Kevin Riggs Module 2 Assignment WriteUp

Requirements:

Define a class that can accumulate information about a sequence of numbers and calculate its average and Standard Deviation (STD).

For testing purposes, use the class to calculate the average and Standard Deviation of the sequence of number that you submitted to the first discussion.
The class should be usable by any code that needs to accumulate statistics on a sequence of values.

Design:

I want this class to be able to accept doubles as an input.
I want this class to provide the average and the standard deviation of the inputted values.

One decision was to prevent the user from directly accessing the doubles once inserted. The values can be modified, but only through a helper.

The second decision was how to calculate average and standard deviation. One option I thought about to maximize efficiency was to use a running average and standard deviation. Every time a new value is added or changed, the average/standard deviation is updated, not recalculated. Then the value can be quickly accessed. I landed on the easy approach, which can be more efficient in certain scenarios(huge list, but only one calculation). My approach is to calculate the statistics using the current values when asked.

I did also use a private variable itemCount, which makes things easier when calculating the statistics and using the class.

Test Design:

I took a semi-functional test approach on this one. I have a test for both the average and the standard deviation. Both test the ability to add a value and verify that the statistic returned is correct. Additionally, I have a test that validates the test framework for my own sake.

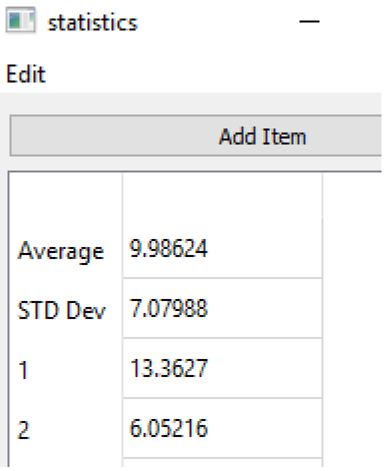
Testing Output:

```
[==========] Running 3 tests from 2 test suites.
[----------] Global test environment set-up.
[----------] 1 test from newgt
[ RUN      ] newgt.newgtc
[       OK ] newgt.newgtc (0 ms)
[----------] 1 test from newgt (0 ms total)

[----------] 2 tests from statistics
[ RUN      ] statistics.average
[       OK ] statistics.average (0 ms)
[ RUN      ] statistics.stddev
[       OK ] statistics.stddev (0 ms)
[----------] 2 tests from statistics (0 ms total)

[----------] Global test environment tear-down
[==========] 3 tests from 2 test suites ran. (0 ms total)
[  PASSED  ] 3 tests.
```

Test on my data set:

