Package 'WRS2'

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Type Package

Title A Collection of Robust Statistical Methods

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Description A collection of robust statistical methods based on Wilcox' WRS functions. It implements robust t-tests (independent and dependent samples), robust ANOVA (including between-within subject designs), quantile ANOVA, robust correlation, robust mediation, and nonparametric ANCOVA models based on robust location measures.

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URL https://r-forge.r-project.org/projects/psychor/

Imports MASS, reshape, plyr, stats, graphics, grDevices, utils

Depends R (>= 4.0.0)

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VignetteBuilder knitr

LazyData yes

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ByteCompile yes

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Contents

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ancova *Robust ANCOVA*

Description

This function computes robust ANCOVA for 2 independent groups and one covariate. It compares trimmed means. No parametric assumption (e.g. homogeneity) is made about the form of the regression lines. A running interval smoother is used. A bootstrap version which computes confidence intervals using a percentile t-bootstrap is provided as well.

Usage

```
ancova(formula, data, tr = 0.2, fr1 = 1, fr2 = 1, pts = NA, ...)

ancboot(formula, data, tr = 0.2, nboot = 599, fr1 = 1, fr2 = 1, pts = NA, ...)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.
fr1	values of the span for the first group (1 means unspecified)
fr2	values of the span for the second group (1 means unspecified)
pts	can be used to specify the design points where the regression lines are to be compared; if NA design points are chosen.
nboot	number of bootstrap samples
...	currently ignored.

Value

Returns an object of class ancova containing:

evalpts	covariate values (including points close to these values) where the test statistic is evaluated
n1	number of subjects at evaluation point (first group)
n2	number of subjects at evaluation point (first group)
trDiff	trimmed mean differences
se	standard errors for trimmed mean differences
ci.low	lower confidence limit for trimmed mean differences
ci.hi	upper confidence limit for trimmed mean differences
test	values of the test statistic
crit.vals	critical values
p.vals	p-values
fitted.values	fitted values from interval smoothing
call	function call

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t2way

Examples

```
head(invisibility)
ancova(mischief2 ~ cloak + mischief1, data = invisibility)

## specifying covariate evaluation points
ancova(mischief2 ~ cloak + mischief1, data = invisibility, pts = c(3, 4, 8, 1))

## bootstrap version
ancboot(mischief2 ~ cloak + mischief1, data = invisibility)
```

---

binband *Comparison of discrete distributions*

Description

binband compares two independent variables in terms of their probability function. discANOVA Tests the global hypothesis that for two or more independent groups, the corresponding discrete distributions are identical. That is, test the hypothesis that independent groups have identical multinomial distributions. discmcp provides multiple comparisons for J independent groups having discrete distributions. discstep implements the step-down multiple comparison procedure for comparing J independent discrete random variables.

Usage

```
binband(x, y, KMS = FALSE, alpha = 0.05, ADJ.P = FALSE, ...)
discANOVA(formula, data, nboot = 500, ...)
discmcp(formula, data, alpha = 0.05, nboot = 500, ...)
discstep(formula, data, nboot = 500, alpha = 0.05, ...)
```

Arguments

x	an numeric vector of data values for group 1.
y	an numeric vector of data values for group 2.
formula	an object of class formula.
data	an optional data frame for the input data.
nboot	number of bootstrap samples.
alpha	alpha level.
KMS	whether the Kulinskaya-Morgenthaler-Staudte method for comparing binomials should be used.
ADJ.P	whether the critical p-value should be adjusted to control FWE when the sample size is small (<50)
...	currently ignored.

Value

discANOVA returns an object of class "med1way" containing:

test	value of the test statistic
crit.val	critical value
p.value	p-value
call	function call

The remaining functions return an object of class "robtab" containing:

partable	parameter table

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Kulinskaya, E., Morgenthaler, S. and Staudte, R. (2010). Variance stabilizing the difference of two binomial proportions. American Statistician, 64, p. 350-356.

See Also

t1way, Qanova

Examples

