a text file) into a one-dimensional, floating-point array of type **double**;
       b) Sort the data from least to greatest value;
       c) Calculate the mean, median, variance, and standard deviation of the data set;
       d) Display the data list in ascending order together with the the number of data points and the
          mean, median, variance, and standard deviation;
Your program should have a function that reads the data file, a function that sorts the data (consult
    google for c program code for either a *selection* or *bubble* sort), a function that calculates the
    requested statistics, and a function to display the results.

Use the program to process each of the following data sets. You should create two data files that the
    program will read.

    First data set (19 data points):

      8.5   15.5 16.9   4.2 9.2
      12.8   8.1 11.6 13.8 5.1
      7.0   11.0   7.7   8.8 9.9
      4.7   17.3   8.4 15.2

Second data set (17 data points):

99.944	100.039	99.960	100.093	99.993
100.054	100.066	99.936	99.932	99.913
100.059	100.029	100.085	100.079	100.095
100.061	100.098			

Turn in:
1.   An outline of your program approach.
2.   A paper copy of your C program (pay attention to style).
3.   Screen printouts showing execution of program for both data sets.
4.   A disk with your program (not project).
5.   If you choose to do the bonus, provide a brief but clear explanation of the difference between selection sort and bubble sort. Use simple illustrations of how each sort method proceeds. What do you think is the most important difference between the two methods with respect to execution time for the sort? Why?

Hint on program development:

Work on the functions to sort, compute, and display before working on the function to get the data from a file. You can do this by "hardwiring" a test array to which you already know the answers into the file reading function so that it returns the known array rather than some unknown array obtained from reading a file. You can then modify the file reading function to actually read a file.

Programming Assignment 09 - Evaluation Criteria

Names _____

Criteria	Points Available	Points Awarded
Program Style		
header in each function	10	
purpose/goal state in headers	10	
meaningful variable names	10	
variables defined w/ comment	10	
whitespace/readability	10	
algorithm comments	10	
organization	10	
Functions		
`main`	10	
no assignment statements in `main`	30	
display header function	10	
file reading function	20	
sorting function	20	
statistics function	30	
report results function	10	
Program Function		
pleasing user interface	30	
file read properly	20	
data sorted properly	30	
statistics calculated properly	20	
BONUS		
explain difference between selection sort and bubble sort use illustrations	100	
	Total Pts:	/300