

Package: PSIndependenceTest (via r-universe)

November 1, 2024

Title Independence Tests for Two-Way, Three-Way and Four-Way Contingency Tables

Version 0.0.1

Description Presentation two independence tests for two-way, three-way and four-way contingency tables. These tests are: the modular test and the logarithmic minimum test. For details on this method see: Sulewski (2017) <[doi:10.18778/0208-6018.330.04](https://doi.org/10.18778/0208-6018.330.04)>, Sulewski (2018) <[doi:10.1080/02664763.2018.1424122](https://doi.org/10.1080/02664763.2018.1424122)>, Sulewski (2019) <[doi:10.2478/bile-2019-0003](https://doi.org/10.2478/bile-2019-0003)>, Sulewski (2021) <[doi:10.1080/00949655.2021.1908286](https://doi.org/10.1080/00949655.2021.1908286)>.

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GenTab2 *Two-way contingency table r x c - generation*

Description

Generating a two-way contingency table r x c

Usage

GenTab2(pi_j, n)

Arguments

pi _j	a numeric matrix with non-negative probability values of the two-way contingency table
n	a sample size

Details

Generating a two-way contingency table $r \times c$ using the probability matrix p_{ij} . If H_0 is true then p_{ij} equals $1 / r / c$.

Value

The function returns the two-way contingency table $r \times c$

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2016). *Moc testów niezależności w tablicy dwudzielczej większej niż 2×2* , Przegląd statystyczny 63(2), 190-210

Examples

```
r = 6; c = 2
GenTab2(array(1 / r / c, dim = c(r, c)), 93)
GenTab2(matrix(c(0.125,0.25,0.25,0.375), nrow=2), 100)
```

GenTab3

Three-way contingency table $r \times c \times t$ - generation

Description

Generating a three-way contingency table $r \times c \times t$.

Usage

```
GenTab3(pijt, n)
```

Arguments

<code>pijt</code>	a numeric matrix with non-negative probability values of the three-way contingency table
<code>n</code>	a sample size

Details

Generating a three-way contingency table $r \times c \times t$ using the probability matrix p_{ijt} . If H_0 is true then p_{ijt} equals $1 / r / c / t$.

Value

The function returns the three-way contingency table $r \times c \times t$

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
r = 2; c = 3; t = 4
GenTab3(array(1 / (r * c * t), dim = c(r, c, t)),250)
table = GenTab3(array(0.125, dim = c(2, 2, 2)), 100)
GenTab3(prop.table(table),100)
```

 GenTab4

Four-way contingency table r x c x t x u - generation

Description

Generating a four-way contingency table r x c x t x u.

Usage

```
GenTab4(pijtu, n)
```

Arguments

pijtu	a numeric matrix with non-negative probability values of the four-way contingency table
n	a sample size

Details

Generating a four-way contingency table r x c x t x u using the probability matrix pijtu. If H_0 is true then pijtu equals $1 / r / c / t / u$.

Value

The function returns the four-way contingency table r x c x t x u

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
r = 2; c = 2; t = 2; u = 3
GenTab4(array(1 / (r * c * t * u), dim = c(r, c, t, u)),150)
table = GenTab4(array(1/16, dim = c(2, 2, 2, 2)), 200)
GenTab4(prop.table(table),200)
```

Lms2.cv

Logarithmic Minimum Test for Independence in Two-Way Contingency Table

Description

Calculates the critical values of the logarithmic minimum test.

Usage

```
Lms2.cv(nr, nc, n, alfa, B = 10000)
```

Arguments

nr	a number of rows
nc	a number of columns
n	a sample size
alfa	a significance level
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the logarithmic minimum test for independence in $r \times c$ contingency table,

Value

The function returns the critical value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2019). *The LMS for Testing Independence in Two-way Contingency Tables*. Biometrical Letters 56(1), 17-43 #'

Examples

```
Lms2.cv(2, 2, 40, 0.05, B = 1e3)
```

```
Lms2.cv(2, 3, 60, 0.1, B = 1e2)
```

Lms2.pvalue	<i>Logarithmic Minimum Test for Independence in Two-Way Contingency Table</i>
-------------	-------------------------------------------------------------------------------

Description

Calculates the p-value of the logarithmic minimum test.

