Package 'npordtests'

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Type Package

Title Nonparametric Tests for Equality of Location Against Ordered Alternatives

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Description Performs nonparametric tests for equality of location against ordered alternatives.

License GPL (>= 2)

NeedsCompilation no

Repository CRAN

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Imports stats, utils

Depends R (>= 3.5.0)

RoxygenNote 6.1.1

LazyData true

LazyLoad true

Suggests testthat

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R topics documented:

`AtTest` *Adaptive Test (AT)*

Description

`AtTest` performs the Adaptive Test.

Usage

```
AtTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.
`data`	a data frame containing the variables in the formula `formula`
`alpha`	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
`na.rm`	a logical value indicating whether NA values should be stripped before the computation proceeds.
`verbose`	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

`statistic`	the Adaptive test statistic.
`mean`	the mean of the Adaptive test statistic.
`variance`	the variance of the Adaptive test statistic.
`Z`	the standardized test statistic.
`p.value`	the p-value of the test.
`alpha`	the level of significance.

method	the character string "Adaptive test".
data	a data frame containing the variables in which NA values (if exist) are removed.
formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Beier, F., Buning, H.(1997). An adaptive test against ordered alternatives. *Computational Statistics & Data Analysis*, **25:4**, 441-452.

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
AtTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
AtTest(Values~Group,lehmann)
```

---

chicks *Chicks' weight data*

Description

This real data is reported by Chang and Yen (2011). Eighteen chicks were randomly assigned to three treatments with six chicks in each for balanced data.

Usage

```
data("chicks")
```

Format

A data frame with 18 observations on the following 2 variables.

`diet` Diets of different protein content

`weight` Chicks' weight (in grams)

Details

Treatment 1 (Diet 1) had the diet with the lowest level of protein; treatment 2 (Diet 2) had the diet with a medium level of protein; and treatment 3 (Diet 3) had the diet with the highest level of protein. Does the average weight of chicks increase with the amount of protein? Hypothesis is being investigated.

Source

Chang, C. H. and Yen, C.H. (2011). A Nonparametric Test for the Ordered Alternative Based on Fast Discrete Fourier Transform Coefficient. *Journal of Testing and Evaluation*, **39:6**, 1131-1143.

Examples

```
library(npordtests)

data(chicks)
levels(chicks$diet) <- c("diet 1", "diet 2", "diet 3")
boxplot(weight~diet,data=chicks,xlab="Diet")
```

FtmTest *Ferdhiana, Terpstra and Magel (FTM) Test*

Description

`FtmTest` performs FTM test.

Usage

```
FtmTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.
`data`	a data frame containing the variables in the formula `formula`
`alpha`	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
`na.rm`	a logical value indicating whether NA values should be stripped before the computation proceeds.
`verbose`	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

`statistic`	the FTM test statistic.
`mean`	the mean of the FTM test statistic.
`variance`	the variance of the FTM test statistic.
`Z`	the standardized test statistic.
`p.value`	the p-value of the test.
`alpha`	the level of significance.
`method`	the character string "FTM test".
`data`	a data frame containing the variables in which NA values (if exist) are removed.
`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Ferdhiane, R., Terpstra, J., Magel, R.C. (2008). A nonparametric test for the ordered alternative based on Kendall's correlation coefficient. *Communications in Statistics-Simulation and Computation*, **37:6**, 1117-1128.

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
FtmTest(Y~X,jdata)
```

GcTest *Gaur's Gc Test*

Description

`GcTest` performs Gaur's Gc test.

Usage

```
GcTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE, c = 2)
```

Arguments

formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.
data	a data frame containing the variables in the formula formula
alpha	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
verbose	a logical for printing output to R console.
c	a integer value chosen from (1,...,min(n_i)) for subsample size. Default is set to c = 2.

Value

A list with class "owt" containing the following components:

statistic	the Gaur's Gc test statistic.
mean	the mean of the Gaur's Gc test statistic.
variance	the variance of the Gaur's Gc test statistic.
Z	the standardized test statistic.
p.value	the p-value of the test.
alpha	the level of significance.
method	the character string "Gaur's Gc test ".
data	a data frame containing the variables in which NA values (if exist) are removed.
formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Gaur, A., (2017). A class of k-sample distribution-free tests for location against ordered alternatives. *Communications in Statistics-Theory and Methods*, **46:5**, 2343-2353.

