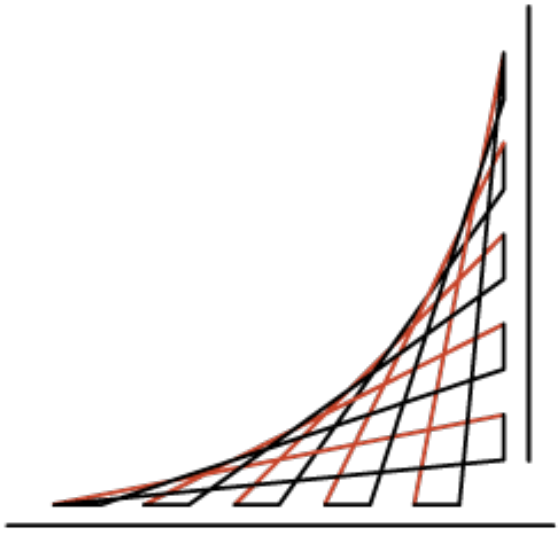

ESCUELA COLOMBIANA DE INGENIERÍA
JULIO GARAVITO

VIGILADA MINEDUCACIÓN

SYSTEMS ENGINEERING

Arquitecturas Empresariales

Laboratory 2

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Contents

1 Prerequisites

These are the necessary installations to run the application on your computer:

Maven - Dependency Management
Java 8 - Development Environment
Git - Version Control System
Spark - Micro framework for creating web applications in Java 8

2 Introduction

In this application a program is developed to calculate the mean and standard deviation of a set of n real numbers. The program reads the n real numbers from a web page.

For this calculation, an own implementation of a LinkedList that is compatible with the Java api will be used. Additionally, the Spark micro framework is used to develop the web application

3 Concepts

3.1 Linked List

The LinkedList class is a collection which can contain many objects of the same type, just like the ArrayList.

The LinkedList class has all of the same methods as the ArrayList class because they both implement the List interface. This means that you can add items, change items, remove items and clear the list in the same way.
[1]

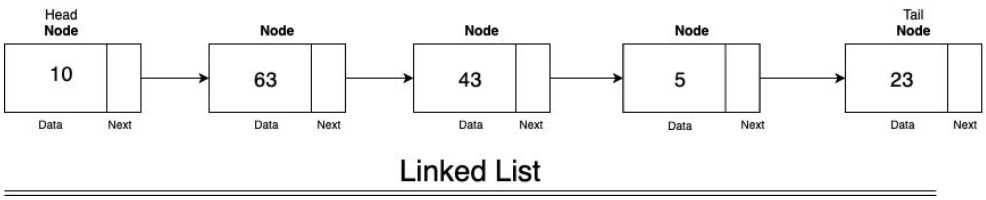

Figure 1: Linked list, *taken from* [1]

3.2 Mean

The mean is the average of a set of data. The average is the most common measure of location for a set of numbers. The average locates the center of the data.

The formula proposed in this laboratory for the calculation of the mean is the following

$$x_{avg} = \frac{\sum_{i=1}^{n} x_i}{n}$$

3.3 Standard Deviation

Standard deviation is a measure of the spread or dispersion of a set of data. Themore widely the values are spread out, the larger the standard deviation.
The formula for calculating the standard deviation is:

$$\sigma = \sqrt{\frac{\sum_{i=1}^{n} (x_i - x_{avg})^2}{n-1}}$$

3.4 Spark Framework

Spark framework is a rapid development web framework inspired by the Sinatra framework for Ruby and is built around Java 8 Lambda Expression philosophy, making it less verbose than most applications written in other Java frameworks. With Spark, you can have a REST API ready to serve JSON in less than ten lines of code. [2]

4 Architecture

4.1 Class diagram of LinkeList

An own implementation of LinkedList is made. The class extends AbstractSecuentialList and implements the List, Deque, Clonable and Serializable interfaces to be compatible with the Java api. It also makes its own implementation of the Linked List Iterator, implementing from Iterator. Finally, it has its own implementation of the nodes that are part of the LinkeList, each of them stores the value and the reference to the next node.

