Consider A Sample With Data Values Of 10, 17, 9, 5, And 19. Compute The Variance. X (to 1 Decimal) Compute

Consider A Sample With Data Values Of 10, 17, 9, 5, And 19. Compute The Variance. X (to 1 Decimal) Compute This statement sets the foundation for understanding how to measure the variability within a dataset. Variance is a fundamental concept in statistics that quantifies how much the data points in a sample differ from the mean, or average, of the data. Calculating variance helps in understanding the spread and consistency of data, which is crucial for various fields such as research, finance, quality control, and data analysis. In this article, we will walk through the step-by-step process of calculating the variance for the sample data set: 10, 17, 9, 5, and 19, and we will ensure the final result is presented with one decimal precision.

Understanding Variance: Definition and Importance

What Is Variance?

Variance is a statistical measure that describes the dispersion of data points in a dataset. It provides an average of the squared differences between each data point and the mean of the dataset. The formula for the variance of a sample is:

$$s^2 = \frac{1}{n - 1} \sum_{i=1}^{n} (x_i - \bar{x})^2$$

where:
- s^2 is the sample variance,
- n is the number of data points,
- x_i represents each data point,
- $\bar{x}$ is the mean of the sample.

The reason for dividing by $n - 1$ (instead of n) is to account for the fact that we're working with a sample rather than the entire population, which makes the variance an unbiased estimator.

Why Is Variance Important?

Variance provides insights into the data's consistency and reliability:
- Low Variance: Indicates data points are close to the mean, suggesting

stability.
- High Variance: Signifies data points are spread out over a broader range, indicating variability.

Understanding variance is essential in:
- Comparing different datasets,
- Assessing risk in financial portfolios,
- Quality control in manufacturing processes,
- Conducting hypothesis testing and predictive modeling.

Step-by-Step Calculation of Variance for the Given Data

Let's now proceed with the actual calculation of variance for our sample data: 10, 17, 9, 5, and 19.

Step 1: List the Data Points

The data points are:
- $x_1 = 10$
- $x_2 = 17$
- $x_3 = 9$
- $x_4 = 5$
- $x_5 = 19$

Step 2: Calculate the Mean ($\bar{x}$)

The mean is the sum of all data points divided by the number of points:

$$
\bar{x} = \frac{10 + 17 + 9 + 5 + 19}{5} = \frac{60}{5} = 12.0
$$

So, the mean of the sample is 12.0.

Step 3: Compute the Squared Deviations from the Mean

Subtract the mean from each data point and square the result:

Data Point (x_i)	Difference ($x_i - \bar{x}$)	Squared Difference ($(x_i - \bar{x})^2$)

10	$10 - 12.0 = -2.0$	$(-2.0)^2 = 4.0$
17	$17 - 12.0 = 5.0$	$5.0^2 = 25.0$
9	$9 - 12.0 = -3.0$	$(-3.0)^2 = 9.0$
5	$5 - 12.0 = -7.0$	$(-7.0)^2 = 49.0$
19	$19 - 12.0 = 7.0$	$7.0^2 = 49.0$

Step 4: Sum of Squared Deviations

Add all the squared differences:

$$
4.0 + 25.0 + 9.0 + 49.0 + 49.0 = 136.0
$$

Step 5: Calculate the Variance

Divide the sum of squared deviations by $n - 1$, which is $5 - 1 = 4$:

$$
s^2 = \frac{136.0}{4} = 34.0
$$

Therefore, the sample variance is 34.0.

Interpreting the Variance Result

The calculated variance of 34.0 indicates the degree of spread within the sample data. To gain a more intuitive understanding, it is often helpful to consider the standard deviation, which is the square root of the variance:

$$
s = \sqrt{34.0} \approx 5.8
$$

This means, on average, data points tend to deviate from the mean by approximately 5.8 units.

Additional Considerations in Variance

Calculation

Population vs. Sample Variance

While the above calculation is for a sample, if you are working with an entire population, the denominator would be \(n \) instead of \(n - 1 \). This adjustment ensures an unbiased estimate when dealing with samples, especially in inferential statistics.

