

Measures of Central Tendency and Variation

Central tendency and variation are two measures used in statistics to summarize data. Measure of central tendency shows where the center or middle of the data set is located, whereas measure of variation shows the dispersion among data values.

<u>Measures of central tendency</u>	<u>Measures of variation</u>															
<p>Mean: average of data values,</p> $\bar{x} = \frac{\sum x}{n} \quad \text{or} \quad \mu = \frac{\sum x}{N}$ <p>(sample* mean) (population** mean)</p> <p>\bar{x} or μ denotes mean; Σ denotes summation notation; Σx denotes the sum of data values; n or N denotes the number of values in a sample</p>	<p>Standard deviation: measure of how much data values are deviated away from mean.</p> $s = \sqrt{\frac{\sum(x-\bar{x})^2}{n-1}} \quad \text{or} \quad \sigma = \sqrt{\frac{\sum(x-\mu)^2}{N}}$ <p>(sample* standard deviation) (population** standard deviation)</p> <p>Variance: square of the standard deviation.</p>															
<p>E.g. Find the mean of following values: {2, 3, 5, 2, 4, 2,}</p> <p>Solution:</p> <p>a. Find Σx, and n; $\Sigma x = 2 + 3 + 5 + 2 + 4 + 2 = 18$; $n = 6$</p> <p>b. $\bar{x} = \frac{\Sigma x}{n} = \frac{18}{6} = 3$</p>	<p>E.g. Find the standard deviation and variance of following values: {2, 3, 5, 2, 4, 2,}</p> <p>Solution:</p> <p>a. Compute the mean, \bar{x} or μ.</p> <p>b. Find $x - \bar{x}$ or $x - \mu$ for each individual value.</p> <p>c. Find the square for each individual value from step b, $(x - \bar{x})^2$ or $(x - \mu)^2$.</p> <p>d. Calculate the sum of all of the squares, $\sum(x - \bar{x})^2$ or $\sum(x - \mu)^2$.</p> <p>e. Divide the sum by the number of values, N or $n-1$.</p> <p>f. Compute the square root of the number from step e.</p>															
<p>Median: “middle value” or the average of “middle two values” in a data set when the numbers are arranged in an order.</p> <p>E.g. Find the median of following values: {2, 3, 5, 2, 4, 2}</p> <p>Solution:</p> <p>a. Sort the numbers in an order (ascending order): 2, 2, 2, 3, 4, 5</p> <p>b. Compute the average of two middle numbers if the ‘n’ (n=6) is an even number: $\frac{2+3}{2} = 2.5$</p> <p>c. Median is 2.5</p> <p>(NB: If the ‘n’ is an odd number, then find the middle value after sorting the numbers in an order)</p>	<p style="text-align: center;">Calculating standard deviation</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>x</th> <th>$x - \bar{x}$</th> <th>$(x - \bar{x})^2$</th> </tr> </thead> <tbody> <tr> <td>2</td> <td>2-3 = -1</td> <td>(-1)² = 1</td> </tr> <tr> <td>3</td> <td>3-3 = 0</td> <td>(0)² = 0</td> </tr> <tr> <td>4</td> <td>4-3 = 1</td> <td>(1)² = 1</td> </tr> <tr> <td colspan="2"></td> <td>$\Sigma(x - \bar{x})^2 = 2$</td> </tr> </tbody> </table> <p style="text-align: center;">$\bar{x} = 3 \quad \quad s = \sqrt{\frac{2}{3-1}} = \sqrt{1} = 1$</p> <p>Standard deviation, $s = 1$; Variance, $s^2 = 1$</p>	x	$x - \bar{x}$	$(x - \bar{x})^2$	2	2-3 = -1	(-1) ² = 1	3	3-3 = 0	(0) ² = 0	4	4-3 = 1	(1) ² = 1			$\Sigma(x - \bar{x})^2 = 2$
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<p>Mode: value that occurs with greatest frequency.</p> <p>E.g. Find the mode of following values: {2, 3, 5, 2, 4, 2}</p> <p>Solution: Most common number/Mode is 2.</p>	<p>Range: difference between the maximum value and the minimum value in a data set, Range = maximum value - minimum value</p> <p>E.g. Find the range of following values: {3, 2, 4}</p> <p>Solution: Subtract the lowest value from the biggest value = 4-2 = 2</p>															

*Sample: Subset of a population; **Population: Entire collection of elements or objects or individuals used in the study.

Reference:

Brase, C. H., and Brase, C. P. (2012). *Understandable Statistics: Concepts and Methods* (10th ed.). Cengage Learning.



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