Consequently, we have the following classes:

1. MyCustomLinkedList: Own implementation of a LinkeList in Java.
2. MyCustomNode: Represents a node of the LinkedList. It has value and reference to the next node.
3. MyCustomListIterator: Allows to iterate the LinkeList based on an index. Implements the Iterator interface.

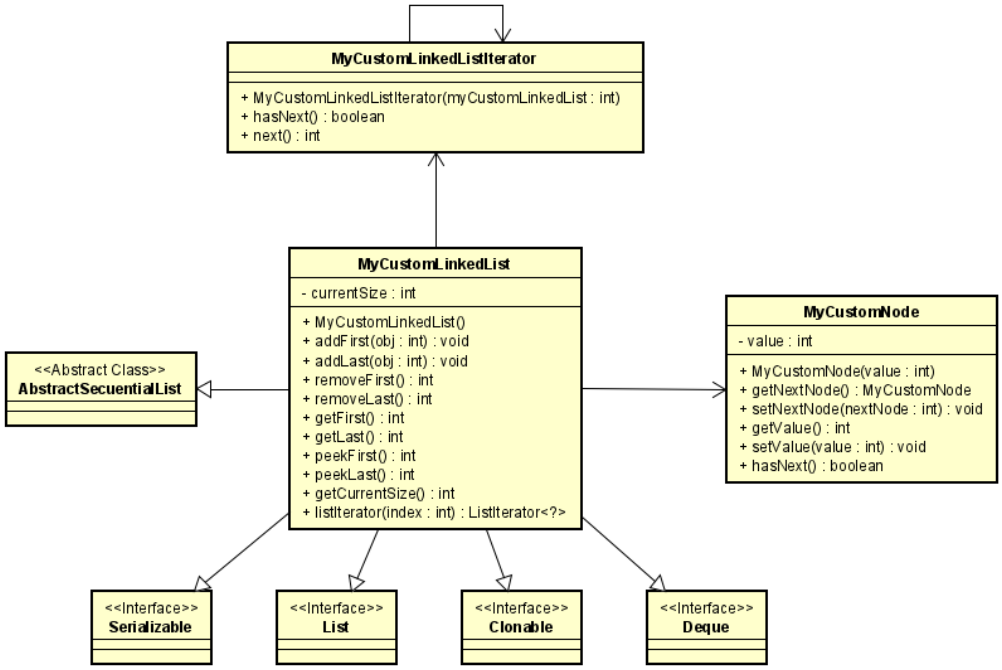

Figure 2: Class diagram

4.2 Spark Web App

Here is a class called ComputingService that will allow the user to access the application services. In this case, this class will connect with an interface called Calculator that will allow to perform an operation on a LinkedList. In this case, the standard deviation or the mean of the values in the LinkedList can be calculated. For that there are two classes called MeanCalculator and StandardDesviationCalculator that extend from the Calculator interface. This allows us to add more operations easily in case the user requires it.

The services mentioned above are accessed from the SparkWebApp class, which is in charge of reading the request made with the client, calculating the mean and standard deviation with the numbers read and finally returning the response to the client in html format.

In this case we are going to have the following classes:

1. SparkWebApp: Is in charge of reading the request made with the client, calculating the mean and standard deviation with the numbers read and finally returning the response to the client in html format.

