VITAL MATHEMATICS

STATISTICS

Empirical Rule for Data with a Bell – Shaped Distribution

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INTRODUCTION

The empirical rule for data with a bell – shaped distribution is used to identify 3 set of data using the mean and standard deviation. The 3 sets of data are:

- About 68% of all data values are within 1 standard deviation from the mean.
- About 95% of all data values are within 2 standard deviations from the mean.
- About 99.7% of all data values are within 3 standard deviations from the mean.

EMPIRICAL RULE FOR DATA WITH A BELL – SHAPED DISTRIBUTION EQUATION

- 65% of data values

$\bar{x} - s;\ \bar{x} + s$

- 95% of data values

$\bar{x} - 2s;\ \bar{x} + 2s$

- 99.7% of data values

$\bar{x} - 3s;\ \bar{x} + 3s$

SOLVING EMPIRICAL RULE FOR DATA WITH A BELL – SHAPED DISTRIBUTION

$\bar{x} - s;\ \bar{x} + s$

$\bar{x} - 2s;\ \bar{x} + 2s$

$\bar{x} - 3s;\ \bar{x} + 3s$

STEP 1) Calculate the sample mean if it is not given.

$$\bar{x} = \frac{\Sigma x}{n}$$

STEP 2) Calculate the sample standard deviation if it is not given.

$$s = \sqrt{\frac{\Sigma(x - \bar{x})^2}{n - 1}}$$

STEP 3) Identify which percentage to calculate

STEP 4) Provide conclusion

EMPIRICAL RULE FOR DATA WITH A BELL – SHAPED DISTRIBUTION EXAMPLE

Example 1) What percentage of values are between 1 and 33, when the mean is 17 and standard deviation is 8?

Example 2) Find which values compose 68%, 95% and 99.7% of data, when $\bar{x} = 47 \; and \; s = 3$?

Concepts Concerning the EMPIRICAL RULE FOR DATA WITH A BELL – SHAPED DISTRIBUTION

When the data is not bell-shaped, this rule will not accurately report the data. For data that is not bell-shaped, use the Chebyshev's theorem in order to find what percentage of numbers are within a number of standard deviations from the mean. The Chebyshev's theorem has one restriction, $k \neq 1$; or standard deviation cannot be 1.

$$Chebyshev's\ Theorem: 1 - \frac{1}{k^2}; k \neq 1$$

K is any positive number

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