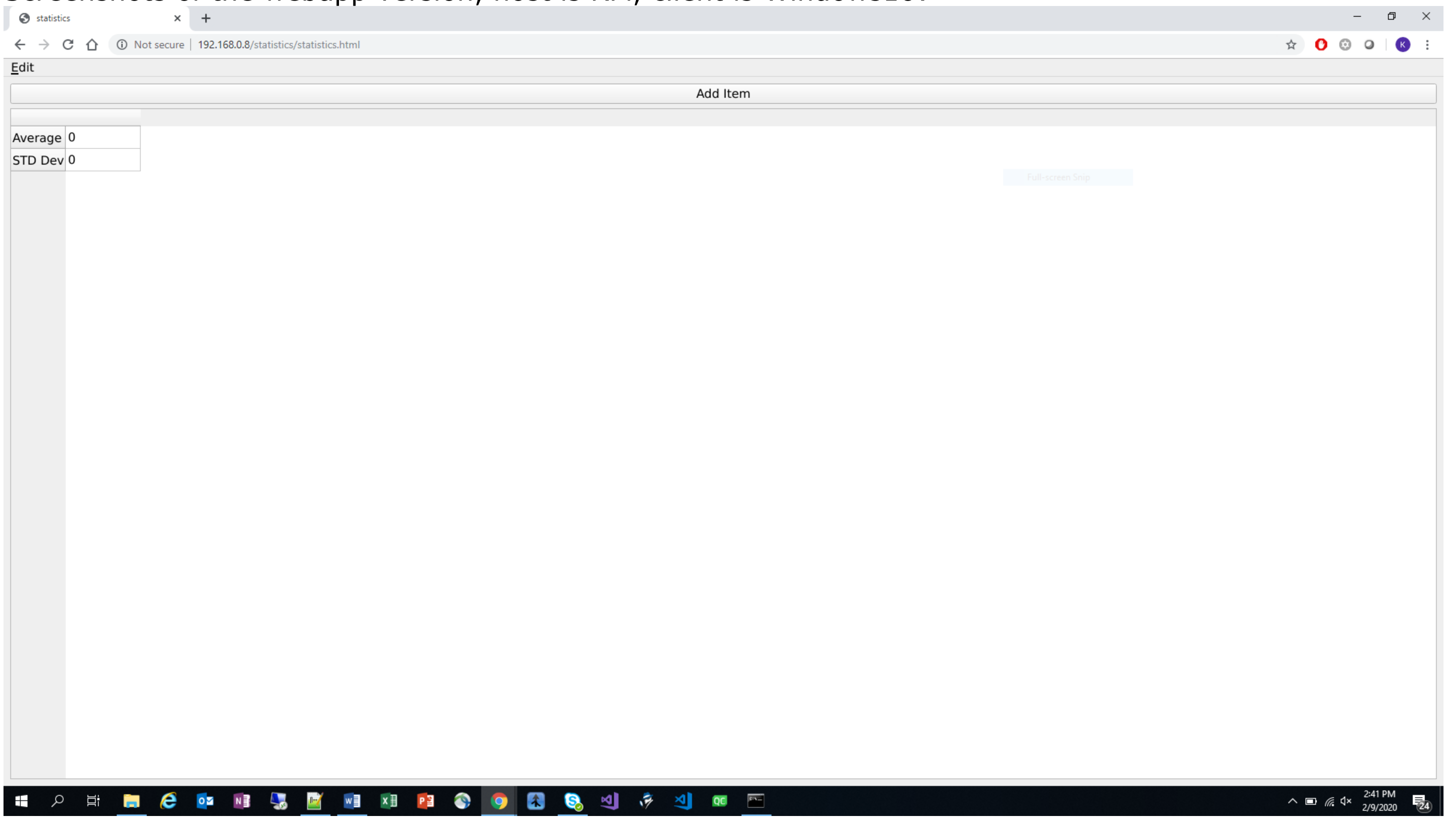


Average	9.98624
STD Dev	7.07988
1	13.3627
2	6.05216

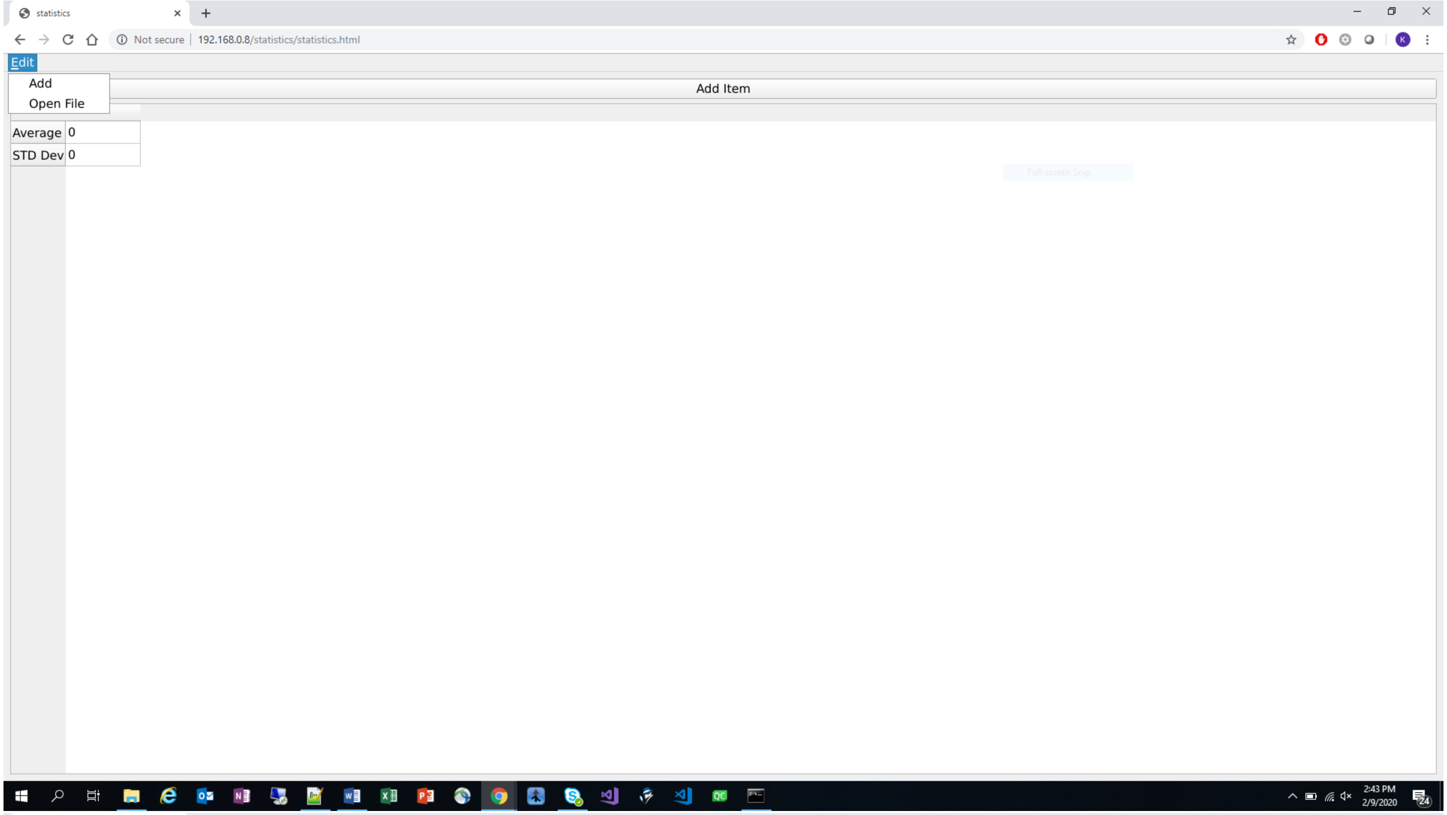
Implementation Preview:

I have a webapp hosted that demonstrates the functionality of the statistics class. Right now I'm using a raspberry pi but I'm thinking of using gitlab. I can add a link to this and future implementations if there is interest. It is not currently on the public internet but I can configure the router and map a domain name.