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
```

```
GcTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
GcTest(Values~Group,lehmann)
```

---

hvwi *Hepatic vein waveform index data*

Description

This data collected by Pedersen et al. (2008) was taken from Terpstra et al. (2011). The data are calculated from doppler waveforms corresponding to 66 patients who were scheduled for a percutaneous liver needle biopsy.

Usage

```
data("hvwi")
```

Format

A data frame with 66 observations on the following 2 variables.

`Group` Fibrosis groups: `A`:cirrhosis, `B`:severe, `C`:moderate, `D`:mild and `E`:none

`Values` HVWI values for the five fibrosis groups

Source

Terpstra, J. T., Chang, C. H. and Magel, C. M. (2011). On the use of Sperman's correlation coefficient for testing ordered alternatives. *Journal of Statistical Computation and Simulation*, **81:11**, 1381-1392.

References

Pedersen, J. F., Madsen, L. G., Vibeke, A. L. Hamberg, O., Horn, T., Federspiel, B. and Bytzer, P. (2008). A doppler waveform index to characterize hepatic vein velocity pattern and evaluate hepatic fibrosis. *J. Clin. Ultrasound*, **36:4**, 208-211.

Examples

```
data(hvwi)
levels(hvwi$Group) <- c("cirrhosis", "severe", "moderate", "mild", "none")
boxplot(Values~Group,data=hvwi,xlab="Fibrosis group",ylab="HVWI value")
```

`hypertension` *Hypertension data*

Description

This data presented by Dmitrienko et al. (2006) is to examine the effect of different drug doses on diastolic blood pressure.

Usage

```
data("hypertension")
```

Format

A data frame with 68 observations on the following 2 variables.

`doseLevel` Dose levels: `A`: Placebo, `B`: Dose 10 mg/day, `C`: Dose 20 mg/day, `D`: Dose 40 mg/day

`rdbp` Mean reduction in diastolic blood pressure

Details

Patients with hypertension were randomized into four groups with different dose levels, 0, 10, 20, and 40 mg/day, where the group with 0 mg/day was the placebo group. The number of patients in each group were 17, 17, 18, and 16, respectively. The complete data can be found at the Dmitrienko et al.(2006) or Shan et al. (2014).

Source

Dmitrienko, A., Chuang-Stein, C. and D'Agostino, R. (2006). *Pharmaceutical Statistics Using SAS: A Practical Guide (SAS Press)*. SAS Institute, 1 edition.

References

Shan, G., Young, D. and Kang, L. (2014). A New Powerful Nonparametric Rank Test for Ordered Alternative Problem. *PLoS ONE*, **9:11**, doi:10.1371/journal.pone.0112924.

Examples

```
data(hypertension)
levels(hypertension$doseLevel) <- c("placebo", "10", "20", "40")
boxplot(rdbp~doseLevel,data=hypertension,xlab="Dose level",ylab="Mean reduction in dbp")
```

jdata *Jonckheere's data*

Description

This synthetic data is reported by Jonckheere (1954). The data consists of 4 groups with 4 observations in each.

Usage

```
jdata
```

Format

A data frame with 16 observations on the following 2 variables.

`X` Number of samples

`Y` Value

Source

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

data(jdata)
levels(jdata$X) <- c("I", "II", "III", "IV")
boxplot(Y~X,data=jdata,xlab="Groups")
```

JtTest *Jonckheere-Terpstra (JT) Test*

Description

`JtTest` performs JT test.

Usage

```
JtTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.
data	a data frame containing the variables in the formula formula
alpha	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
verbose	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

statistic	the JT test statistic.
mean	the mean of the JT test statistic.
variance	the variance of the JT test statistic.
Z	the standardized test statistic.
p.value	the p-value of the test.
alpha	the level of significance.
method	the character string "JT test".
data	a data frame containing the variables in which NA values (if exist) are removed.
formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
JtTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
JtTest(Values~Group,lehmann)
```

KtpTest *Terpstra, Chang and Magel's KTP Test*

Description

KtpTest performs KTP test.

Usage

```
KtpTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.
data	a data frame containing the variables in the formula formula
alpha	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
verbose	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

statistic	the KTP test statistic.
mean	the mean of the KTP test statistic.
variance	the variance of the KTP test statistic.
Z	the standardized test statistic.
p.value	the p-value of the test.
alpha	the level of significance.
method	the character string "KTP".
data	a data frame containing the variables in which NA values (if exist) are removed.
formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Terpstra, J., Chang, C.H., Magel, R.C. (2011). On the use of Spearman's correlation coefficient for testing ordered alternatives. *Journal of Statistical Computation and Simulation*, **81:11**, 1381-1392.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
KtpTest(Y~X,jdata)
```

`lehmann` *Lehmann's data*

Description

This synthetic data is reported by Lehmann (1975). The data consists of 3 groups with 28, 23 and 21 observations respectively.

Usage

```
lehmann
```

Format

A data frame with 72 observations on the following 2 variables.

`Group` Number of samples

`Values` Value

Source

Lehmann, E. (1975). *Nonparametrics: Statistical Methods based on Ranks*, Holden-Day, San Francisco, 1st edition, p.12.

