Compare Multiple Related Samples

The command compares multiple related samples using the Friedman test (nonparametric alternative to the one-way ANOVA with repeated measures) and calculates the Kendall's coefficient of concordance (also known as Kendall's W). Kendall's W makes no assumptions about the underlying probability distribution and allows to handle any number of outcomes, unlike the standard Pearson correlation coefficient. Friedman test is similar to the Kruskal-Wallis one-way analysis of variance with the difference that Friedman test is an alternative to the repeated measures ANOVA with balanced design.

How To

- ✓ For unstacked data (each column is a sample):
  - Run the **STATISTICS->NONPARAMETRIC STATISTICS -> COMPARE MULTIPLE RELATED SAMPLES [FRIEDMAN ANOVA, CONCORDANCE]** command.
  - Select variables to compare.
- ✓ For stacked data (with a group variable):
  - Run the **STATISTICS->NONPARAMETRIC STATISTICS -> COMPARE MULTIPLE RELATED SAMPLES (*WITH GROUP VARIABLE*)** command.
  - Select a variable with observations (**VARIABLE**) and a text or numeric variable with the group names (**GROUPS**).

RESULTS

The report includes Friedman ANOVA and Kendall's W test results.

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ANOVA

N	7	*Degrees of Freedom*	3
Corrected for ties			
Chi-square	11.55882	*p-level*	0.00906
Not corrected for ties			
Chi-square	11.22857	*p-level*	0.01055

Kendall's W

Average rank	0.47549
Kendall's W	0.55042

Statistics

VAR	Average rank	Sum of Ranks	Mean
Employee	1.42857	10	4
March	3.71429	26	12
April	2.28571	16	7.42857
May	2.57143	18	7.14286

THE FRIEDMAN ANOVA tests the null hypothesis that the samples are from identical populations. If the p-value is less than the selected α level the null-hypothesis is rejected.

If there are no ties, Friedman test statistic F_t is defined as:

$$F_t = \left[\frac{12}{nk(k+1)}\sum_{i=1}^{k} R_i^2\right] - 3n(k+1)$$

where *n* is the number of rows, or subjects; *k* is the number of columns or conditions, and R_i is the sum of the ranks of i^{th} column.

If ranking results in any ties, the Friedman test statistic F_t is defined as:

$$F_t = \frac{n(k-1)\left[\sum_{i=1}^{k}\frac{R_i^2}{n} - C_F\right]}{\sum r_{ij}^2 - C_F}$$

where *n* is the number rows, or subjects, *k* is the number of columns, and R_i is the sum of the ranks from column, or condition *I;* C_F is the ties correction (Corder et al., 2009). When *n > 15* or *k > 4* the test statistic approximately follows chi-square distribution with *d.f.= k – 1.*

KENDALL'S W is used to assess the agreement between samples, it is a normalization of the Friedman test statistic and ranges from 0 (no agreement) to 1 (complete agreement).

Kendall's W is defined by:

$$W = \frac{12\,R}{m^2(k^3-k)}$$

where *m* is a number of raters, rating *k* subjects in a rank order from 1 to *k*. *R* is a squared deviation.

References

Conover, W. J. (1999), Practical Nonparametric Statistics, Third Edition, New York: John Wiley & Sons.

Corder, Gregory W., Foreman, Dale I. (2009). Nonparametric Statistics for Non-Statisticians: A Step-by-Step Approach.

Friedman, Milton (March 1940). A comparison of alternative tests of significance for the problem of m rankings. The Annals of Mathematical Statistics 11 (1): 86–92.