Usage

```
Lms2.pvalue(stat, nr, nc, n, B = 10000)
```

Arguments

stat	a logarithmic minimum statistic value
nr	a number of rows
nc	a number of columns
n	a sample size
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The p-value of the logarithmic minimum test for independence in $r \times c$ contingency table, 

Value

The function returns the p-value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2019). *The LMS for Testing Independence in Two-way Contingency Tables*. Biometrical Letters 56(1), 17-43

Examples

```
Lms2.pvalue(Lms2.stat(table1), 2, 2, 40, B = 1e3)
Lms2.pvalue(Lms2.stat(table2), 2, 3, 60, B = 1e2)
```

Lms2.stat	<i>Logarithmic Minimum Test for Independence in Two-Way Contingency Table</i>
-----------	-------------------------------------------------------------------------------

Description

Calculates the logarithmic minimum statistics (see Sulewski P. (2019)).

Usage

```
Lms2.stat(nij)
```

Arguments

`nij` a numeric matrix with non-negative values of the two-way contingency table cells

Details

The statistic of the logarithmic minimum test for independence in $r \times c$ contingency table, see formula (4) and example 3 in the article.

Value

The function returns the value of the logarithmic minimum test statistic

Author(s)

Piotr Sulewski, <piotr.sulewski@aps1.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2019). *The LMS for Testing Independence in Two-way Contingency Tables*. Biometrical Letters 56(1), 17-43

Examples

```
Lms2.stat(table1)
Lms2.stat(table2)
```

Lms2.test	<i>Logarithmic Minimum Test for Independence in Two-Way Contingency Table</i>
-----------	-------------------------------------------------------------------------------

Description

Calculates the test statistic and p-value of the logarithmic minimum test.

Usage

```
Lms2.test(nij, B = 10000)
```

Arguments

nij	a numeric matrix with non-negative values of the two-way contingency table cells
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The test statistic and p-value of the logarithmic minimum test for independence in $r \times c$ contingency table,

Value

The function returns values of the test statistic and p-value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@aps1.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2019). *The LMS for Testing Independence in Two-way Contingency Tables*. *Biometrical Letters* 56(1), 17-43

Examples

```
Lms2.test(GenTab2(matrix(1/6, nrow = 2, ncol = 3), 50), B = 1e2)  
Lms2.test(table2, B = 1e3)
```

Lms3.cv	<i>Logarithmic minimum test for independence in three-way contingency table</i>
---------	---------------------------------------------------------------------------------

Description

Calculates the critical value of the Logarithmic minimum test for independence in three-way contingency table (see Sulewski P. (2018)).

Usage

```
Lms3.cv(nr, nc, nt, n, alfa, B = 10000)
```

Arguments

nr	a number of rows
nc	a number of columns
nt	a number of tubes
n	a sample size
alfa	a significance level
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the Logarithmic minimum test for independence in $r \times c \times t$ contingency table,

Value

The function returns the critical value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Con-tingency Table of Small Sizes*, Journal of Statistical Computation and Simulation 91(13), 2780-2799

Examples

```
Lms3.cv(2, 2, 2, 80, 0.05, B = 1e2)  
Lms3.cv(2, 2, 2, 80, 0.1, B = 1e3)
```

Lms3.pvalue	<i>Logarithmic minimum test for independence in three-way contingency table</i>
-------------	---------------------------------------------------------------------------------

Description

Calculates the p-value of the Logarithmic minimum test for independence in three-way contingency table