Examples

```
library(npordtests)

data(lehmann)
levels(lehmann$Group) <- c("Undergraduates", "Trainees", "Staff")
boxplot(Values~Group,data=lehmann,xlab="Groups")
```

LsTest *Hogg, Fisher and Randles' LS Test*

Description

LsTest performs LS test.

Usage

```
LsTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.
data	a data frame containing the variables in the formula formula
alpha	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
verbose	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

statistic	the LS test statistic.
mean	the mean of the LS test statistic.
variance	the variance of the LS test statistic.
Z	the standardized test statistic.
p.value	the p-value of the test.
alpha	the level of significance.
method	the character string "LS test ".
data	a data frame containing the variables in which NA values (if exist) are removed.
formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Beier, F., Buning, H.(1997). An adaptive test against ordered alternatives. *Computational Statistics & Data Analysis*, **25:4**, 441-452.

Hogg, R.V., Fisher, D.M., Randles, R.H. (1975). A Two-Sample Adaptive Distribution-Free Test. *Journal of the American Statistical Association*, **70:351**, 656-661.

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
LsTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
LsTest(Values~Group,lehmann)
```

LtTest *Buning's LT Test*

Description

`LtTest` performs LT test.

Usage

```
LtTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.
`data`	a data frame containing the variables in the formula `formula`
`alpha`	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
`na.rm`	a logical value indicating whether NA values should be stripped before the computation proceeds.
`verbose`	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

`statistic`	the LT test statistic.
`mean`	the mean of the LT test statistic.
`variance`	the variance of the LT test statistic.
`Z`	the standardized test statistic.
`p.value`	the p-value of the test.
`alpha`	the level of significance.
`method`	the character string "LT test ".
`data`	a data frame containing the variables in which NA values (if exist) are removed.
`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Buning, H.(1996). Adaptive tests for the c-sample location problem - the case of two-sided alternatives. *Communications in Statistics-Theory and Methods*, **25**, 1569-1582.

Beier, F., Buning, H.(1997). An adaptive test against ordered alternatives. *Computational Statistics & Data Analysis*, **25:4**, 441-452.

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
LtTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
LtTest(Values~Group,lehmann)
```

`MjtTest` *Modified Jonckheere-Terpstra (MJT) Test*

Description

`MjtTest` performs MJT test.

Usage

```
MjtTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.
`data`	a data frame containing the variables in the formula `formula`
`alpha`	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
`na.rm`	a logical value indicating whether NA values should be stripped before the computation proceeds.
`verbose`	a logical for printing output to R console.

Details

`information.gain` is

$$H(Class) + H(Attribute) - H(Class, Attribute)$$

.

`gain.ratio` is

$$\frac{H(Class) + H(Attribute) - H(Class, Attribute)}{H(Attribute)}$$

`symmetrical.uncertainty` is

$$2\frac{H(Class) + H(Attribute) - H(Class, Attribute)}{H(Attribute) + H(Class)}$$

Value

A list with class "owt" containing the following components:

`statistic`	the MJT test statistic.
`mean`	the mean of the MJT test statistic.
`variance`	the variance of the MJT test statistic.
`Z`	the standardized test statistic.

p.value	the p-value of the test.
alpha	the level of significance.
method	the character string "MJT test ".
data	a data frame containing the variables in which NA values (if exist) are removed.
formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Neuhauser, M., Liu, P.Y., Hothorn, L.A.(1998). Nonparametric Tests for Trend: Jonckheere's Test, a Modification and a Maximum Test. *Biometrical Journal*, **40:8**, 899-909.

Tryon, V. P., Hettmansperger, T. P. (1973). A class of nonparametric tests for homogeneity against ordered alternatives. *Annals of Statistics*, **1**, 1061-1070.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
MjtTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
MjtTest(Values~Group,lehmann)
```

---

neuhauser *Neuhauser's data*

Description

This synthetic data is reported by Neuhauser et al. (1998). The data consists of 4 groups with 10 observations per group.

Usage

```
neuhauser
```

Format

A data frame with 72 observations on the following 2 variables.

`group` Group number

`value` Value

Source

Neuhauser M, Liu PY, Hothorn LA (1998), Nonparametric Tests for Trend: Jonckheere's Test, a Modification and a Maximum Test. *Biom J*, **40**, 899-909.

Examples

```
library(npordtests)

data(neuhauser)
boxplot(value~group,data=neuhauser,xlab="Groups")
```

`RsTest` *Hogg, Fisher and Randles' RS Test*

Description

`RsTest` performs RS test.

