Assignment 8
Due: 6:00PM 11/3/23

Purpose: The purpose of this assignment is to process an arbitrarily large set of real data from a file, and compute the arithmetic mean, the standard deviation, and the median of the set of data. This assignment will allow you to gain some experience with file I/O, sorting, allocatable arrays.

Your goal: Write a Fortran program that reads in real data from an arbitrarily large file (assume one real data point per line) and which computes the mean, the median, and standard deviation of the data set. Your code should prompt the use to supply the name of the file and output the number of points, the arithmetic mean, median, and standard deviation of the data set, and should write the sorted data out a new file (with the output file name supplied by the user). You may consult the Wikipedia page on "Selection Sort" for a description of the algorithm but write your own code to do the selection sort. **You may not consult any other sources beyond the class notes and the Wikipedia Selection Sort page to do this assignment!**

The arithmetic mean of a set $\{x_i\}$ of N data points is defined by

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

while the standard deviation is defined by

$$\sigma = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \bar{x})^2}{N}}$$

Note: do not try to compute the mean and standard deviation in a single loop as this method is not numerically stable!

The median can be defined as follows:

$$med(x) = \begin{cases} x_{\frac{N}{2}+1} & \text{if } N \text{ is odd} \\ \frac{x_{\frac{N}{2}} + x_{\frac{N}{2}+1}}{2} & \text{if } N \text{ is even} \end{cases}$$

Hints: I suggest that you create this program in stages as follows:

1. First get your code to read in an arbitrarily large data set and store it in an array. Verify it is working.
2. Next get your code to compute the average of the data set. Verify your answer.
3. Next get your code to calculate the standard deviation. Verify your answer.
4. Sort the data using the selection sort. Verify that the data is correctly sorted.
5. Compute the median from the sorted data.
6. Output your results and verify that the output file has the correct results.

Note: Make sure that your submission conforms to the **Instructions for Source Code Submission** instructions and that you have followed all of the **Good Programming Tips** in the notes!