

## GLAB 330.2.2 - Standard Deviation

### Introduction:

**Standard Deviation ( $\sigma$ )** in statistics, typically denoted by  $\sigma$ , is a measure of how much a data set varies (dispersion) between values in a set of data. The lower the standard deviation, the closer the data points tend to be to the mean (or expected value),  $\mu$ . In this lab, we will demonstrate how to calculate the standard deviation.

### Learning Objective:

By the end of this lab learners will be able to calculate the standard deviation.

### Given Dataset

Imagine that we have the following data set representing the number of books read by five learners in a month:

Number of Books (X)
2
4
4
4
5
5
7
9

## Instructions:

Here are the steps to calculate the standard deviation:

1. Calculate the mean (average) of the data set:

$$\bar{X} = \frac{2 + 4 + 4 + 4 + 5 + 5 + 7 + 9}{8} = \frac{40}{8} = 5$$

$$X = (2+4+4+4+5+5+7+9)/8 = 40/8 = 5$$

2. Calculate the squared differences from the mean for each data point:

### Step 2: Calculate the Deviations and Squared Deviations

$x_i$	Deviation ( $x_i - \bar{x}$ )	Squared Deviation ( $(x_i - \bar{x})^2$ )
2	$2 - 5 = -3$	$(-3)^2 = 9$
4	$4 - 5 = -1$	$(-1)^2 = 1$
4	$4 - 5 = -1$	$(-1)^2 = 1$
4	$4 - 5 = -1$	$(-1)^2 = 1$
5	$5 - 5 = 0$	$(0)^2 = 0$
5	$5 - 5 = 0$	$(0)^2 = 0$
7	$7 - 5 = 2$	$(2)^2 = 4$
9	$9 - 5 = 4$	$(4)^2 = 16$
Sum ( $\Sigma$ )	0	32

$$(2-5)^2 = (-3)^2 = 9$$

$$(4-5)^2 = (-1)^2 = 1$$

$$(4-5)^2 = (-1)^2 = 1$$

$$(4-5)^2 = (-1)^2 = 1$$

$$(5-5)^2 = (0)^2 = 0$$

$$(5-5)^2 = (0)^2 = 0$$

$$(7-5)^2 = (2)^2 = 4$$

$$(9-5)^2 = (4)^2 = 16$$

### 3. Calculate the Variance ( $s^2$ )

The sum of squared deviations,  $\sum (x_i - \bar{x})^2$ , is 32.

$$s^2 = \frac{\sum (x_i - \bar{x})^2}{n - 1} = \frac{32}{8 - 1} = \frac{32}{7} \approx 4.5714$$

After taking the sum of these squared differences, I get  $(32)/(8-1) = 32/7$ , which is roughly 4.5714.

### 4. Take the square root of the variance to get the standard deviation:

$$s = \sqrt{4.5714} \approx 2.138$$

Sqrt  $(32/7) = (4*\text{sqrt}(14))/7$ , which is roughly **2.138**.

Since this problem involves a positive quantity, the SD of the number of books read by these students is 2. This means that on average, **the number of books read by each student deviates from the mean by about 2 books.**

---

## Canvas Submission Instructions:

- Upload your project to your GitHub account without setting it to private.
- Utilize the `README` file for any necessary additional instructions.
- Incorporate suitable comments throughout your project.
- Share the GitHub link on Canvas by clicking on the "Start Assignment" button located in the top-right corner of the Assignment page.