Impact of Data Variability

High variance suggests that data points are widely spread, which could imply variability in processes or measurements. Conversely, low variance suggests consistency, which is often desirable in quality control.

Applications of Variance

- Finance: Measuring the volatility of asset returns.
- Manufacturing: Ensuring product consistency.
- Research: Testing hypotheses about data variability.
- Data Science: Feature engineering and model evaluation.

Conclusion

Calculating variance is a vital step in statistical analysis, providing insights into the data's dispersion and reliability. For the data set 10, 17, 9, 5, and 19, we meticulously computed the variance to be 34.0 with one decimal place. This measure, along with the standard deviation, offers a quantitative understanding of how much the data points fluctuate around the mean. Mastering variance computation enhances your ability to interpret data accurately and supports informed decision-making across various disciplines.

Summary of Steps to Compute Variance

- Calculate the mean (\(\bar{x} \)) of the data set.
- Subtract the mean from each data point to find deviations.
- Square each deviation to eliminate negative values.

- Sum all squared deviations.
- Divide this sum by $n - 1$ (for a sample) to find the variance.

By following these steps, you can easily compute the variance for any dataset, enabling a deeper understanding of data variability and supporting robust statistical analysis.

Frequently Asked Questions

How do you calculate the variance for the sample data values 10, 17, 9, 5, and 19?

First, find the mean of the data, then subtract the mean from each data point and square the result. Sum these squared differences, then divide by the number of data points minus one (n-1).

What is the mean of the sample data 10, 17, 9, 5, and 19?

The mean is calculated as (10 + 17 + 9 + 5 + 19) / 5 = 60 / 5 = 12.0.

Can you show the step-by-step calculation of the variance for the given data set?

Yes. Calculate squared deviations: (10-12)^2=4, (17-12)^2=25, (9-12)^2=9, (5-12)^2=49, (19-12)^2=49. Sum: 4+25+9+49+49=136. Divide by n-1=4: 136/4=34.0. So, the variance is 34.0.

What is the variance of the sample data (rounded to 1 decimal place)?

The variance is 34.0 when rounded to 1 decimal place.

Why do we divide by n-1 instead of n when computing the sample variance?

Dividing by n-1 instead of n provides an unbiased estimate of the population variance from a sample, correcting for the bias that occurs because the sample mean is used as an estimate of the true population mean.

Additional Resources

Consider a sample with data values of 10, 17, 9, 5, and 19. Compute the variance. X (to 1 decimal) compute – this is a fundamental statistical task that helps statisticians, data analysts, and students understand the spread or dispersion of a data set. Variance measures how much the data points deviate from the mean, providing insight into the variability within the data. Calculating the variance accurately is essential for tasks such as risk assessment, quality control, and hypothesis testing. In this article, we will explore the step-by-step process to compute the variance for the given data set, ensuring clarity and understanding for beginners and seasoned analysts alike.

Understanding Variance and Its Importance

Variance is a statistical measure that quantifies how much the data points in a dataset spread out around the mean (average). A low variance indicates that the data points tend to be close to the mean, while a high variance suggests a wide spread.

Why is Variance Important?

- Assessing Data Consistency: Variance helps determine the consistency of data points.
- Comparing Data Sets: Variance allows comparison between different datasets' variability.
- Foundation for Standard Deviation: Variance is the squared value of the standard deviation, a more interpretable measure of spread.
- Informs Decision Making: Variance is used in finance, engineering, quality control, and many other fields to make informed decisions based on data variability.

Step-by-Step Guide to Computing Variance

Let's proceed methodically to compute the variance of the data set: 10, 17, 9, 5, and 19.