```
## Consider a study aimed at comparing two methods for reducing shoulder pain after surgery.
## For the first method, the shoulder pain measures are:
x1 <- c(2, 4, 4, 2, 2, 2, 4, 3, 2, 4, 2, 3, 2, 4, 3, 2, 2, 3, 5, 5, 2, 2)
## and for the second method they are:
x2 <- c(5, 1, 4, 4, 2, 3, 3, 1, 1, 1, 1, 2, 2, 1, 1, 5, 3, 5)

fit1 <- binband(x1, x2)
fit1

fit2 <- binband(x1, x2, KMS = TRUE, alpha = 0.01)
fit2

## More than two groups:
discANOVA(libido ~ dose, viagra, nboot = 200)

## Multiple comparisons:
discmcp(libido ~ dose, viagra)

discstep(libido ~ dose, viagra)
```

bush *Bushtucker Foods*

Description

In the TV show "I'm a celebrity, get me out of here" the celebrities had to eat things like stick insects, fish eyes, etc. This dataset records the time taken to retch when eating these things.

Usage

```
bush
```

Format

A data frame with 5 variables and 8 observations:

`participant` participant ID

`stick_insect` time taken to retch when eating a stick insect

`kangaroo_testicle` time taken to retch when eating a kangaroo testicle

`fish_eye` time taken to retch when eating a fish eye

`witchetty_grub` time taken to retch when eating a witchetty grub

Details

Dataset from Field et al. book (p. 557).

References

Field, A., Miles, J., & Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
bush
summary(bush)
```

bwtrim *A robust two-way mixed ANOVA using trimmed means.*

Description

The bwtrim function computes a two-way between-within subjects ANOVA on the trimmed means. It is designed for one between-subjects variable and one within-subjects variable. The functions sppba, sppbb, and sppbi compute the main fixed effect, the main within-subjects effect, and the interaction effect only, respectively, using bootstrap. For these 3 functions the user can choose an M-estimator for group comparisons.

Usage

```
bwtrim(formula, id, data, tr = 0.2, ...)
tsplit(formula, id, data, tr = 0.2, ...)
sppba(formula, id, data, est = "mom", avg = TRUE, nboot = 500, MDIS = FALSE, ...)
sppbb(formula, id, data, est = "mom", nboot = 500, ...)
sppbi(formula, id, data, est = "mom", nboot = 500, ...)
```

Arguments

formula	an object of class formula.
id	subject ID.
data	an optional data frame for the input data.
tr	trim level for the mean.
est	Estimate to be used for the group comparisons: either "onestep" for one-step M-estimator of location using Huber's Psi, "mom" for the modified one-step (MOM) estimator of location based on Huber's Psi, or "median".
avg	If TRUE, the analysis is done by averaging K measures of location for each level of the fixed effect, and then comparing averages by testing the hypothesis that all pairwise differences are equal to zero. If FALSE the analysis is done by testing whether K equalities are simultaneously true.
nboot	number of bootstrap samples.
MDIS	if TRUE the depths of the points in the bootstrap cloud are based on Mahalanobis distance, if FALSE a projection distance is used.
...	currently ignored.

Details

The tsplit function is doing exactly the same thing as bwtrim. It is kept in the package in order to be consistent with older versions of the Wilcox (2012) book. For sppba, sppbb, and sppbi the analysis is carried out on the basis of all pairs of difference scores. The null hypothesis is that all such differences have a robust location value of zero. In the formula interface it is required to specify full model.

Value

`bwtrim` returns an object of class `"bwtrim"` containing:

`Qa`	first main effect
`A.p.value`	p-value first main effect
`A.df`	df F-distribution first main effect
`Qb`	second main effect
`B.p.value`	p-value second main effect
`B.df`	df F-distribution second main effect
`Qab`	interaction effect
`AB.p.value`	p-value interaction effect
`AB.df`	df F-distribution interaction
`call`	function call
`varnames`	variable names

`sppba`, `sppbb`, and `sppbi` returns an object of class `"spp"` containing:

`test`	value of the test statistic
`p.value`	p-value
`contrasts`	contrasts matrix

References

Wilcox, R. (2017). Introduction to Robust Estimation and Hypothesis Testing (4th ed.). Elsevier.

