

Package ‘additivityTests’

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Type Package

Title Additivity Tests in the Two Way Anova with Single Sub-Class
Numbers

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Description Implementation of the Tukey, Mandel, Johnson-Graybill, LBI, Tusell
and modified Tukey non-additivity tests.

License GPL-3

VignetteBuilder knitr

Suggests knitr

URL <https://github.com/simecek/additivityTests>

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additivityTests-package

Additivity tests in the two way ANOVA with single sub-class numbers.

Description

In many applications of statistical methods, it is assumed that the response variable is a sum of several factors and a random noise. In a real world this may not be an appropriate model. For example, some patients may react differently to the same drug treatment or the effect of fertilizer may be influenced by the type of a soil. There might exist an interaction between factors.

If there is more than one observation per cell then standard ANOVA techniques may be applied. Unfortunately, in many cases it is infeasible to get more than one observation taken under the same conditions. For instance, it is not logical to ask the same student the same question twice.

Six tests of additivity hypothesis (under various alternatives) are included in this package: Tukey test, modified Tukey test, Johnson-Graybill test, LBI test, Mandel test and Tussell test.

Details

Testing for interaction in the two way ANOVA with single sub-class numbers.

Author(s)

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See Also

Useful links:

- <https://github.com/simecek/additivityTests>

Boik

Multi-headed Machine Data

Description

Performance of a multiple-headed machine used to fill bottles. Weights for six heads on five occasions were recorded.

Usage

data(Boik)

Source

Robert J. Boik: A comparison of three invariant tests of additivity in two-way classifications with no replications, Computational Statistics & Data Analysis, 1993.

critical.values	<i>Critical Values for the Johnson-Graybill, LBI and Tusell tests</i>
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Description

Compute the critical values by performing N simulation.

Usage

```
critical.values(a, b, N = 1e+05, alpha = 0.05)
```

Arguments

a	number of rows
b	number of columns
N	number of simulations
alpha	level(s) of the test

Value

A list containing three components: critical values for Johnson-Graybill, LBI and Tusell tests, respectively.

See Also

[johnson.graybill.test](#), [lbi.test](#), [tusell.test](#)

Examples

```
data(Boik)
critical.values(nrow(Boik), ncol(Boik), 0.01)
```

johnson.graybill.test	<i>Johnson and Graybill Additivity Test</i>
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Description

Test for an interaction in two-way ANOVA table by the Johnson-Graybill test.

Usage

```
johnson.graybill.test(Y, alpha = 0.05, critical.value = NA, Nsim = 1000)
```

Arguments

Y	data matrix
alpha	level of the test
critical.value	result of critical.values function, see Details
Nsim	number of simulations to be used for a critical value estimation

Details

The critical value can be computed in advance and given in the parameter critical value. If not a function [critical.values](#) is called to do that.

Value

A list with class "aTest" containing the following components: test statistics stat, critical value critical.value and the result of the test result, i.e. whether the additivity hypothesis has been rejected.

References

Johnson, D.E. and Graybill, F.A.: An analysis of a two-way model with interaction and no replication, *Journal of the American Statistical Association* **67**, pp. 862–868, 1972.

See Also

[tukey.test](#), [mtukey.test](#), [mandel.test](#), [lbi.test](#), [tusell.test](#)

Examples

```
data(Boik)
johnson.graybill.test(Boik)
```

lbi.test

Locally Best Invariant (LBI) Additivity Test

Description

Test for an interaction in two-way ANOVA table by the LBI test.

Usage

```
lbi.test(Y, alpha = 0.05, critical.value = NA, Nsim = 1000)
```

Arguments

Y	data matrix
alpha	level of the test
critical.value	result of critical.values function, see Details
Nsim	number of simulations to be used for a critical value estimation

Details

The critical value can be computed in advance and given in the parameter `critical.value`. If not a function `critical.values` is called to do that.

Value

A list with class "aTest" containing the following components: test statistics `stat`, critical value `critical.value` and the result of the test `result`, i.e. whether the additivity hypothesis has been rejected.

References

Boik, R.J.: Testing additivity in two-way classifications with no replications: the locally best invariant test, *Journal of Applied Statistics* **20**, pp. 41–55, 1993.