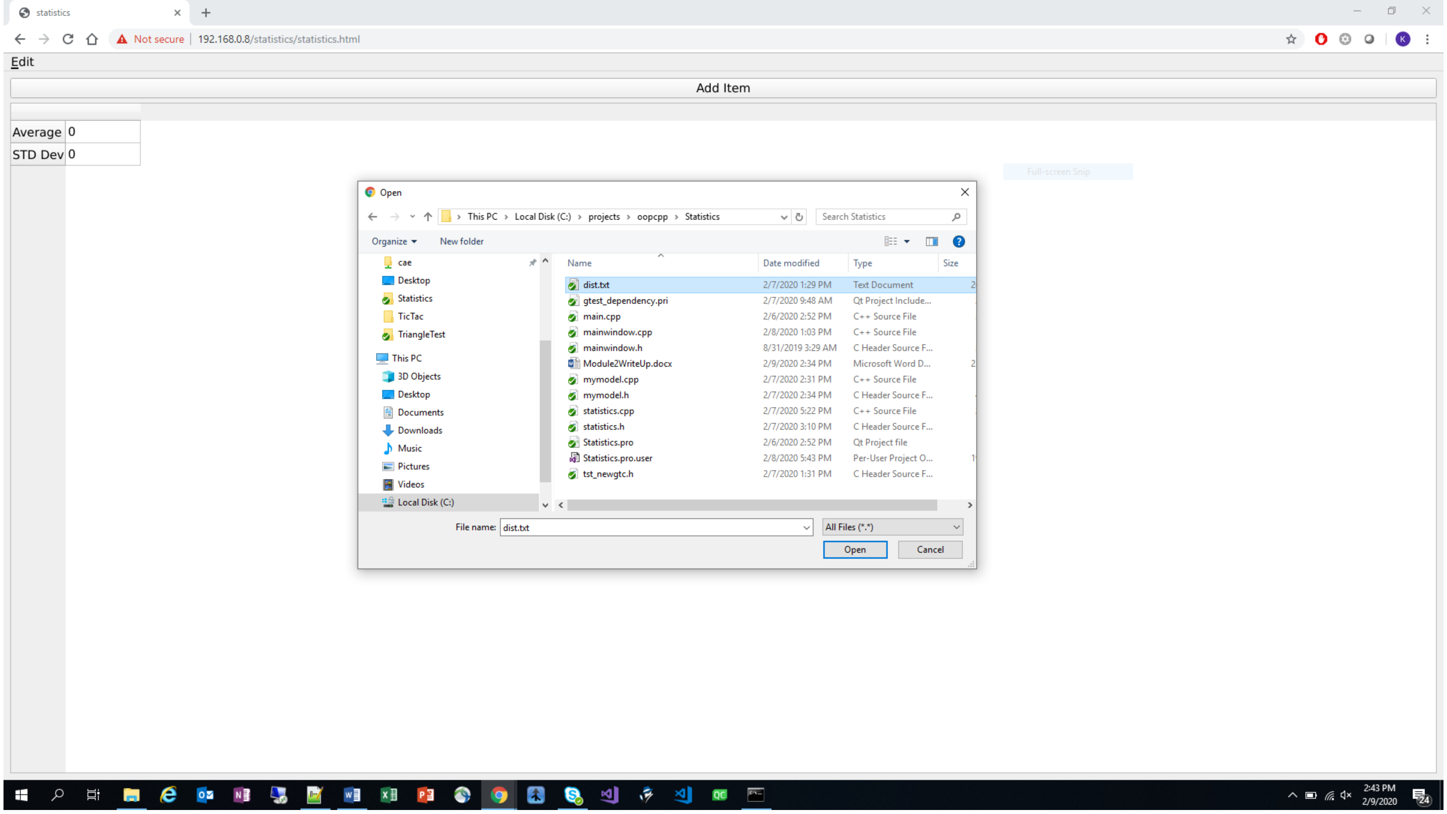
You can enter the values manually or select a file of doubles separated by newline characters. I am considering supporting separation by commas and spaces.
Screenshots of the webapp version, host is RPi, client is Windows10:



Average	0
STD Dev	0



Average	0
STD Dev	0

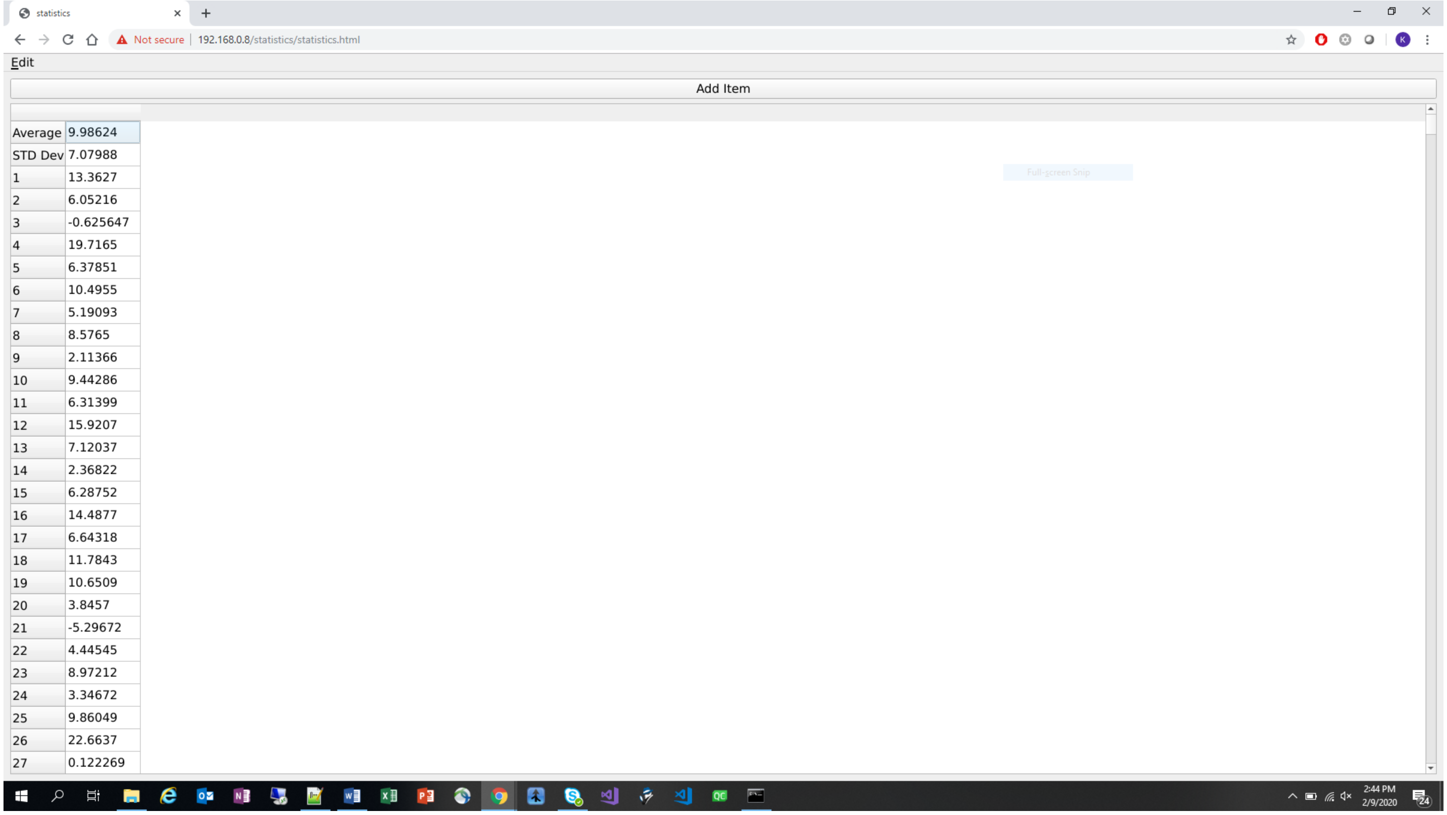


Average	0
STD Dev	0

Name	Date modified	Type	Size
dist.txt	2/7/2020 1:29 PM	Text Document	2
gtest_dependency.pri	2/7/2020 9:48 AM	Qt Project Include...	
main.cpp	2/6/2020 2:52 PM	C++ Source File	
mainwindow.cpp	2/8/2020 1:03 PM	C++ Source File	
mainwindow.h	8/31/2019 3:29 AM	C Header Source F...	
Module2WriteUp.docx	2/9/2020 2:34 PM	Microsoft Word D...	2
mymodel.cpp	2/7/2020 2:31 PM	C++ Source File	
mymodel.h	2/7/2020 2:34 PM	C Header Source F...	
statistics.cpp	2/7/2020 5:22 PM	C++ Source File	
statistics.h	2/7/2020 3:10 PM	C Header Source F...	
Statistics.pro	2/6/2020 2:52 PM	Qt Project file	
Statistics.pro.user	2/8/2020 5:43 PM	Per-User Project O...	1
tst_newgtc.h	2/7/2020 1:31 PM	C Header Source F...	

File name: dist.txt

All Files (*.*)



Average	9.98624
STD Dev	7.07988
1	13.3627
2	6.05216
3	-0.625647
4	19.7165
5	6.37851
6	10.4955
7	5.19093
8	8.5765
9	2.11366
10	9.44286
11	6.31399
12	15.9207
13	7.12037
14	2.36822
15	6.28752
16	14.4877
17	6.64318
18	11.7843
19	10.6509
20	3.8457
21	-5.29672
22	4.44545
23	8.97212
24	3.34672
25	9.86049
26	22.6637
27	0.122269

Lessons learned:

It is a little bit difficult to work with the client file system with WASM. Currently, a virtual file system can be created on the client end, but this does not give access to the client file system, just a sandbox for temporary files.

