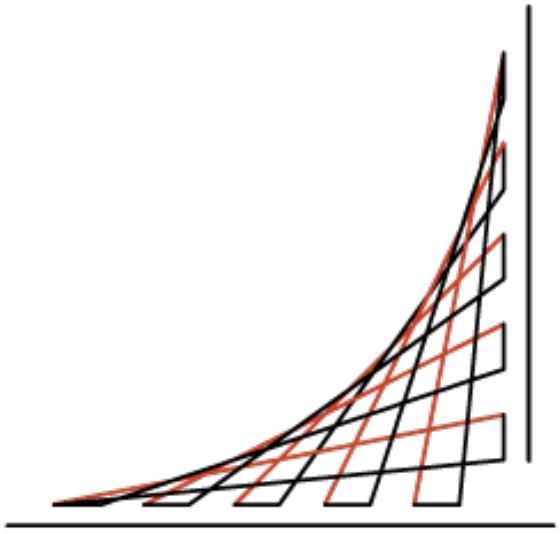

ESCUELA COLOMBIANA DE INGENIERÍA
JULIO GARAVITO

VIGILADA MINEDUCACIÓN

SYSTEMS ENGINEERING

Enterprise Architectures

Laboratory 1

Luis Daniel Benavides Navarro

Author:
Angie Daniela Ruiz Alfonso

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1 Introduction

The aim of this laboratory is write a program that serve for calculate the mean and standard deviation of a set of n real numbers inside a file.

The program use a implementation of a linked list to store the numbers on which the respective calculations will be made.

2 Doubly Linked List

Doubly linked list is a type of linked list in which a node contains a pointer to the previous and the next node.

These nodes consists of three parts: node valor, pointer to the next node, pointer to the previous node. In the figure 1 we can see a sample node of a doubly linked list.[1]

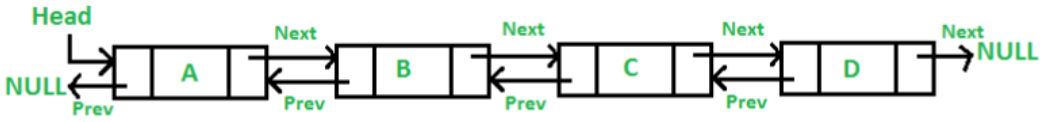

Figure 1: Doubly linked list, *taken from* [2]

3 Concepts

3.1 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 mean is equal to the sum of all values in the data set divided by the total count of numbers in the data set.

The formula for calculating the mean is

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

3.2 Standar Deviation

The standard deviation is a measure of the amount of dispersion of a set of values. A low standard deviation indicates that the values tend to be close to the mean of the set, while a high standard deviation indicates that the values are spread out over a wider range.

The formula for calculating the standard deviation is

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

4 Architecture

4.1 Class diagram

In the development of this laboratory the iterator design pattern was implemented. According to GoF definition this pattern provides a way to access the elements of a collection in a sequential manner without exposing their underlying representation, this pattern is used to iterate a collection of objects in a defined manner.

The key idea is to abstract the responsibility of the access and traversal outside the collection and put it in an Iterator object that defines a standard traversal protocol, in this way achieving a decoupling.[3]