See Also

`t2way`

Examples

```
## data need to be on long format
pictureLong <- reshape(picture, direction = "long", varying = list(3:4), idvar = "case",
timevar = c("pictype"), times = c("couple", "alone"))
pictureLong$pictype <- as.factor(pictureLong$pictype)
colnames(pictureLong)[4] <- "friend_requests"

## 2-way within-between subjects ANOVA
bwtrim(friend_requests ~ relationship_status*pictype, id = case, data = pictureLong)

## between groups effect only (MOM estimator)
sppba(friend_requests ~ relationship_status*pictype, case, data = pictureLong)

## within groups effect only (MOM estimator)
sppbb(friend_requests ~ relationship_status*pictype, case, data = pictureLong)

## interaction effect only (MOM estimator)
sppbi(friend_requests ~ relationship_status*pictype, case, data = pictureLong)
```

chile *Chile Heat and Length*

Description

Originally from pepperjoe.com, this dataset contains the name, length, and heat of chiles. Heat is measured on a scale from 0-11. (0-2 ... for sissys, 3-4 ... sort of hot, 5-6 ... fairly hot, 7-8 ... real hot, 9.5-9 ... torrid, 9.5-11 ... nuclear).

Usage

```
chile
```

Format

A data frame with 3 variables and 85 observations:

`name` name of the chile

`length` length in cm

`heat` heat of the chile

References

Wright, D. B., & London, K. (2009). Modern Regression Techniques Using R. Sage.

Examples

```
summary(chile)
```

diet *Diet and Weight Loss*

Description

Weight loss is studied for three different types of diets.

Usage

```
bush
```

Format

A data frame with 7 variables and 78 observations:

`gender` gender

`age` age

`height` body height

`diet.type` three types of diet

`initial.weight` initial weight before diet

`final.weight` final weight after diet

`weight.loss` weight loss

References

Couturier, D. L., Nicholls, R., and Fernandes, M. (2018). ANOVA with R: analysis of the diet dataset. Retrieved online.

Examples

```
str(diet)
```

---

electric *The Electric Company*

Description

These data are based on an educational TV show for children called "The Electric Company". In each of four grades, the classes were randomized into treated (TV show) and control groups (no TV show). At the beginning and at the end of the school year, students in all the classes were given a reading test. The average test scores per class were recorded.

Usage

```
electric
```

Format

A data frame with 5 variables and 192 observations:

`City` Fresno and Youngstown

`Grade` grade

`Pretest` reading scores at the beginning of the semester

`Posttest` reading scores at the end of the semester

`Group` treatment vs. control

References

Gelman, A., & Hill, J. (2007). Data Analysis Using Regression and Multilevel/Hierarchical Models. Cambridge University Press: New York, NY.

Examples

```
summary(electric)
```

---

essays *Academic Writing Data*

Description

This study looked at the effects of two forms of written corrective feedback on lexico-grammatical accuracy in the academic writing of English as a foreign language university students. It had a 3x4 within-by-between design with three groups (two treatment and one control) measured over four occasions (pretest/treatment, treatment, posttest, delayed posttest).

Usage

```
bush
```

Format

A data frame with 4 variables and 120 observations:

`id` participant ID

`group` control, direct, indirect

`essay` four measurement occasions

`errorRatio` error ratio

References

McGrath, D. (2016). The Effects of Comprehensive Direct and Indirect Written Corrective Feedback on Accuracy in English as a Foreign Language Students' Writing (Unpublished master's thesis). Macquarie University, Sydney, Australia.

Examples

```
head(essays)
summary(essays)
```

eurosoccer *European Soccer Leagues*

Description

Contains various team stats from five European soccer leagues (2008/09 season).

