

## ASSIGNMENT (QUESTION -3)

**If  $\mu = 55$ ,  $\sigma_a = 4$ ,  $\sigma_b = 10$ ,  $\sigma_c = 15$ , In this which is better**

### Introduction

In statistics, the mean ( $\mu$ ) and standard deviation ( $\sigma$ ) are important measures used to analyze data distribution. The mean represents the average value of a dataset, while standard deviation measures how much the data values vary or spread from the mean. A smaller standard deviation indicates that the data values are closely concentrated around the mean, whereas a larger standard deviation shows greater variation in the data.

In this assignment, three datasets have the same mean value but different standard deviations. The given values are:

- Mean ( $\mu$ ) = 55
- Standard deviation  $\sigma_a = 4$
- Standard deviation  $\sigma_b = 10$
- Standard deviation  $\sigma_c = 15$

The objective is to determine which dataset is better based on its standard deviation.

### Understanding Mean and Standard Deviation

#### Mean ( $\mu$ )

The mean is the average value of all observations in a dataset. It represents the central value around which data points are distributed.

In this case:

- All three datasets have the same mean value (55).
- This means the average performance or central value is equal for all datasets.

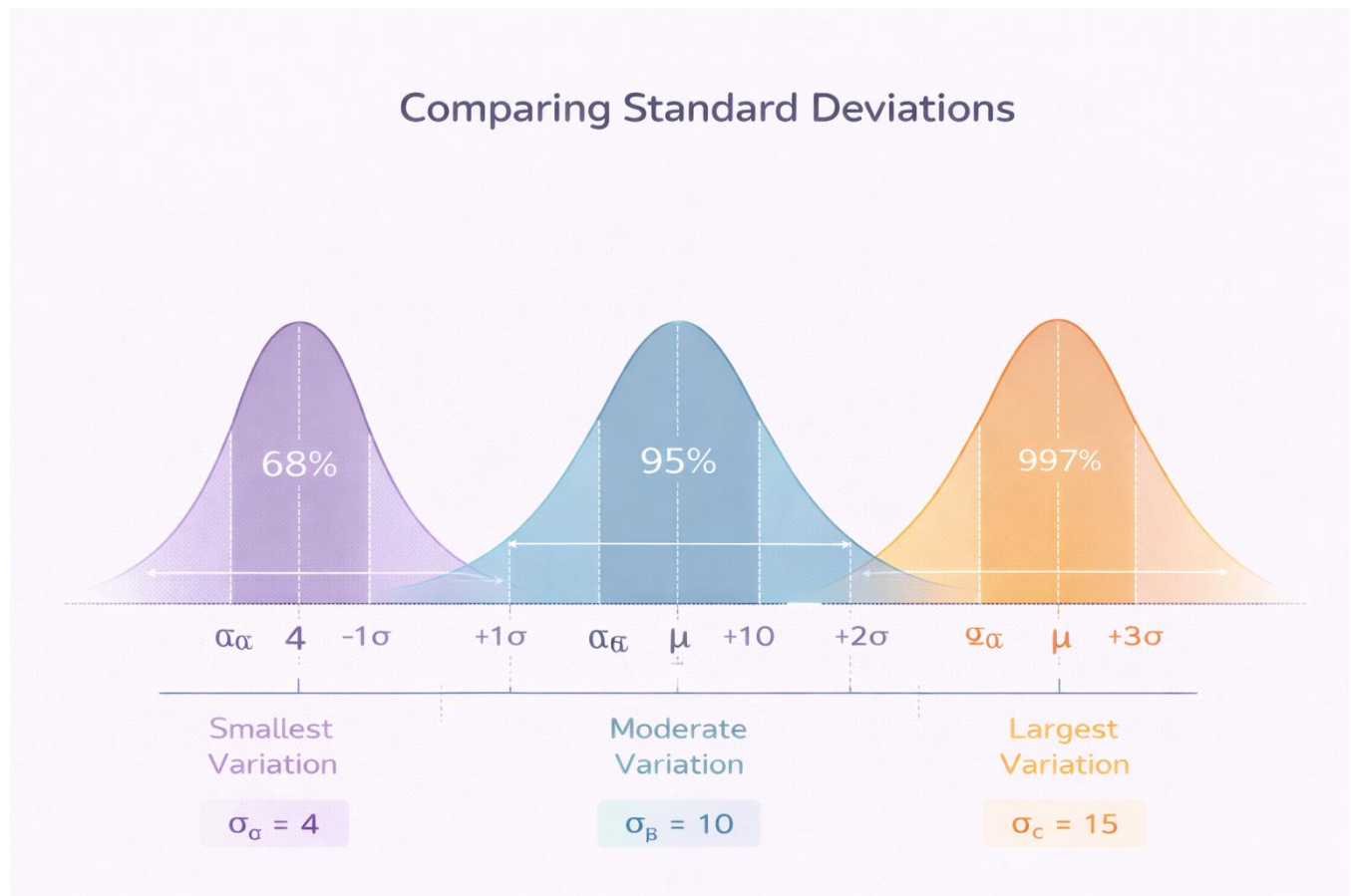
#### Standard Deviation ( $\sigma$ )