Usage

```
Lms3.pvalue(stat, nr, nc, nt, n, B = 10000)
```

Arguments

stat	a Logarithmic minimum statistic value
nr	a number of rows
nc	a number of columns
nt	a number of tubes
n	a sample size
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the modular test for independence in $r \times c \times t$ contingency table,

Value

The function returns the p-value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@aps1.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Con-tingency Table of Small Sizes*, Journal of Statistical Computation and Simulation 91(13), 2780-2799

Examples

```
tab1 = GenTab3(array(0.125, dim = c(2, 2, 2)), 100)
Lms3.pvalue(Lms3.stat(tab1), 2, 2, 2, 100, B=1e2)
Lms3.pvalue(Lms3.stat(table4), 2, 2, 2, 80, B = 1e3)
```

Lms3.stat	<i>Logarithmic minimum test for independence in three-way contingency table</i>
-----------	---------------------------------------------------------------------------------

Description

Calculates the statistic of the Logarithmic minimum test for independence in three-way contingency table (see Sulewski P. (2018)).

Usage

```
Lms3.stat(nijt)
```

Arguments

nijt	a numeric matrix with non-negative values of the three-way contingency table cells
------	------------------------------------------------------------------------------------

Details

The statistic of Logarithmic minimum test for independence in $r \times c \times t$ contingency table, see formula (6) in the article.

Value

The function returns the value of the logarithmic minimum test statistic.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Con-tingency Table of Small Sizes*, Journal of Statistical Computation and Simulation 91(13), 2780-2799

Examples

```
Lms3.stat(table3)
Lms3.stat(GenTab3(array(1/12, dim=c(2,2,3)), 120))
```

Lms3.test	<i>Logarithmic minimum test for independence in three-way contingency table</i>
-----------	---------------------------------------------------------------------------------

Description

Calculates the test statistic and p-value of the Logarithmic minimum test for independence in three-way contingency table

Usage

```
Lms3.test(nijt, B = 10000)
```

Arguments

nijt	a numeric matrix with non-negative values of the three-way contingency table cells
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The test statistic and p-value of the Logarithmic minimum test for independence in $r \times c \times t$ contingency table,

Value

The function returns values of the test statistic and p-value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@aps1.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Contingency Table of Small Sizes*, Journal of Statistical Computation and Simulation 91(13), 2780-2799

Examples

```
Lms3.test(GenTab3(array(0.125, dim = c(2, 2, 2)), 80), B = 1e2)
Lms3.test(table4, B = 1e3)
```

Lms4.cv	<i>Logarithmic minimum test for independence in four-way contingency table</i>
---------	--------------------------------------------------------------------------------

Description

Calculates the critical value of the Logarithmic minimum test for independence in four-way contingency table

Usage

```
Lms4.cv(nr, nc, nt, nu, n, alfa, B = 10000)
```

Arguments

nr	a number of rows
nc	a number of columns
nt	a number of tubes
nu	a number of tubes
n	a sample size
alfa	a significance level
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the Logarithmic minimum test for independence in $r \times c \times t$ contingency table,

Value

The function returns the critical value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@aps1.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Con-tingency Table of Small Sizes*, Journal of Statistical Computation and Simulation 91(13), 2780-2799

Examples

```
Lms4.cv(2, 2, 2, 2, 160, 0.05, B = 1e2)  
Lms4.cv(2, 2, 2, 2, 160, 0.1, B = 1e3)
```

Lms4.pvalue	<i>Logarithmic minimum test for independence in four-way contingency table</i>
-------------	--------------------------------------------------------------------------------

Description

Calculates the p-value of the Logarithmic minimum test for independence in four-way contingency table

Usage

```
Lms4.pvalue(stat, nr, nc, nt, nu, n, B = 10000)
```

Arguments

stat	a Logarithmic minimum statistic value
nr	a number of rows
nc	a number of columns
nt	a number of tubes
nu	a number of
n	a sample size
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the modular test for independence in $r \times c \times t \times u$ contingency table,