Usage

```
eurosoccer
```

Format

A data frame with 11 variables and 96 teams:

`League` Country

`Team` Team

`Games` Number of games

`Won` Games won

`Tied` Games tied

`Lost` Games lost

`GoalsScored` Goals scored

`GoalsConceded` Goals conceded

`GoalDifference` Goal difference

`Points` Final amount of points

`GoalsGame` Goal scored per game

Examples

```
head(eurosoccer)
```

goggles *Beer Goggles Effect*

Description

This dataset is about the effects of alcohol on mate selection in night-clubs. The hypothesis is that after alcohol had been consumed, subjective perceptions of physical attractiveness would become more inaccurate (beer-goggles effect). There are 48 participants: 24 males, 24 females. The reseacher took 3 groups of 8 participants to a night club. One group got no alcohol, one group 2 pints, and one group 4 pints. At the end of the evening the researcher took a photograph of the person the participant was chatting up. The attractiveness of the person on the photo was then evaluated by independent judges.

Usage

```
goggles
```

Format

A data frame with 3 variables and 48 observations:

`gender` 24 male, 24 female students

`alcohol` amount of alcohol consumed

`attractiveness` attractiveness rating (0-100)

Details

Dataset from Field et al. book (p. 501).

References

Field, A., Miles, J, & Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
goggles
summary(goggles)
```

---

hangover *Hangover Symptoms*

Description

In a study on the effect of consuming alcohol, hangover symptoms were measured for two independent groups, with each subject consuming alcohol and being measured on three different occasions. One group consisted of sons of alcoholics and the other was a control group.

Usage

```
hangover
```

Format

A data frame with 4 variables and 120 observations:

`symptoms` number of hangover symptoms

`group` son of alcoholic vs. control

`time` measurement occasion

`id` subject ID

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Examples

```
summary(hangover)
```

`invisibility` *Cloaks of Invisibility*

Description

We are interested in the effect that wearing a cloak of invisibility has on people's tendency to mischief. 80 participants were placed in an enclosed community. Hidden cameras recorded mischievous acts. It was recorded how many mischievous acts were conducted in the first 3 weeks (mischief1). After 3 weeks 34 participants were told that the cameras were switched off so that no one would be able to see what they're getting up to. The remaining 46 subjects were given a cloak of invisibility. These people were told not to tell anyone else about their cloak and they could wear it whenever they liked. The number of mischievous acts were recorded over the next 3 weeks (mischief2).

Usage

```
invisibility
```

Format

A data frame with 3 variables and 80 observations:

`cloak` factor with 34 subjects in the no cloak condition, 46 in the cloak condition

`mischief1` number of mischievous acts during the first 3 weeks

`mischief2` number of mischievous acts during the second 3 weeks

Details

Fictional dataset from Field et al. book (p. 485).

References

Field, A., Miles, J., & Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
invisibility
summary(invisibility)
```

Leerkes *Maternal Self-Efficacy*

Description

TIn this dataset (n = 92) the relationship between how girls were raised by there own mother and their later feelings of maternal self-efficacy, i.e. our belief in our ability to succeed in specific situations. The other variable is self-esteem (can act as mediator). All variables are scored on a continuous scale from 1 to 4.

Usage

```
Leerkes
```

Format

A data frame with 3 variables and 92 observations:

`MatCare` maternal care

`Efficacy` maternal self-efficacy

`Esteem` self-esteen

References

Leerkes, E.M. & Crockenberg, S.C. (2002). The development of maternal self-efficacy and its impact on maternal behavior. Infancy, 3, 227-247.

Howell, D.C. (2012). Statistical Methods for Psychology (8th edition). Wadsworth, Belmont, CA.

Examples

```
summary(Leerkes)
```

med1way *Heteroscedastic one-way ANOVA for medians.*

Description

This function computes a one-way ANOVA for the medians. Homoscedasticity assumption not required. There shouldn't be too many ties.

