

# Laboratory 2

Introduction to Heroku.

Author: Angi Paola Jimenez Pira  
Teacher: Luis Daniel Benavides Navarro

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# 1 Introduction

This document explain a solution implemented for the problem described in the enunced of this Laboratory. First, it will be made known the way to calculate the arithmetic mean and standar deviation of a set of values, after, it will show the architecture developed and tools used to make a statistics calculator that allow calculate this measures. Worth noting, that data structure used for develop the calculator is a doubly linked list also developed in this laboratory, for this reason, this document will also contains information about this data structure. This project was developed using different tools like Heroku, Spark Framework, Circleci, Maven, Java, Git and Github, later it will be explained the function and importance of this tools.

## 2 Objectives

- To develop a statistics calculator that can calculate arithmetic mean and standard deviation of a set of values.
- To develop a data structure, a doubly linked list.
- To learn a part of Spark architecture and implement this framework in the develop of this project.
- To learn to deploy a web app in Heroku.
- To use known tools like Circleci, Maven, Java, Git and GitHub to develop a web app.

## 3 Glosary

- **Spark:** Spark Framework is a simple and expressive Java/Kotlin web framework DSL built for rapid development.
- **Apache Maven:** Is a build automation tool used primarily for Java projects. Maven can also be used to build and manage projects written in C, Ruby, Scala, and other languages.
- **Java:** Is a general-purpose, class-based, object-oriented programming language designed for having lesser implementation dependencies. It is a computing platform for application development.
- **Circleci:** CircleCI is a modern continuous integration and continuous delivery (CI/CD) platform.
- **Heroku:** Heroku is a cloud platform that lets companies build, deliver, monitor and scale apps.
- **Git:** Git is an open-source version control system that was started by Linus Torvalds—the same person who created Linux.
- **Github:** GitHub is a code hosting platform for version control and collaboration. It lets you and others work together on projects from anywhere.

- **Doubly Linked List:** Is a linked data structure that consists of a set of sequentially linked records called nodes. Each node contains three fields: two link fields (references to the previous and to the next node in the sequence of nodes) and one data field.
- **Aritmethic Mean:** Is the simple average, or sum of a series of numbers divided by the count of that series of numbers.
- **Standard Deviation:** Is a statistic that measures the dispersion of a dataset relative to its mean and is calculated as the square root of the variance.

## 4 Problem description

Use Maven and GITHUB.

Write a program to calculate the mean and standard deviation of a set of n real numbers.

Your program reads the n real numbers from a file.

Use a linked list to store the n numbers for the calculations. (Note: You have to write your own implementation of a linked list and it must be compliant with Java's collections API).

Thoroughly test the program. At least two tests should use the data in the columns of Table 1. Expected results are provided in Table 2.

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**

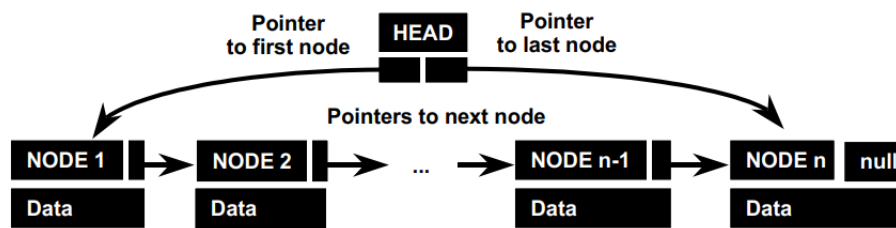
## 5 Overview

### 5.1 About Linked Lists

Linked lists are a common abstract data type used to maintain collections of data.

Linked lists are implemented with pointers. A linked list typically has two components.

- List head
- List node(s)



Some of the options for linked list structure are:

- the list head can point to the first node, last node, or both
- a list node can point to the next node, prior node, or both

Null pointers are often used to indicate an empty list or the end of the list. Typical operations on a linked list include:

- add node
- remove node
- next node
- prior node

### 5.2 Arithmetic Mean and Standard Deviation

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.

Standard deviation is a measure of the spread or dispersion of a set of data. The more widely the values are spread out, the larger the standard deviation. For example, say we have two separate lists of exam results from a class of 30 students; one ranges from 31 standard deviation would be

larger for the results of the first exam.

The formula for calculating the mean is:

$$x_{avg} = \frac{\sum_{i=1}^n x_i}{n} \quad (5.1)$$

The formula for standard deviation,  $\sigma$ , is :

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (x_i - x_{avg})^2}{n - 1}} \quad (5.2)$$

Where:

- S is the symbol for summation
- i is an index to the n numbers
- x is the data in the set
- n is the number of items in the set

For the next set of values the arithmetic and standard deviation is:

<b>x</b>
186
699
132
272
291
331
199
1890
788
1601

**Table 3**

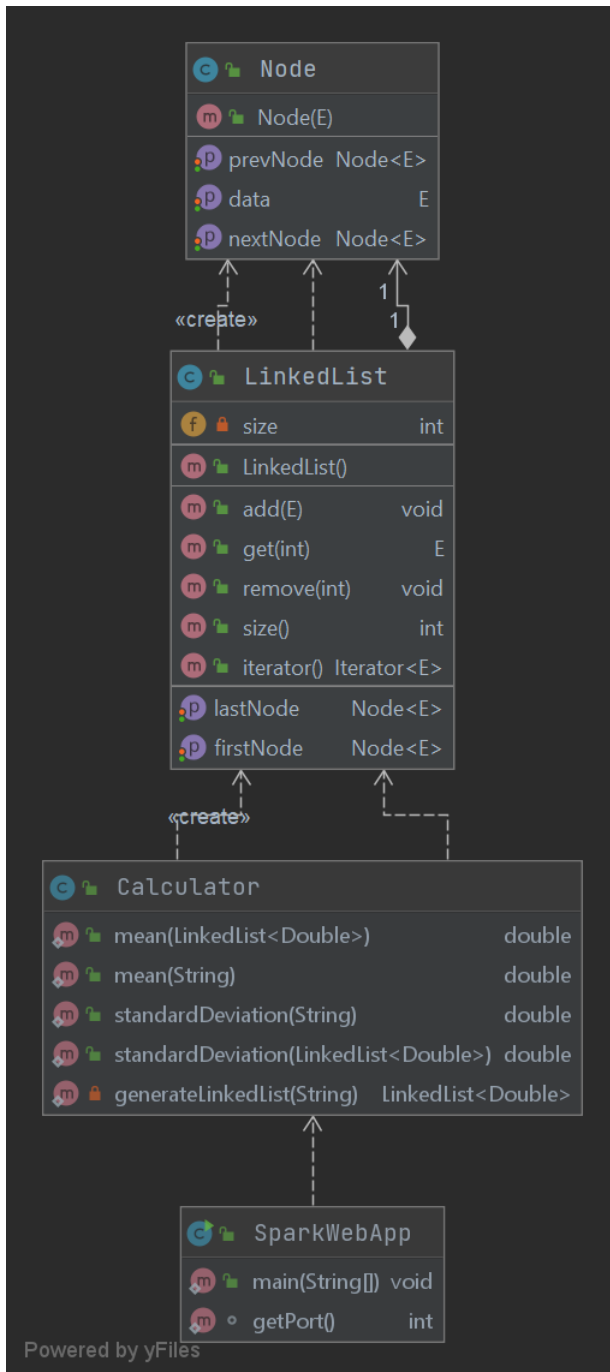
$$x_{avg} = 638.9$$

$$\sigma = 625.633981$$

## 6 Architecture of program

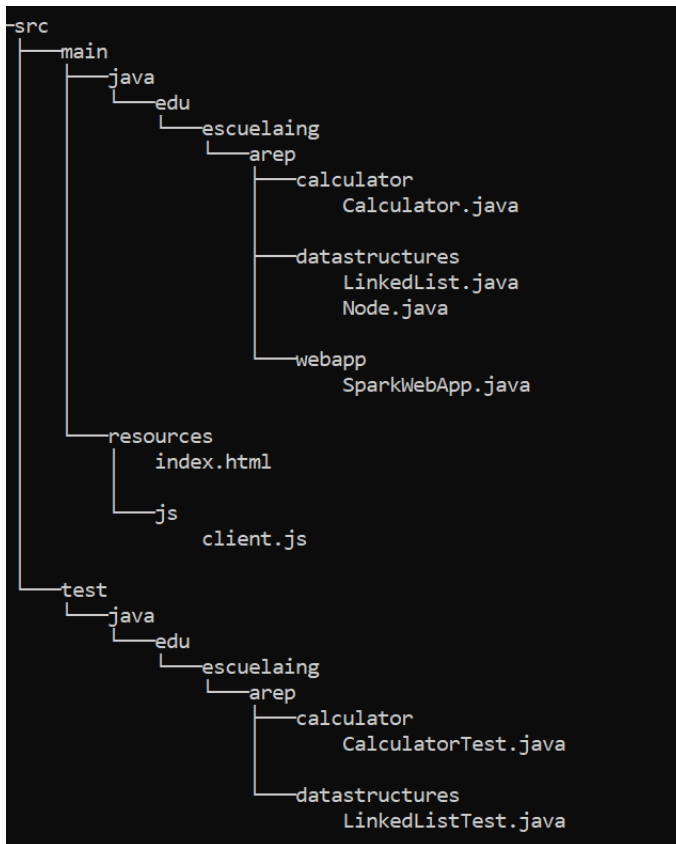
### 6.1 Class Diagram

The next image shows the class Diagram of the solution implemented:



## 6.2 Project Tree

The next image shows the structure of the project generated by the Maven dependency manager, with the objective of giving more information for the reader about how the solution was implemented:



## 6.3 Technology Stack

- **Development environment:** Java Development Kit 8.0, IntelliJ IDEA, Spark Framework
- **Dependency Manager:** Maven
- **Version Control:** Git, Github
- **Tests:** JUnit4, Postman
- **Deploy and build:** Heroku, Circleci

## 6.4 Documentation

The documentation and instructions for use are in a git repository: <https://github.com/angipaola10/AREP-LAB2>.

## 7 Conclusions

- The use of tools like Circleci and Heroku to build and deploy a web app is very important because this tools help us to check the code and test developed in the program. Also, with this tools we can found bugs, duplicated code and other factors that make our project less efficient.
- Spark allow us develop web apps, we were able to make the endpoints required to establish a communication between back-end and front-end using this framework.

## References

- [1] Spark. <https://sparkjava.com/>
- [2] Wikipedia. [https://en.wikipedia.org/wiki/Apache\\_Maven](https://en.wikipedia.org/wiki/Apache_Maven).
- [3] Circleci. <https://circleci.com/docs/enterprise/overview/>
- [4] Heroku. <https://www.heroku.com/what>
- [5] Wikipedia. [https://en.wikipedia.org/wiki/Doubly\\_linked\\_list](https://en.wikipedia.org/wiki/Doubly_linked_list)