Value

The function returns the p-value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@aps1.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Con-tingency Table of Small Sizes*, Journal of Statistical Computation and Simulation 91(13), 2780-2799

Examples

```
data = GenTab4(array(1/16, dim = c(2, 2, 2, 2)), 160)
Lms4.pvalue(Lms4.stat(data), 2, 2, 2, 2, 160, B=1e3)
Lms4.pvalue(Lms4.stat(table6), 2, 2, 2, 2, 160, B = 1e2)
```

Lms4.stat	<i>Logarithmic minimum test for independence in four-way contingency table</i>
-----------	--------------------------------------------------------------------------------

Description

Calculates the statistic of the Logarithmic minimum test for independence in four-way contingency table

Usage

```
Lms4.stat(nijtu)
```

Arguments

nijtu a numeric matrix with non-negative values of the four-way contingency table cells

Details

The statistic of Logarithmic minimum test for independence in $r \times c \times t \times u$ contingency table,

Value

The function returns the value of the logarithmic minimum test statistic.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Con-tingency Table of Small Sizes*, Journal of Statistical Computation and Simulation 91(13), 2780-2799

Examples

```
Lms4.stat(GenTab4(array(1/16, dim = c(2, 2, 2, 2)), 160))  
Lms4.stat(table5)
```

Lms4.test	<i>Logarithmic minimum test for independence in four-way contingency table</i>
-----------	--------------------------------------------------------------------------------

Description

Calculates the test statistic and p-value of the Logarithmic minimum test for independence in four-way contingency table

Usage

```
Lms4.test(nijtu, B = 10000)
```

Arguments

nijtu	a numeric matrix with non-negative values of the four-way contingency table cells
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The test statistic and p-value of the Logarithmic minimum test for independence in $r \times c \times t \times u$ contingency table,

Value

The function returns values of the test statistic and p-value of the logarithmic minimum test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Con-tingency Table of Small Sizes*, Journal of Statistical Computation and Simulation 91(13), 2780-2799

Examples

```
Lms4.test(GenTab4(array(1/16, dim = c(2, 2, 2, 2)), 160), B = 1e2)  
Lms4.test(table6, B = 1e3)
```

`Mod2.cv`*Modular test for independence in two-way contingency table*

Description

Calculates the critical value of the modular test for independence in two-way contingency table see formula (9) in the article.

Usage

```
Mod2.cv(nr, nc, n, alfa, B = 10000)
```

Arguments

<code>nr</code>	a number of rows
<code>nc</code>	a number of columns
<code>n</code>	a sample size
<code>alfa</code>	a significance level
<code>B</code>	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the modular test for independence in $r \times c$ contingency table, see formula (2) in the article.

Value

The function returns the critical value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2016). *Moc testów niezależności w tablicy dwudzielczej większej niż 2×2* , Przegląd statystyczny 63(2), 190-210

Examples

```
Mod2.cv(2, 2, 40, 0.05, B = 1e2)
Mod2.cv(2, 3, 60, 0.1)
```

`Mod2.pvalue`*Modular test for independence in two-way contingency table*

Description

Calculates the p-value of the modular test for independence in two-way contingency table

Usage

```
Mod2.pvalue(stat, nr, nc, n, B = 10000)
```

Arguments

<code>stat</code>	a modular statistic value
<code>nr</code>	a number of rows
<code>nc</code>	a number of columns
<code>n</code>	a sample size
<code>B</code>	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The p-value of the modular test for independence in $r \times c$ contingency table,

Value

The function returns the p-value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2016). *Moc testów niezależności w tablicy dwudzielczej większej niż 2×2* , Przegląd statystyczny 63(2), 190-210

Examples

```
pij=matrix(1/4, nrow = 2, ncol = 2)
tab4=GenTab2(pij, 30)
Mod2.pvalue(Mod2.stat(tab4), 2, 2, 30, B=1e3)
Mod2.pvalue(2.5, 3, 2, 60)
```

`Mod2.stat`*Modular test for independence in two-way contingency table*

Description

Calculates the statistic of the modular test for independence in two-way contingency table (see Sulewski P. (2016)).