Usage

```
med1way(formula, data, iter = 1000, ...)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
iter	number of iterations to determine critical value.
...	currently ignored.

Details

Evaluating the test statistic using the df proposed in the literature can result in the actual level being less than the nominal level, (i.e., around 0.02-0.025 when testing at the 0.05 level and the sample size is small). A better strategy is to simulate the critical value and computing the p-value accordingly, as implemented in this function.

Value

Returns an object of class med1way containing:

test	F-value of the test statistic
crit.val	critical value
p.value	p-value
call	function call

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t1way,t1waybt, Qanova

Examples

```
set.seed(123)
med1way(libido ~ dose, data = viagra, iter = 3000)
```

---

med2way *A two-way ANOVA for medians.*

Description

This function computes a two-way ANOVA medians with interactions effects.

Usage

```
med2way(formula, data, ...)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
...	currently ignored.

Details

There should not be too many ties in the data. The test statistics for the main effects in med2way are F-distributed, the (heteroscedastic) test for the interaction is chi-square distributed. Post hoc tests can be performed using mcp2a.

Value

Returns an object of class t2way containing:

Qa	first main effect
A.p.value	p-value first main effect
Qb	second main effect
B.p.value	p-value second main effect
Qab	interaction effect
AB.p.value	p-value interaction effect
call	function call
varnames	variable names
dim	design dimensions

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t2way, med1way

Examples

```
med2way(attractiveness ~ gender*alcohol, data = goggles)
mcp2a(attractiveness ~ gender*alcohol, data = goggles, est = "median")
```

movie *Movies and Aggressive Affect*

Description

Participants are randomly assigned to one of two groups. The first group watches a violent film, and the other watches a nonviolent film. Afterwards, the aggressive affect is measured, and it is desired to compare three groups, taking gender and degress into account as well.

Usage

```
movie
```

Format

A data frame with 4 variables and 68 observations:

`degree` no degree vs. degree

`gender` 36 males, 32 females

`type` violend vs. nonviolent

`aggressive` aggressive affect

Details

Artificial dataset from Wilcox book (p. 316).

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Examples

```
movie
summary(movie)
```

onesampb *One-sample percentile bootstrap*

Description

Tests whether a robust location measure (median, Huber Psi) differs from a null value and reports a 95% confidence interval based on percentile bootstrap.

Usage

```
onesampb(x, est = "onestep", nboot = 2000, nv = 0, alpha = 0.05, ...)
```

Arguments

x	a numeric vector.
est	robust estimator to be used ("onestep", "mom", or "median").
nboot	number of bootstrap samples.
nv	value under H0.
alpha	alpha level.
...	currently ignored.

Value

Returns an object of class "onesampb" containing:

ci	95% confidence interval
estimate	robust location sample estimate
p.value	p-value
n	number of effective observations
call	function call

References

Wilcox, R. (2017). Introduction to Robust Estimation and Hypothesis Testing (4th ed.). Elsevier.

See Also

t1way

Examples

```
set.seed(123)
x <- rnorm(30)
onesampb(x, nboot = 100)    ## H0: Psi = 0

set.seed(123)
x <- rlnorm(30)
onesampb(x, est = "median", nv = 1)   ## H0: median = 1
```

pbcor *Robust correlation coefficients.*

Description

The pbcor function computes the percentage bend correlation coefficient, wincor the Winsorized correlation, pball the percentage bend correlation matrix, winall the Winsorized correlation matrix.

Usage

```
pbcor(x, y = NULL, beta = 0.2, ci = FALSE, nboot = 500, alpha = 0.05, ...)
pball(x, beta = 0.2, ...)
wincor(x, y = NULL, tr = 0.2, ci = FALSE, nboot = 500, alpha = 0.05, ...)
winall(x, tr = 0.2, ...)
```

Arguments

x	a numeric vector, a matrix or a data frame.
y	a second numeric vector (for correlation functions).
beta	bending constant.
tr	amount of Winsorization.
ci	whether boostrap CI should be computed or not.
nboot	number of bootstrap samples for CI computation.
alpha	alpha level for CI computation.
...	currently ignored.

