INTRODUCTIONT O COMPLEX SYSTEMS, JAVA, MVN, AND GIT

Assignment Kit

Requirements

Program 1 requirements

UseMaven and GITHUB.

Writea progra mt o calculatet he mean and standard deviation of as etof n real numbers.

Your program reads the n realnum bersfrom a fi le.

Usea l inked listt o store the n numbersfor t hec alculations. (Note: Youh ave to writeyou r own ni mplementati onof a l inkedl ist an di t mu st be compliant withJava 's collections API)

Thoroughly testt heprogra m. At least two testss hould uset heda tai n the columns of Table1.   Expected resultsa reprovi ded in Table2.

Column 1	Column 2
EstimateP roxy 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	ExpectedV alue		ActualV alue	
	Mean	Std. Dev	Mean	Std. Dev
Table1 :Col umn 1	550.6	572.03		
Table1: Col umn 2	60.32	62.26		

Table 2

Linked lists
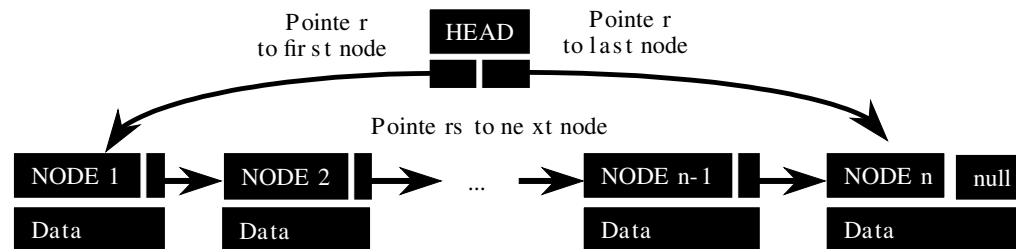
Linked listsa rea c ommon abstractda tat ypeus ed to maintain collectionsof da ta.

Linked listsa rei mplemented with pointers.

Al inked listt ypically hast wo components.
● listhe ad
● listnode (s)

Pointe r
to fir s t node   HEAD   Pointe r
to l a s t node

Pointe rs to ne xt node

| NODE 1 | | → | NODE 2 | | → | ... | → | NODE n-1 | | → | NODE n | null |
| Data | | | Data | | | | | Data | | | Data | |

Someof t heopt ionsfor l inked lists tructurea re
● thel isthe ad can pointt o the firstnode , lastnode , or both
● al istnode c an pointt o thene xtnode , prior node, or both

Nullpoi ntersa reoft en used to indicatea n empty listor t hee nd of thel ist.

Typicalope rationson a l inked listi nclude
● add node
● removenode
● nextnode
● prior node

Mean and standard deviation

Overview

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% to 98%, the other from 82% to 93%. The standard deviation would be larger for there sults of the first exam.

Calculating mean and standard deviation

The formula for calculating the mean is

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

The formula for standard deviation, s , is

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

where
- $\sum$ ist hes ymbolfor s ummation
- i isa n index to the n numbers
- x ist heda tai n thes et
- n ist henum ber of itemsi n the set

A mean and standard deviation example

A mean and standard deviation example

In this example, we will calculate mean and standard deviation of the data in Table 3.

X
186
699
132
272
291
331
199
1890
788
1601

Table 3

1. In this example, there are 10 items in the data set. Therefore, we set n = 10.
2. We can now solve the summation items in the mean formula.

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

n	x
1	186
2	699
3	132
4	272
5	291
6	331
7	199
8	1890
9	788
10	1601
Total	$\sum_{i=1}^{10} x_i = 6389$

3. We can then substitute the intermediate value into the formula.

$$x_{avg} = \frac{6389}{10}$$

$$x_{avg} = 638.9$$

A mean and standard dd eviation example, cont.

4. Wec an now substitute x_{avg} to calculatet he intermediate valuesfor t he standard deviation formula.

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

n	x	$(x_i - x_{avg})^2$
1	186	205,118.41
2	699	3,612.01
3	132	256,947.61
4	272	134,615.61
5	291	121,034.41
6	331	94,802.41
7	199	193,512.01
8	1890	1,565,251.21
9	788	22,230.81
10	1601	925,636.41
Total	$\sum_{i=1}^{10} x_i = 6389$	$\sum_{i=1}^{10}(x_i - x_{azvg})^2 = 3,522,761.90$

5. Wec an then substitute thei ntermediateva luei nto theform ula.

$$s = \sqrt{\frac{3,522,761.00}{9}}$$

$$s = \sqrt{391,417.878}$$

$$s = 625.633981$$