Usage

```
Mod2.stat(nij)
```

Arguments

`nij` a numeric matrix with non-negative values of the two-way contingency table cells

Details

The statistic of the modular test for independence in $r \times c$ contingency table, see formula (2) in the article.

Value

The function returns the value of the modular test statistic.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Słupsk.

References

Sulewski, P. (2016). *Moc testów niezależności w tablicy dwudzielczej większej niż 2×2* , Przegląd statystyczny 63(2), 190-210

Examples

```
tab5=GenTab2(matrix(1/12, nrow = 3, ncol = 4), 60)
Mod2.stat(tab5)
Mod2.stat(table1)
```

`Mod2.test`*Modular test for independence in two-way contingency table*

Description

Calculates the test statistic and p-value of the modular test for independence in two-way contingency table

Usage

```
Mod2.test(nij, B = 10000)
```

Arguments

<code>nij</code>	a numeric matrix with non-negative values of the two-way contingency table cells
<code>B</code>	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The test statistic and p-value of the modular test for independence in $r \times c$ contingency table,

Value

The function returns values of the test statistic and p-value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Słupsk.

References

Sulewski, P. (2016). *Moc testów niezależności w tablicy dwudzielczej większej niż 2×2* , Przegląd statystyczny 63(2), 190-210

Examples

```
pij=matrix(1/4, nrow = 2, ncol = 2)
Mod2.test(GenTab2(pij, 50), B = 1e3)
Mod2.test(table1, B = 1e2)
```

`Mod3.cv`*Modular test for independence in three-way contingency table*

Description

Calculates the critical value of the modular test for independence in three-way contingency table (see Sulewski P. (2018)).

Usage

```
Mod3.cv(nr, nc, nt, n, alfa, B = 10000)
```

Arguments

<code>nr</code>	a number of rows
<code>nc</code>	a number of columns
<code>nt</code>	a number of tubes
<code>n</code>	a sample size
<code>alfa</code>	a significance level
<code>B</code>	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the modular test for independence in $r \times c \times t$ contingency table,

Value

The function returns the critical value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
Mod3.cv(2, 2, 2, 80, 0.05, B = 1e2)
Mod3.cv(2, 2, 2, 80, 0.1, B = 1e3)
```

`Mod3.pvalue`*Modular test for independence in three-way contingency table*

Description

Calculates the p-value of the modular test for independence in three-way contingency table

Usage

```
Mod3.pvalue(stat, nr, nc, nt, n, B = 10000)
```

Arguments

<code>stat</code>	a modular statistic value
<code>nr</code>	a number of rows
<code>nc</code>	a number of columns
<code>nt</code>	a number of tubes
<code>n</code>	a sample size
<code>B</code>	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the modular test for independence in $r \times c \times t$ contingency table,

Value

The function returns the p-value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@aps1.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. *Journal of Applied Statistics* 45(13), 2481-2498

Examples

```
data = GenTab3(array(0.125, dim = c(2, 2, 2)), 80)
Mod3.pvalue(Mod3.stat(data), 2, 2, 2, 80, B = 1e2)
Mod3.pvalue(Mod3.stat(table4), 2, 2, 2, 80, B = 1e3)
```

`Mod3.stat`*Modular test for independence in three-way contingency table*

Description

Calculates the statistic of the modular test for independence in three-way contingency table (see Sulewski P. (2018)).

Usage

```
Mod3.stat(nijt)
```

Arguments

`nijt` a numeric matrix with non-negative values of the three-way contingency table cells

Details

The statistic of the modular test for independence in $r \times c \times t$ contingency table, see formula (6) in the article.

Value

The function returns the value of the modular test statistic.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
Mod3.stat(GenTab3(array(0.125, dim = c(2, 2, 2)), 100))  
Mod3.stat(table4)
```

