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Levels of Measurement

Levels of measurement, also called scales of measurement, tell you how precisely variables are recorded.

There are 4 levels of measurement:

1. **Nominal**: the data can only be categorized

- Gender

- Ethnicity

- Car brands

- Marital status

- City of birth

2. **Ordinal**: the data can be categorized and ranked

- Language ability (e.g., beginner, intermediate, fluent)

- Likert-type questions (e.g., very dissatisfied to very satisfied)

3. **Interval**: the data can be categorized, ranked, and evenly spaced (i.e. there is difference among each variable)

   - Temperature in Fahrenheit or Celsius (note: The difference between any two adjacent temperatures is the same: one degree. But zero degrees is defined differently depending on the scale – it doesn't mean an absolute absence of temperature.)

4. **Ratio**: the data can be categorized, ranked, evenly spaced, and has a natural zero.

   - Height

   - Age

   - Weight

   - Temperature in Kelvin (Note: For example, in the Kelvin temperature scale, there are no

   negative degrees of temperature – zero means an absolute lack of thermal energy.)

**Which descriptive statistics can I apply on my data?**

Data type	Mathematical operations	Measures of central tendency	Measures of variability
Nominal	• Equality (=, ≠)	• Mode	• None
Ordinal	• Equality (=, ≠) • Comparison (>, <)	• Mode • Median	• Range • Interquartile range
Interval	• Equality (=, ≠) • Comparison (>, <) • Addition, subtraction (+,−)	• Mode • Median • Arithmetic mean	• Range • Interquartile range • Standard deviation • Variance
Ratio	• Equality (=, ≠) • Comparison (>, <) • Addition, subtraction (+,−) • Multiplication, division (×, ÷)	• Mode • Median • Arithmetic mean • *Geometric mean	• Range • Interquartile range • Standard deviation • Variance • **Relative standard deviation

Source: https://www.scribbr.com/statistics/levels-of-measurement/

Levels of Symmetry

In statistical theory, location and variability are referred to as the first and second moments of a distribution. The third and fourth moments are called skewness and kurtosis.

Skewness essentially measures the symmetry of the distribution
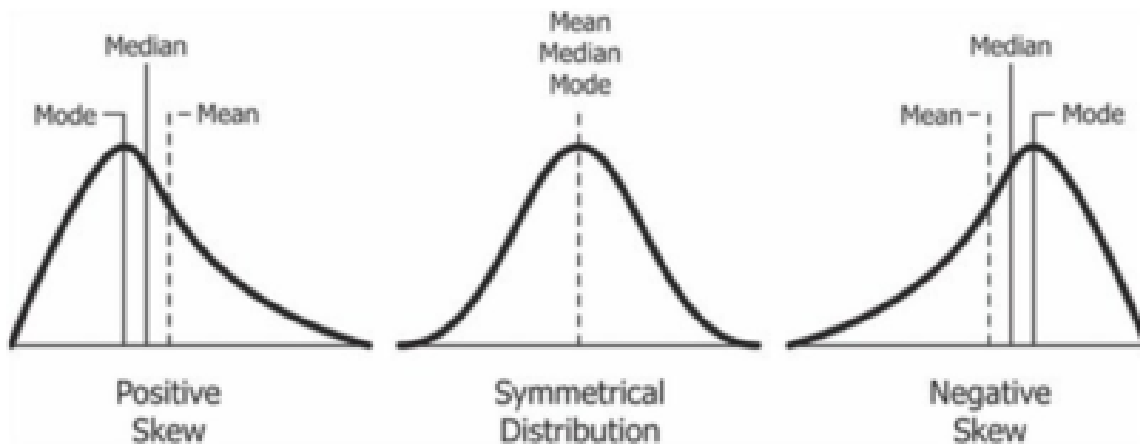
Kurtosis determines the heaviness of the distribution tails

Source: https://www.analyticsvidhya.com/blog/2021/05/shape-of-data-skewness-and-kurtosis/
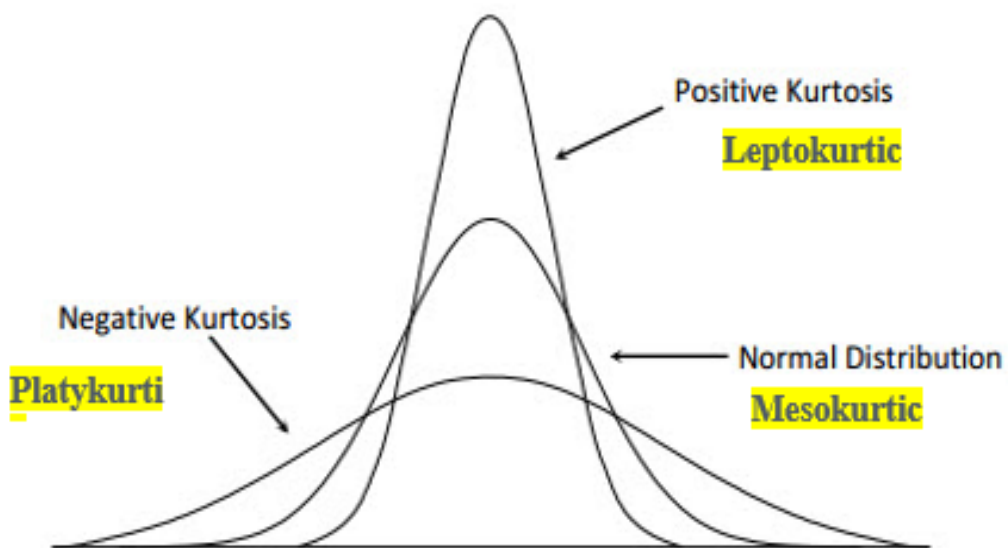
Types of Correlation

1.   Pearson-
Works well with interval or ratio data, when data has a linear relationship, no outliers, normally distributed data
2.   Spearman-
Works on ordinal , interval or ratio data, when data has a linear relationship, no outliers, need not be normally distributed
3.   Kendall-
Ordinal or continuous data, when data has a linear relationship, no outliers, need not be normally distributed

Since they all have different techniques to find correlations all of them provide different results.
Source: https://ademos.people.uic.edu/Chapter22.html#2_a_brief_overview_of_correlations

Degrees of Freedom

Degrees of freedom refers to the maximum number of logically independent values, which are values that have the freedom to vary, in the data sample.
Example-
- Consider a data sample consisting of, for the sake of simplicity, five positive integers. The values could be any number with no known relationship between them. This data sample would, theoretically, have five degrees of freedom.
- Four of the numbers in the sample are {3, 8, 5, and 4} and the average of the entire data sample is revealed to be 6.
- This must mean that the fifth number has to be 10. It can be nothing else. It does not have the freedom to vary.
- So the degrees of freedom for this data sample is 4.

$$D_f = N - 1$$