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Kruskal Wallis Test

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Kruskal-Wallis H test

The Kruskal-Wallis H test (sometimes also called the "one-way ANOVA on ranks") is a rank-based nonparametric test that can be used to determine if there are statistically significant differences between more than two groups of an independent variable on a continuous or ordinal dependent variable.

It is considered the nonparametric alternative to the one-way ANOVA, and an extension of the Mann-Whitney U test to allow the comparison of more than two independent groups.

Examples

- You want to find out how test anxiety affects actual test scores. The independent variable "test anxiety" has three levels: no anxiety, low-medium anxiety and high anxiety. The dependent variable is the exam score, rated from 0 to 100%.

- You want to find out how socioeconomic status affects attitude towards sales tax increases. Your independent variable is "socioeconomic status" with three levels: working class, middle class and wealthy. The dependent variable is measured on a 5-point Likert scale from strongly agree to strongly disagree.

Assumptions

- **dependent variable** should be measured at the **ordinal** or **continuous level**.
- **independent variable** should consist of **two or more categorical**, **independent groups**.
- **independence of observations**.
- groups should have the **same shape distributions**.

Hypothesis

H0: All populations are the same.

H1: All populations are not the same.

Calculation

The test statistic used in this test is called the H statistic.

$$H = \left[\frac{12}{n_T(n_T + 1)} \sum_{i=1}^{k} \frac{R_i^2}{n_i} \right] - 3(n_T + 1)$$

Where:

n_T = sum of sample sizes for all samples,

c = number of samples,

R_i = sum of ranks in the ith sample,

n_i = size of the ith sample.

Interpretation

- test statistic > critical value   Reject H0
- test statistic < critical value   Fail to Reject H0

Example

Sample question: A shoe company wants to know if three groups of workers have different salaries:

- 1 group: 23K, 41K, 54K, 66K, 78K.
- 2 group: 45K, 55K, 60K, 70K, 72K
- 3 group: 18K, 30K, 34K, 40K, 44K.

Thank you for attention!!!