Mathematics 1266 (C Programming) Hilary 2019, third assignment

February 10, 2019

due by 9am Monday 18/2/19

Your program is

- to read in (double precision) numbers from the keyboard, and store them in array of doubles. You may assume that an array of 200 doubles is sufficient to hold the numbers read, i.e., at most 200 will be read.
- count them
- calculate their sample average
- their sample variance,
- and sample standard deviation, and
- print these results.
- If you would like to do something more advanced, for no extra marks, mind you, you could also print the median.

For example: in the example below, the numbers are not input from the keyboard, but from the file `y`. This is called *input redirection.* This file is on the website.

```
prompt% cat numbers

 13 17 19 17 25 17 19 17 23 17 19
 23 17 19 17 77 17 19 17 23
 23 17 19 17 69 17 19 17 23 17 19 17 25 17 19 17
 23 17 19 17 71 17 19 17 23
 23 17 19 17 69 17 19 17 23 17 19
 23 17 19 17 75 17 19 17 23 17 19 17 25
 23 17 19 17 69 17 19 17 23 17 19
 23 17 19 17 71 17 19 17 23 17 19 17 25 17 19 17
 23 17 19 17 77 17 19 17 23 17 19 17
 23 17 19 17 69 17 19 17 23
prompt% a.out < numbers
117 numbers
sample  average 22.931624
sample variance 208.340112
sample standard deviation 14.433992
prompt%
```

Definitions

- Average of n numbers x_i is $(\sum_{i=0}^{n-1} x_i)/n$. You may divide a double by an integer, getting a double.
- The sample standard deviation is

$$\frac{\sum_{i=0}^{n-1}(x_i - \overline{x})^2}{n-1}$$

- To use the `sqrt()` function, you need

```
#include <math.h>

...
gcc -lm ...
```

- The median of numbers $x_0, \ldots, x_{n-1}$ is obtained by sorting the list, result $y_0, \ldots, y_{n-1}$, say; if n is odd then the median is the one in the middle, otherwise it is the average of the two middle numbers.

  Sorting the numbers to get the median is not very easy.

Again

- Comments are important and helpful, but please try to keep the lines in your program short — under 80 columns wide.
- Make sure your program works, ***on the maths machines,*** or at least that it ‘compiles.’ It is bad if a program is not working properly, but the ***worst*** thing you can do is to submit a program which does not compile on the maths machines.
- In programming, it is very important to follow a specification *exactly,* and for this reason you will always be expected to follow the specification *exactly.*
- You should use indentation to make the program as easy to read as possible. Statements between curly braces should be indented, and so on.
- Comments are very important, but not insisted on as it is hard to tell whether or not they are adequate. Nevertheless, you are encouraged to add comments to your program.