See Also

[tukey.test](#), [mtukey.test](#), [mandel.test](#), [johnson.graybill.test](#), [tusell.test](#)

Examples

```
data(Boik)
lbi.test(Boik)
```

`mandel.test`

Mandel Additivity Test

Description

Test for an interaction in two-way ANOVA table by the Mandel test.

Usage

```
mandel.test(data, alpha = 0.05, critical.value = NA)
```

Arguments

<code>data</code>	data matrix
<code>alpha</code>	level of the test
<code>critical.value</code>	result of critical.values function, see Details

Details

The critical value can be computed in advance and given in the parameter `critical.value`. If not a function `critical.values` is called to do that.

Value

A list with class "aTest" containing the following components: test statistics `stat`, critical value `critical.value` and the result of the test `result`, i.e. whether the additivity hypothesis has been rejected.

References

Mandel, J.: Non-additivity in Two-way Analysis of Variance, *Journal of the American Statistical Association* **56**, pp. 878–888, 1961.

See Also

[tukey.test](#), [mtukey.test](#), [johnson.graybill.test](#), [lbi.test](#), [tusell.test](#)

Examples

```
data(Boik)
mandel.test(Boik)
```

mtukey.test	<i>Modified Tukey Additivity Test</i>
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Description

Test for an interaction in two-way ANOVA table by the modified Tukey test.

Usage

```
mtukey.test(Y, alpha = 0.05, correction = 0, Nboot = 1000)
```

Arguments

<code>Y</code>	data matrix
<code>alpha</code>	level of the test
<code>correction</code>	type of small sample size correction (0=none, 1=bootstrap without replacement, 2=sampling), see Details
<code>Nboot</code>	number of simulations to be used for small sample size correction

Details

The level of the modified Tukey test is unstable for a small sample size. In such cases either bootstrapping (`correction=1`) or sampling (`correction=2`) should be used to compute the critical value.

Value

A list with class "aTest" containing the following components: test statistics `stat`, critical value `critical.value` and the result of the test `result`, i.e. whether the additivity hypothesis has been rejected.

References

Simecek, Petr, and Simeckova, Marie. "Modification of Tukey's additivity test." *Journal of Statistical Planning and Inference*, **2012**.

See Also

[tukey.test](#), [mandel.test](#), [johnson.graybill.test](#), [lbi.test](#), [johnson.graybill.test](#)

Examples

```
data(Boik)
mtukey.test(Boik)
mtukey.test(Boik, correction=2, Nboot=2000)
```

`tukey.test`

Tukey Additivity Test

Description

Test for an interaction in two-way ANOVA table by the Tukey test.

Usage

```
tukey.test(data, alpha = 0.05, critical.value = NA)
```

Arguments

`data` data matrix
`alpha` level of the test
`critical.value` result of [critical.values](#) function, see Details

Details

The critical value can be computed in advance and given in the parameter `critical.value`. If not a function [critical.values](#) is called to do that.

Value

A list with class "aTest" containing the following components: test statistics `stat`, critical value `critical.value` and the result of the test `result`, i.e. whether the additivity hypothesis has been rejected.

References

Tukey, J.W.: One Degree of Freedom for Non-additivity, *Biometrics* **5**, pp. 232–242, 1949.

See Also

[tusell.test](#), [mtukey.test](#), [mandel.test](#), [lbi.test](#), [johnson.graybill.test](#)

Examples

```
data(Boik)
tukey.test(Boik)
```

tusell.test	<i>Tusell Additivity Test</i>
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Description

Test for an interaction in two-way ANOVA table by the Tusell test.

Usage

```
tusell.test(Y, alpha = 0.05, critical.value = NA, Nsim = 1000)
```

Arguments

- Y data matrix
- alpha level of the test
- critical.value result of [critical.values](#) function, see Details
- Nsim number of simulations to be used for a critical value estimation

Details

The critical value can be computed in advance and given in the parameter critical value. If not a function [critical.values](#) is called to do that.

Value

A list with class "aTest" containing the following components: test statistics stat, critical value critical.value and the result of the test result, i.e. whether the additivity hypothesis has been rejected.

References

Tusell, F.: Testing for Interaction in Two-way ANOVA Tables with no Replication, *Computational Statistics & Data Analysis* **10**, pp. 29–45, 1990

See Also

[tukey.test](#), [mtukey.test](#), [mandel.test](#), [lbi.test](#), [johnson.graybill.test](#)

Examples

```
data(Boik)
tusell.test(Boik)
```

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