2. Calculator (Interface): Interface that represents the calculations done on my Linked List

3. MeanCalculator: Class that computes the mean of a set of numbers on a Linked List

4. StandardDesviationCalculator: Class that computes the Standard Deviation of a set of numbers on a Linked List

5. Computing Service: Computes the Standard Deviation of a set of numbers on a Linked List

6. ComputingServiceImpl: Service that implements the computation of mean and standard deviation on a LinkedList

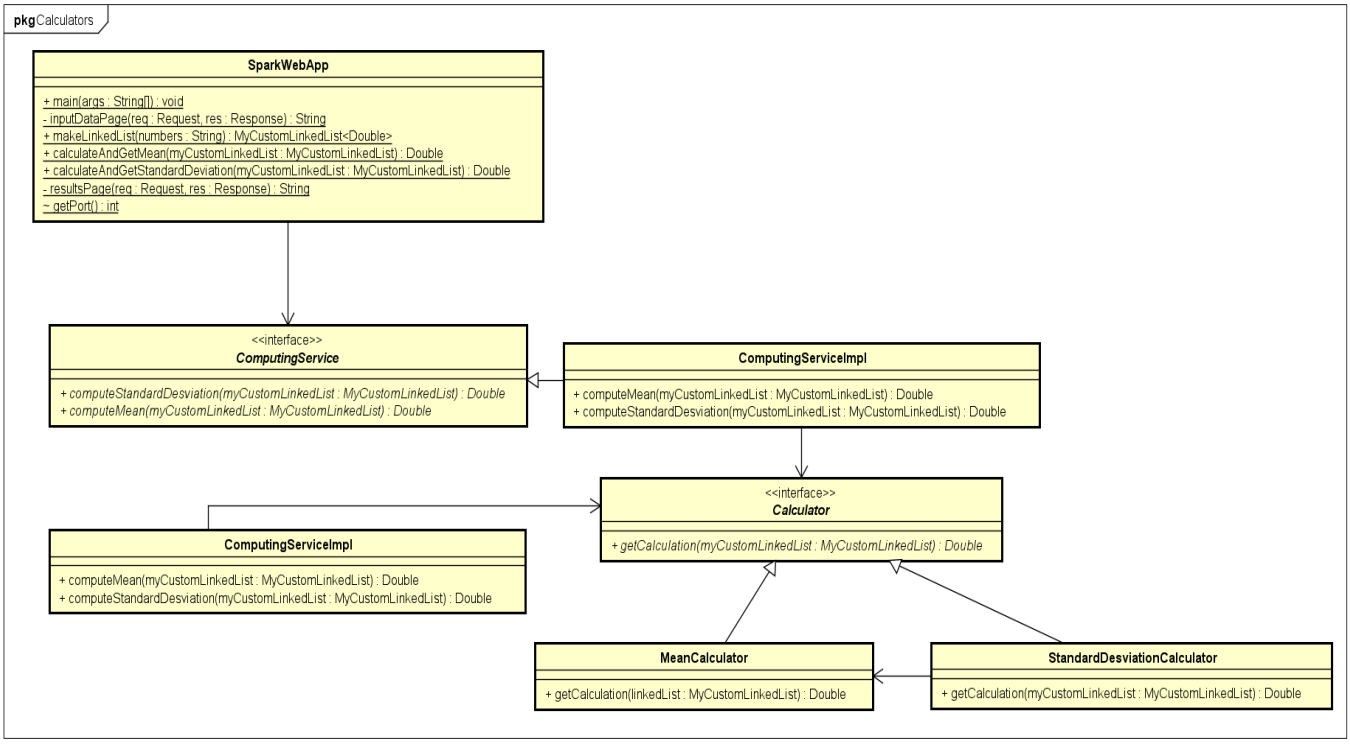

Figure 3: Class Diagram 2

4.3 Deploy Diagram

The client will access from his machine through the HTTP protocol the heroku cloud server that stores a spark web application. This microframework will allow us to create java web applications. In addition, it is very simple and lightweight and will manage all the requests made by the user to, in this case, calculate the mean and standard deviation of a set of numbers.

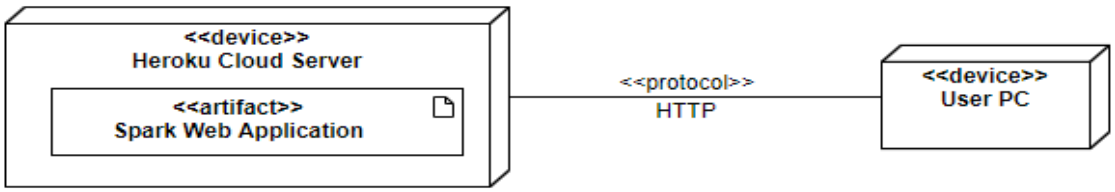

Figure 4: Deploy Diagram

5 Tests Cases

In this workshop we have two test cases along with their respective mean and standard deviation. In the following tables you can see the test data and the expected results.