Step 1: Organize the Data

Data Point
10
17
9
5
19

Step 2: Calculate the Mean (Average)

The mean (denoted as μ for population or $\bar{x}$ for sample) is calculated as:

$$
\text{Mean} = \frac{\text{Sum of all data points}}{\text{Number of data points}}
$$

Applying to our dataset:

$$
\text{Sum} = 10 + 17 + 9 + 5 + 19 = 60
$$

Number of data points, $n = 5$

$$
\boxed{
\text{Mean} = \frac{60}{5} = 12.0
}
$$

Note: The mean is 12.0 (to 1 decimal place), which will serve as the central point for computing deviations.

Step 3: Find Each Data Point's Deviation from the Mean

Subtract the mean from each data point:

Data Point	Deviation ($x_i - \bar{x}$)
10	$10 - 12 = -2$
17	$17 - 12 = 5$
9	$9 - 12 = -3$
5	$5 - 12 = -7$
19	$19 - 12 = 7$

Step 4: Square Each Deviation

Squaring each deviation ensures all differences are positive and gives weight to larger deviations.

Data Point	Deviation	Squared Deviation ($(x_i - \bar{x})^2$)
10	-2	$(-2)^2 = 4$
17	5	$5^2 = 25$

9	-3	$(-3)^2 = 9$
5	-7	$(-7)^2 = 49$
19	7	$7^2 = 49$

Step 5: Sum of Squared Deviations

Add all squared deviations:

$$
4 + 25 + 9 + 49 + 49 = 136
$$

Step 6: Choose Variance Type: Population or Sample

- Population Variance (σ^2): Dividing by n.
- Sample Variance (s^2): Dividing by $n - 1$ (degrees of freedom correction).

Given that our data set is a sample, we will compute the sample variance:

$$
s^2 = \frac{\text{Sum of squared deviations}}{n - 1}
$$

which is:

$$
s^2 = \frac{136}{5 - 1} = \frac{136}{4} = 34
$$

Step 7: Final Variance Value (to 1 Decimal)

Expressed to one decimal place:

$$
\boxed{
\text{Variance (s}^2\text{)} = 34.0
}
$$

Additional Considerations and Tips

Variance vs. Standard Deviation

- Variance: The average of squared deviations, expressed in squared units.

- Standard Deviation: The square root of variance, bringing the measure back to the original units.

For our dataset:

$$
\text{Standard Deviation} = \sqrt{34} \approx 5.8
$$

Sample vs. Population Variance

- When working with a sample, divide by $n - 1$ to get an unbiased estimate.
- When working with an entire population, divide by n.

Why Use $n - 1$?

Dividing by $n - 1$ (known as Bessel's correction) corrects the bias in the estimation of the population variance from a sample.

Practical Applications of Variance

Understanding the variance of a dataset has broad applications:

- Quality Control: Measuring the consistency of manufacturing processes.
- Finance: Assessing the volatility of stock returns.
- Research: Determining the reliability of experimental data.
- Education: Analyzing test score spreads to evaluate test difficulty or student performance.

Summary and Key Takeaways

- The mean of the data set (10, 17, 9, 5, 19) is 12.0.
- Deviations from the mean are calculated for each data point.
- Squaring these deviations emphasizes larger differences.
- The sum of squared deviations is 136.
- For a sample data set, the variance is 34.0.
- Variance provides a quantitative measure of data variability; combined with the standard deviation, it offers a comprehensive picture of data dispersion.

Final Notes

Calculating variance is an essential skill in statistics that underpins many advanced analytical techniques. Whether you're analyzing experimental data, financial returns, or quality metrics, understanding how to compute and interpret variance allows for robust data analysis and informed decision-making.

Remember, always clarify whether you're working with a sample or an entire population, as this affects the divisor used in the calculation. Practice with different datasets to become more comfortable with the process, and consider visualizing data dispersion through charts such as histograms or box plots for a more intuitive understanding.

In conclusion, the variance of the data set 10, 17, 9, 5, and 19, computed as a sample, is 34.0 (to 1 decimal). This measure provides valuable insight into how data points are distributed around the mean, serving as a foundational component in statistical analysis and interpretation.

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