Standard deviation measures the spread or dispersion of data values from the mean.

#### Key Points

- **Small standard deviation** → data values are close to the mean → more consistency.
- **Large standard deviation** → data values are widely spread → less consistency.

Therefore, when comparing datasets with the same mean, the dataset with the smallest standard deviation is considered better because it shows greater reliability and stability.



## Comparison of Given Standard Deviations

### Case 1: $\sigma_a = 4$

- Very small variation from the mean.
- Data values are closely concentrated around 55.
- Indicates high consistency and reliability.

### Range Using Empirical Rule ( $\mu \pm \sigma$ )

$$55 \pm 4 = 51 \text{ to } 59$$

Most values lie in a narrow range.

### Case 2: $\sigma_b = 10$

- Moderate variation from the mean.
- Data values are more spread out compared to  $\sigma_a$ .

- Less consistent than the first dataset.

### Range

$$55 \pm 10 = 45 \text{ to } 65$$

### Case 3: $\sigma_c = 15$

- Large variation from the mean.
- Data values are widely spread.
- Indicates low consistency and higher uncertainty.

### Range

$$55 \pm 15 = 40 \text{ to } 70$$

## Determining the Better Dataset

Since all datasets have the same mean (55), the comparison depends on consistency and variation.

Dataset	Standard Deviation	Interpretation
$\sigma_a$	4	Highest consistency (Best)
$\sigma_b$	10	Moderate consistency
$\sigma_c$	15	Lowest consistency

The dataset with  $\sigma_a = 4$  is better because it has the smallest standard deviation and shows minimum variation from the mean.

## Importance of Smaller Standard Deviation

A smaller standard deviation is preferred because:

- It indicates stable and reliable data.
- Values are close to the average.
- Predictability is higher.
- Error or uncertainty is minimal.

This concept is widely used in quality control, performance analysis, and statistical decision-making.

## Conclusion

When comparing datasets with the same mean, the dataset with the smallest standard deviation is considered better because it shows less variation and greater consistency. In this case, the dataset with standard deviation  $\sigma_a = 4$  is the best among the three because its values are closest to the mean value of 55. The other datasets with  $\sigma_b = 10$  and  $\sigma_c = 15$  show greater spread and lower consistency. Therefore,  $\sigma_a = 4$  represents the most reliable and stable distribution.

Furthermore, the comparison of standard deviations helps in understanding the consistency and reliability of data. When datasets have the same mean value, the standard deviation becomes the key factor in determining the quality of the distribution. A smaller standard deviation indicates that data values are closely grouped around the mean, showing stability and predictability. This concept is widely applied in areas such as quality control, performance measurement, and scientific research, where consistent results are preferred.

Moreover, understanding the role of standard deviation supports better decision-making in statistical analysis. It helps researchers and analysts evaluate the variability of data and choose the most reliable dataset for practical applications. In this case, the dataset with  $\sigma_a = 4$  provides the highest consistency and least variation, making it the most suitable and dependable distribution. Therefore, standard deviation plays a crucial role in measuring data spread and identifying the best possible dataset among multiple options.