Column 1	Column 2
Estimate Proxy Size	Development Hours
160	15.0
591	69.9
114	6.5
229	22.4
230	28.4
270	65.9
128	19.4
1657	198.7
624	38.8
1503	138.2

Table 1

Test	**Expected Value**		**Actual Value**	
	Mean	*Std. Dev*	*Mean*	*Std. Dev*
Table 1: Column 1	550.6	572.03		
Table 1: Column 2	60.32	62.26		

Table 2

Figure 5: Test data

6 Results

In this case, the correct operation of the application will be tested through the web application.For that we enter the numbers on the web page and we will immediately obtain the results.
We observe that in both cases we obtain the expected results.

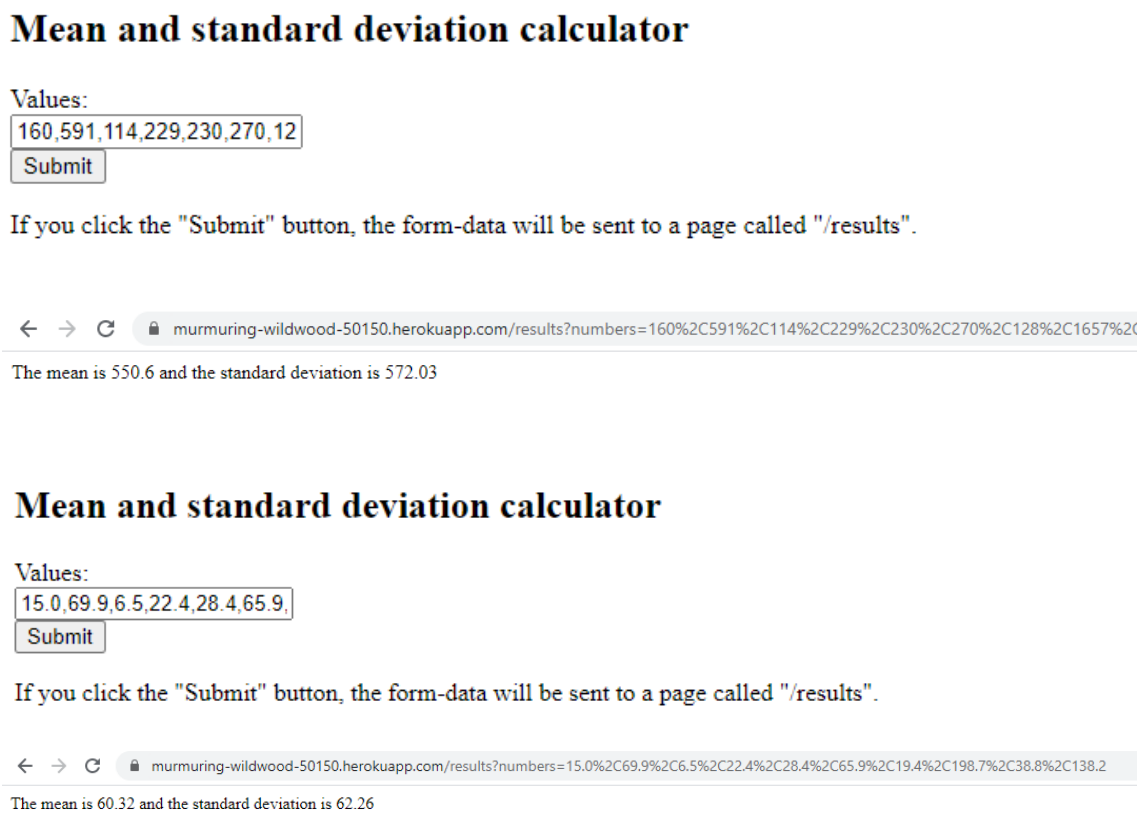

Figure 6: Results obtained

7 References

[1] W3Schools, *Java linkedlist*, `https://www.w3schools.com/java/java_linkedlist.asp`, Accessed on 2021-01-29.

[2] *Building an api with the spark java framework*, https://www.baeldung.com/spark-framework-rest-api, Accessed on 2021-02-05, 2020.