

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.

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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 $lhs \sim rhs$ 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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
AtTest(Y~X,data)
```

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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
FtmTest(Y~X,data)
```

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 $lhs \sim rhs$ 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 $(1, \dots, \min(n_i))$ 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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
GcTest(Y~X,data)
```

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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
JtTest(Y~X,data)
```

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 $lhs \sim rhs$ where lhs gives the sample values and rhs the corresponding groups.
data	a data frame containing the variables in the formula <code>formula</code>
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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
KtpTest(Y~X,data)
```

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 $lhs \sim rhs$ 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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
LsTest(Y~X,data)
```

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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
LtTest(Y~X,data)
```

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 $lhs \sim rhs$ 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 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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
MjtTest(Y~X,data)
```

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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
RsTest(Y~X,data)
```

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 $lhs \sim rhs$ 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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
SsTest(Y~X,data)
```

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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
StTest(Y~X,data)
```

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 $lhs \sim rhs$ 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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
TmTest(Y~X,data)
```

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 $lhs \sim rhs$ 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)

X<-as.factor(c(1,1,1,1,2,2,2,2,3,3,3,3,4,4,4,4))
Y<-c(19,20,60,130,21,61,80,129,40,99,100,149,49,110,151,160)
data<-cbind.data.frame(X,Y)
WsTest(Y~X,data)
```

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