Details

It tested is whether the correlation coefficient equals 0 (null hypothesis) or not. Missing values are deleted pairwise. The tests are sensitive to heteroscedasticity. The test statistic H in pball tests the hypothesis that all correlations are equal to zero.

Value

pbcor and wincor return an object of class "pbcor" containing:

cor	robust correlation coefficient
test	value of the test statistic
p.value	p-value
n	number of effective observations
cor_ci	bootstrap confidence interval
call	function call

pball and winall return an object of class "pball" containing:

pbcorm	robust correlation matrix
p.values	p-values
H	H-statistic
H.p.value	p-value H-statistic
cov	variance-covariance matrix

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

twocor

Examples

```
x1 <- subset(hangover, subset = (group == "control" & time == 1))$symptoms
x2 <- subset(hangover, subset = (group == "control" & time == 2))$symptoms

pbcor(x1, x2)
pbcor(x1, x2, beta = 0.1, ci = TRUE)

wincor(x1, x2)
wincor(x1, x2, tr = 0.1, ci = TRUE)

require(reshape)
hanglong <- subset(hangover, subset = group == "control")
hangwide <- cast(hanglong, id ~ time, value = "symptoms")[,-1]

pball(hangwide)
winall(hangwide)
```

---

picture *Profile Pictures*

Description

This dataset examines how the profile pictures on social network platforms affect the number of friend requests when females are in a relationship. The relationship status is a between-subject variable (part of the participants did set their status to relationship). For the first 3 weeks the subjects had a picture of their own in their profiles. For the following 3 weeks they posted a picture with a man.

Usage

```
picture
```

Format

A data frame with 4 variables and 40 observations:

`case` subject id

`relationship_status` Relationship status on social network platform

`couple` amount of friend requests when profile picture as couple

`alone` amount of friend requests when profile picture as single

Details

Dataset from Field et al. book (p. 644).

References

Field, A., Miles, J., & Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
picture
summary(picture)
```

Pygmalion *Pygmalion Data*

Description

The Pygmalion effect is the phenomenon where higher expectations lead to an increase in performance. For instance, when teachers expect students to do well and show intellectual growth, they do; when teachers do not have such expectations, performance and growth are not so encouraged and may in fact be discouraged in a variety of ways. This dataset contains reasoning IQ scores of children. For the experimental group, positive expectancies had been suggested to teachers after the pretest. For the experimental group, no expectancies had been suggested after the pretest. For both groups we have reasoning IQ posttest scores. The dataset is taken from Elashoff and Snow (1970).

Usage

```
Pygmalion
```

Format

A data frame with 3 variables and 114 observations:

`Pretest` pretest score

`Posttest` posttest score

`Group` treatment vs. control

References

Elashoff, J. D., & Snow, R. E. (1970). A case study in statistical inference: Reconsideration of the Rosenthal-Jacobson data on teacher expectancy. Technical Report No. 15, School of Education, Stanford University.

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Examples

```
summary(Pygmalion)
```

`Qanova` *Quantile ANOVA*

Description

One-way ANOVA based on quantiles. Only known method to work well when tied values are likely to occur.

Usage

```
Qanova(formula, data, q = 0.5, nboot = 600, ...)
```

Arguments

`formula`	an object of class formula.
`data`	an optional data frame for the input data.
`q`	quantile (or vector of quantiles) to be used.
`nboot`	number of bootstrap samples
`...`	currently ignored.

Details

Test global hypothesis that J independent groups have equal quantiles (default: median) using the Harrell-Davis estimator. Performs well when there are tied values.

Value

`Qanova` an object of class `"qanova"` containing:

`psihat`	value of the test statistics
`contrasts`	contrasts
`p.value`	p-value
`call`	function call

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

qcomhd, t1way, discANOVA

Examples

```
## median comparison
set.seed(123)
fitmed <- Qanova(libido ~ dose, viagra, nboot = 200)
fitmed