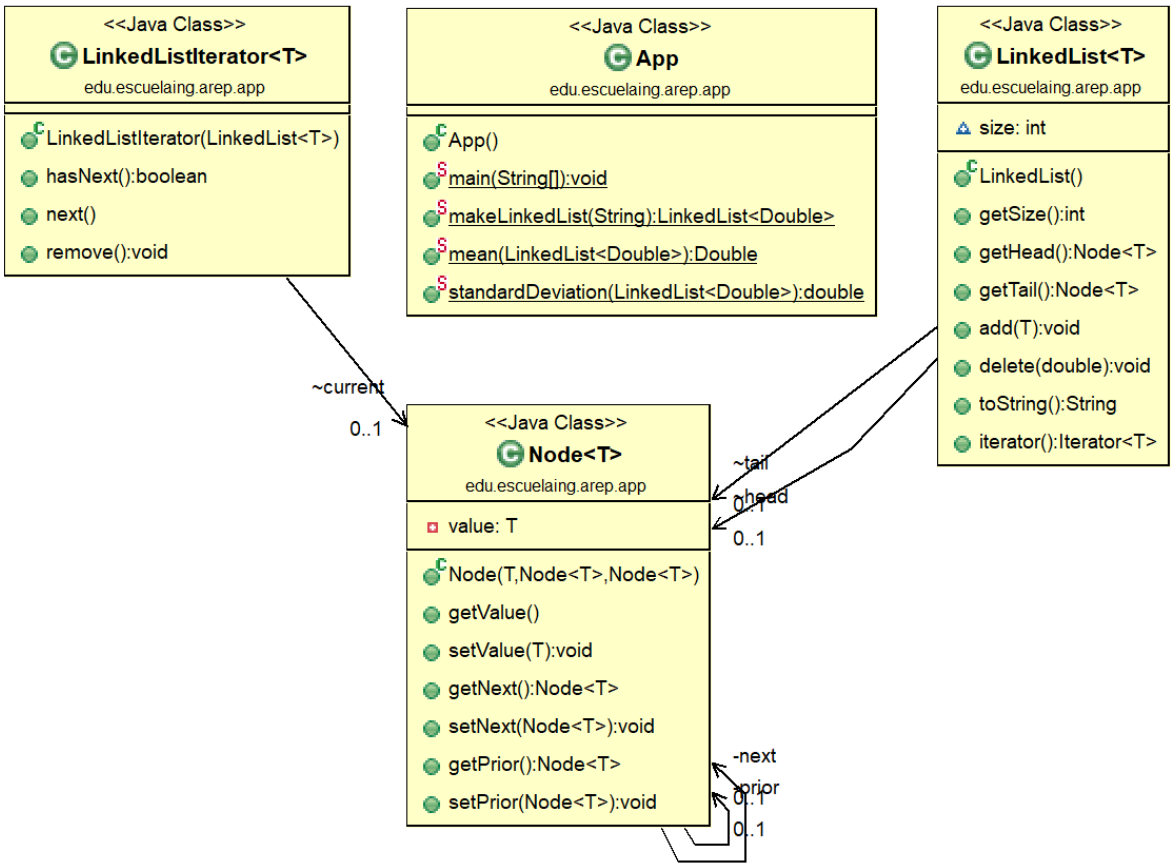

Figure 2: App Class Diagram

The following are the classes or interfaces that were used in the development of the workshop:

1. The LinkedListIterator class: implements the Iterator interface methods providing the necessary logic to iterate the collection and access the elements.
2. The LinkedList class: Implements Iterable so the nodes in this class can be easily iterate using forEach and this class has two methods:

(a) add: this will create a Node and insert it on the tail of the Linked List.

(b) delete: this will find the first node that match with the given value an remove it of the Linked List.

3. The Node class: it contains their value, the reference to the next node and previous node to enable iterate the Linked List.

4. The App class: Provides the following two math static methods:

   (a) mean: calculates the average of the data stored in the Linked List and returns the response rounded to 2 decimal places.

   (b) standardDeviation: calculates the standard deviation of the data stored in the Linked List and returns the response rounded to 2 decimal places.

5 Tests Cases

In this laboratory we have test cases along with their respective mean and standard deviation. This information is in the table 3 and the table 4 that have 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

Figure 3: Test data

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		

Figure 4: Test data

6 Results

The figure 5 are the results obtained:

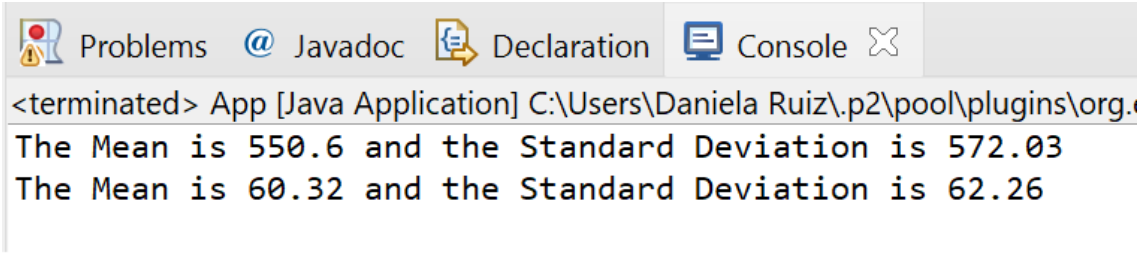

Figure 5: Results obtained

Analyzing the results obtained we can see that correspond to the information stored in the previous tables and how there are equal to the expected we can conclude the program behaves correctly when making the different calculations.

7 References

[1] SOFTWARETESTINGHELP., *Doubly linked list in java*, `https://www.softwaretestinghelp.com/doubly-linked-list-in-java/`, Accessed on 2021-01-25, 2021.

[2] GeeksforGeeks, *Doubly linked list*, `https://www.geeksforgeeks.org/doubly-linked-list/`, Accessed on 2021-01-25, 2014.

[3] E. Gamma, R. Helm, R. Johnson, and J. Vlissides, *Design Patterns: Elements of Reusable Object-Oriented Software*. USA: Addison-Wesley Longman Publishing Co., Inc., 1995, ISBN: 0201633612.