`Mod3.test`*Modular test for independence in three-way contingency table*

Description

Calculates the test statistic and p-value of the modular test for independence in three-way contingency table

Usage

```
Mod3.test(nijt, B = 10000)
```

Arguments

<code>nijt</code>	a numeric matrix with non-negative values of the three-way contingency table cells
<code>B</code>	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The test statistic and p-value of the modular test for independence in $r \times c \times t$ contingency table,

Value

The function returns values of the test statistic and p-value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Contingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
Mod3.test(GenTab3(array(0.125, dim = c(2, 2, 2)), 80), B = 1e3)
Mod3.test(table4, B = 1e3)
```

`Mod4.cv`*Modular test for independence in four-way contingency table*

Description

Calculates the critical value of the modular test for independence in four-way contingency table

Usage

```
Mod4.cv(nr, nc, nt, nu, n, alfa, B = 10000)
```

Arguments

<code>nr</code>	a number of rows
<code>nc</code>	a number of columns
<code>nt</code>	a number of tubes
<code>nu</code>	a number of tubes
<code>n</code>	a sample size
<code>alfa</code>	a significance level
<code>B</code>	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the Logarithmic minimum test for independence in $r \times c \times t$ contingency table,

Value

The function returns the critical value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
Mod4.cv(2, 2, 2, 2, 160, 0.05, B = 1e2)
Mod4.cv(2, 2, 2, 2, 160, 0.1, B = 1e3)
```

 Mod4.pvalue

MOdular test for independence in four-way contingency table

Description

Calculates the p-value of the modular test for independence in four-way contingency table

Usage

```
Mod4.pvalue(stat, nr, nc, nt, nu, n, B = 10000)
```

Arguments

stat	a Logarithmic minimum statistic value
nr	a number of rows
nc	a number of columns
nt	a number of tubes
nu	a number of
n	a sample size
B	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The Critical value of the modular test for independence in $r \times c \times t \times u$ contingency table,

Value

The function returns the p-value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
Mod4.pvalue(Mod4.stat(table6), 2, 2, 2, 2, 160, B = 1e2)
Mod4.pvalue(Mod4.stat(table6), 2, 2, 2, 2, 160, B = 1e3)
```

Mod4.stat	<i>Modular test for independence in four-way contingency table</i>
-----------	--------------------------------------------------------------------

Description

Calculates the statistic of the modular test for independence in four-way contingency table

Usage

```
Mod4.stat(nijtu)
```

Arguments

nijtu	a numeric matrix with non-negative values of the four-way contingency table cells
-------	-----------------------------------------------------------------------------------

Details

The statistic of Logarithmic minimum test for independence in $r \times c \times t \times u$ contingency table,

Value

The function returns the value of the modular test statistic.

Author(s)

Piotr Sulewski, <piotr.sulewski@apsl.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
Mod4.stat(GenTab4(array(1/16, dim = c(2, 2, 2, 2)), 100))  
Mod4.stat(table6)
```

`Mod4.test`*Modular test for independence in four-way contingency table*

Description

Calculates the test statistic and p-value of the modular test for independence in four-way contingency table

Usage

```
Mod4.test(nijtu, B = 10000)
```

Arguments

<code>nijtu</code>	a numeric matrix with non-negative values of the four-way contingency table cells
<code>B</code>	an integer specifying the number of replicates used in the Monte Carlo test (optional)

Details

The test statistic and p-value of the modular test for independence in $r \times c \times t \times u$ contingency table,

Value

The function returns values of the test statistic and p-value of the modular test.

Author(s)

Piotr Sulewski, <piotr.sulewski@aps1.edu.pl>, Pomeranian University in Slupsk.