Usage

```
RsTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.
`data`	a data frame containing the variables in the formula `formula`
`alpha`	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
`na.rm`	a logical value indicating whether NA values should be stripped before the computation proceeds.
`verbose`	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

`statistic`	the RS test statistic.
`mean`	the mean of the RS test statistic.
`variance`	the variance of the RS test statistic.
`Z`	the standardized test statistic.
`p.value`	the p-value of the test.
`alpha`	the level of significance.
`method`	the character string "RS test ".
`data`	a data frame containing the variables in which NA values (if exist) are removed.
`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Beier, F., Buning, H.(1997). An adaptive test against ordered alternatives. *Computational Statistics & Data Analysis*, **25:4**, 441-452.

Hogg, R.V., Fisher, D.M., Randles, R.H. (1975). A Two-Sample Adaptive Distribution-Free Test. *Journal of the American Statistical Association*, **70:351**, 656-661.

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
RsTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
RsTest(Values~Group,lehmann)
```

SsTest *Shan, Young and Kang's S Test*

Description

SsTest performs S test.

Usage

```
SsTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.
data	a data frame containing the variables in the formula formula
alpha	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
verbose	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

statistic	the S test statistic.
mean	the mean of the S test statistic.
variance	the variance of the S test statistic.
Z	the standardized test statistic.
p.value	the p-value of the test.
alpha	the level of significance.
method	the character string "S test".
data	a data frame containing the variables in which NA values (if exist) are removed.
formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Shan, G., Young, D., Kang, L.(2014). A New Powerful Nonparametric Rank Test for Ordered Alternative Problem. *Plos One*, **9:11**, 1-10.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
SsTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
SsTest(Values~Group,lehmann)
```

StTest *Gastwirth's ST Test*

Description

`StTest` performs ST test.

Usage

```
StTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.
`data`	a data frame containing the variables in the formula `formula`
`alpha`	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
`na.rm`	a logical value indicating whether NA values should be stripped before the computation proceeds.
`verbose`	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

`statistic`	the ST test statistic.
`mean`	the mean of the ST test statistic.
`variance`	the variance of the ST test statistic.
`Z`	the standardized test statistic.
`p.value`	the p-value of the test.
`alpha`	the level of significance.
`method`	the character string "ST test ".
`data`	a data frame containing the variables in which NA values (if exist) are removed.
`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Beier, F., Buning, H.(1997). An adaptive test against ordered alternatives. *Computational Statistics & Data Analysis*, **25:4**, 441-452.

Gastwirth, J.L.(1965). Percentile modifications of two sample rank tests. *Journal of the American Statistical Association*, **60**, 1127-1141.

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
StTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
StTest(Values~Group,lehmann)
```

TmTest *Terpstra and Magel (TM) Test*

Description

TmTest performs TM test.

Usage

```
TmTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.
data	a data frame containing the variables in the formula formula
alpha	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
verbose	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

statistic	the TM test statistic.
mean	the mean of the TM test statistic.
variance	the variance of the TM test statistic.
Z	the standardized test statistic.
p.value	the p-value of the test.
alpha	the level of significance.
method	the character string "TM test".
data	a data frame containing the variables in which NA values (if exist) are removed.
formula	a formula of the form lhs ~ rhs where lhs gives the sample values and rhs the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Terpstra, J., Magel, R.C. (2003). A new nonparametric test for the ordered alternative problem. *Journal of Nonparametric Statistics*, **15:3**, 289-301.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
TmTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
TmTest(Values~Group,lehmann)
```

WsTest *Beier and Buning's WS Test*

Description

`WsTest` performs WS test.

Usage

```
WsTest(formula, data, alpha = 0.05, na.rm = TRUE, verbose = TRUE)
```

Arguments

`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.
`data`	a data frame containing the variables in the formula `formula`
`alpha`	the level of significance to assess the statistical difference. Default is set to alpha = 0.05.
`na.rm`	a logical value indicating whether NA values should be stripped before the computation proceeds.
`verbose`	a logical for printing output to R console.

Value

A list with class "owt" containing the following components:

`statistic`	the WS test statistic.
`mean`	the mean of the WS test statistic.
`variance`	the variance of the WS test statistic.
`Z`	the standardized test statistic.
`p.value`	the p-value of the test.
`alpha`	the level of significance.
`method`	the character string "WS test ".
`data`	a data frame containing the variables in which NA values (if exist) are removed.
`formula`	a formula of the form `lhs ~ rhs` where `lhs` gives the sample values and `rhs` the corresponding groups.

Author(s)

Bulent Altunkaynak

References

Beier, F., Buning, H.(1997). An adaptive test against ordered alternatives. *Computational Statistics & Data Analysis*, **25:4**, 441-452.

Jonckheere, A. R. (1954). A Distribution-Free k-Sample Test Against Ordered Alternatives. *Biometrika*, **41**, 133-145.

Examples

```
library(npordtests)

## Data from Jonckheere (1954)
data(jdata)
WsTest(Y~X,jdata)

## Data from Lehmann (1975)
data(lehmann)
WsTest(Values~Group,lehmann)
```

Index