In order to accept files from the client, a client specific asynchronous process is opened(combination of JS and html) that allows a user to select a file. On the c++ WASM side, the file contents are converted into a bytearray. If you know the form of the file, you can deserialize the contents of the file. In my case, get a list of doubles.

Source Code:

My plan is to only copy the files directly relevant to the assignment and provide links to the rest of the files. My thought is that way you don’t have to dig through the extra stuff.
For the rest of the source files I can link to the git repo or to the webserver hosting the app? I have the sources and build in the same directory on the server.

Statistics.h // definition of statistics class
Statistics.cpp // implementation of statistics class
Tst_newgtc.h // tests using gtest

```
// statistics.h
#ifndef STATISTICS_H
#define STATISTICS_H

#include <vector>
#include <iostream>


/*
* Statistics Class
```

```
*	Class accepts a double as an input
*	Stores that double and will return
*	the average and standard deviation
*	of the doubles.
*/

class Statistics
{
public:
	//Constructor: initialize private data
	Statistics();

	// add an item to the statistis
	void add(double x);

	// get the value of an individual item
	double getItem(int index) const;

	// set the value
	void setItem(int index, double x);

	// get average
	double getAverage() const;

	// get Standard deviation: using the hint
	double getSTD() const;

	// get number of items
	int getItemCount() const;

private:
	// count containing the number of items
	int itemCount;
	// holds all entered items
	std::vector<double> items;

};

#endif // STATISTICS_H

// statistics.cpp
#include "statistics.h"
#include <math.h>

//Constructor:
Statistics::Statistics() :
	itemCount{0}
{

}

// Adds a double to the existing doubles
void Statistics::add(double x)
{
	this->items.push_back(x);
	this->itemCount++;
}

// Returns the value of an entered item based on the index
```

```
double Statistics::getItem(int index) const
{
	try {
		if(items.size() > index){
			return this->items[index];
		} else {
			return 0;
		}

	} catch (...) {
		return 0;
	}

}

// Modifies an existing item
void Statistics::setItem(int index, double x)
{
	items[index] = x;
}

// Returns the average of the doubles
double Statistics::getAverage() const
{
	double total = 0;
	for(double x : items){
		total += x;
	}
	return items.empty() ? 0 : total / items.size();
}

// returns the standard deviation of the doubles
double Statistics::getSTD() const
{
	if(items.empty()){
		return 0.0;
	} else {
		double x2 = 0;
		double average = getAverage();
		for(double x : items){
			x2 += x*x;
		}
		double s2 = (x2 - items.size() * pow(average, 2)) / (items.size() - 1);
		return sqrt(s2);
	}
}

// Returns the number of doubles entered
int Statistics::getItemCount() const
{
	return this->itemCount;
}


// tst_newgtc.h
#ifndef TST_NEWGTC_H
#define TST_NEWGTC_H

#include <gtest/gtest.h>
```

```
#include <gmock/gmock-matchers.h>

#include "statistics.h"

#include <iostream>

using namespace testing;

TEST(newgt, newgtc)
{
	EXPECT_EQ(1, 1);
	ASSERT_THAT(0, Eq(0));
}

TEST(statistics, average){
	Statistics stats = Statistics();
	stats.add(3.0);
	stats.add(4.0);
	stats.add(5.0);
	ASSERT_EQ(4, stats.getAverage());
	ASSERT_NE(3, stats.getAverage());
}

TEST(statistics, stddev){
	Statistics stats = Statistics();
	stats.add(3.0);
	stats.add(4.0);
	stats.add(5.0);
	ASSERT_EQ(1, stats.getSTD());
	ASSERT_NE(2, stats.getSTD());
}

#endif // TST_NEWGTC_H
```