References

Extension of the information contained in Sulewski, P. (2018). *Power Analysis Of Independence Testing for the Three-Way Con-tingency Tables of Small Sizes*. Journal of Applied Statistics 45(13), 2481-2498

Examples

```
Mod4.test(GenTab4(array(1/16, dim = c(2, 2, 2, 2)), 160), B = 1e2)
Mod4.test(table6, B = 1e2)
```

PSIndependenceTest *The list of package functions and their demonstration*

Description

The **PSIndependenceTest** package puts into practice the modular and logarithmic minimum tests for independence in two-way, three-way and four-way contingency tables. Statistic value, cv value and p-value are calculated. This package also includes three table generation functions and six data sets. The list of package functions is as follows:

Data sets in the package and generating two-way, three-way and four-way contingency tables

table1
table2
table3
table4
table5
table6
GenTab2
GenTab3
GenTab4

Functions for the modular independence test and two-way contingency table

Mod2.stat
Mod2.cv
Mod2.pvalue
Mod2.test

Functions for the modular independence test and three-way contingency table

Mod3.stat
Mod3.cv
Mod3.pvalue
Mod3.test

Functions for the modular independence test and four-way contingency table

Mod4.stat
Mod4.cv
Mod4.pvalue
Mod4.test

Functions for the logarithmic minimum independence test and two-way contingency table

Lms2.stat
Lms2.cv
Lms2.pvalue
Lms2.test

Functions for the logarithmic minimum independence test and three-way contingency table

Lms3.stat
Lms3.cv
Lms3.pvalue
Lms3.test

Functions for the logarithmic minimum independence test and four-way contingency table

Lms4.stat
Lms4.cv
Lms4.pvalue
Lms4.test

table1

First data set as two-way contingency table 2 x 2

Description

The first data set from Sulewski, P. (2017) *A new test for independence in 2x2 contingency tables*, Acta Universitatis Lodzianensis. Folia Oeconomica, 4(330), 55–75 consist of 40 observations described the effect of a treatment for rheumatoid arthritis vs. a placebo. See Table 17 in the paper.

Usage

table1

Format

two-way contingency table 2 x 2

table2	<i>Second data set as two-way contingency table 2 x 3</i>
--------	-----------------------------------------------------------

Description

The second data set obtained using the Monte Carlo method consist of 60 observations when H_0 is true, i.e. all probabilities equal $1/6$

Usage

table2

Format

two-way contingency table 2 x 3

table3	<i>Third data set: three-way contingency table 3 x 3 x 2</i>
--------	--------------------------------------------------------------

Description

The third data set from Sulewski, P. (2021). *Logarithmic Minimum Test for Independence in Three Way Con-tingency Table of Small Sizes*. Journal of Statistical Computation and Simulation 91(13), 2780-2799 consist of 695 observations described the frequency of watching videos at home or at friends' homes for young people between 7 and 15 years of age, cross-classified according to age and sex. See Table 10 in the paper.

Usage

table3

Format

three-way contingency table 3 x 3 x 2

table4	<i>Fourth data set: three-way contingency table 2 x 2 x 2</i>
--------	---------------------------------------------------------------

Description

The fourth data set obtained using the Monte Carlo method consist of 80 observations when H_0 is true, i.e. all probabilities equal $1/8$.

Usage

table4

Format

three-way contingency table 2 x 2 x 2

table5	<i>Fifth data set: four-way contingency table 4 x 2 x 2 x 2</i>
--------	-----------------------------------------------------------------

Description

The fifth data set provides information on the fate of 2201 passengers on the fatal maiden voyage of the ocean liner 'Titanic', summarized according to economic status (class), sex, age and survival.

Usage

table5

Format

four-way contingency table 4 x 2 x 2 x 2

table6	<i>Sixth data set: four-way contingency table 2 x 2 x 2 x 2</i>
--------	-----------------------------------------------------------------

Description

The sixth data set obtained using the Monte Carlo method consist of 160 observations when H_0 is true, i.e. all probabilities equal $1/16$.

Usage

table6

Format

four-way contingency table 2 x 2 x 2 x 2

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