## 1st, 3rd quartile comparison
set.seed(123)
fitquart <- Qanova(libido ~ dose, viagra, q = c(0.25, 0.75), nboot = 200)
fitquart
```

---

rmanova *A heteroscedastic one-way repeated measures ANOVA for trimmed means.*

Description

The rmanova function computes a one-way repeated measures ANOVA for the trimmed means. Homoscedasticity assumption not required. Corresponding post hoc tests can be performed using rmmcp.

Usage

```
rmanova(y, groups, blocks, tr = 0.2, ...)
rmmcp(y, groups, blocks, tr = 0.2, alpha = 0.05, ...)
```

Arguments

y	a numeric vector of data values (response).
groups	a vector giving the group of the corresponding elements of y.
blocks	a vector giving the block of the corresponding elements of y.
tr	trim level for the mean.
alpha	alpha level for post hoc comparisons.
...	currently ignored.

Value

rmanova an object of class "t1way" containing:

test	value of the test statistic
df1	degrees of freedom
df2	degrees of freedom
p.value	p-value
call	function call

rmmcp returns an object of class "mcp1" containing:

comp	inference for all pairwise comparisons
fnames	names of the factor levels

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

rmanovab, med1way, t1way

Examples

```
head(WineTasting)
rmanova(WineTasting$Taste, WineTasting$Wine, WineTasting$Taster)

## post hoc
rmmcp(WineTasting$Taste, WineTasting$Wine, WineTasting$Taster)

head(bush)
require(reshape)
bushLong <- melt(bush, id.var = "participant", variable_name = "food")
rmanova(bushLong$value, bushLong$food, bushLong$participant)

## post hoc
rmmcp(bushLong$value, bushLong$food, bushLong$participant)
```

rmanovab *A heteroscedastic one-way repeated measures bootstrap ANOVA for trimmed means.*

Description

The rmanovab function computes a bootstrap version of the one-way repeated measures ANOVA for the trimmed means. Homoscedasticity assumption not required. Corresponding post hoc tests can be performed using pairdepb.

Usage

```
rmanovab(y, groups, blocks, tr = 0.2, nboot = 599, ...)
pairdepb(y, groups, blocks, tr = 0.2, nboot = 599, ...)
```

Arguments

y	a numeric vector of data values (response).
groups	a vector giving the group of the corresponding elements of y.
blocks	a vector giving the block of the corresponding elements of y.
tr	trim level for the mean.
nboot	number of bootstrap samples.
...	currently ignored.

Value

rmanovab an object of class "rmanovab" containing:

test	value of the test statistic
crit	critical value
call	function call

pairdepb returns an object of class "mcp2" containing:

comp	inference for all pairwise comparisons
fnames	names of the factor levels

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

rmanova

Examples

```
set.seed(123)
rmanovab(WineTasting$Taste, WineTasting$Wine, WineTasting$Taster, nboot = 300)

## post hoc
set.seed(123)
pairdepb(WineTasting$Taste, WineTasting$Wine, WineTasting$Taster, nboot = 300)
```

`runmean` *Running Interval Smoother*

Description

The `runmean` implements a running interval smoother on the trimmed mean, `rungen` uses general M-estimators, `runmbo` performs interval smoothing on M-estimators with bagging.

Usage

```
runmean(x, y, fr = 1, tr = 0.2, ...)
rungen(x, y, fr = 1, est = "mom", ...)
runmbo(x, y, fr = 1, est = "mom", nboot = 40, ...)
```

Arguments

`x`	a numeric vector of data values (predictor)
`y`	a numeric vector of data values (response)
`fr`	smoothing factor (see details)
`tr`	trim level for the mean
`est`	type of M-estimator (`"mom"`, `"onestep"`, or `"median"`)
`nboot`	number of bootstrap samples
`...`	currently ignored.

Details

The larger the smoothing factor, the stronger the smoothing. Often the choice `fr = 1` gives good results; the general strategy is to find the smallest constant so that the plot looks reasonably smooth.

Value

Returns the fitted values.

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

ancova

Examples

```
## trimmed mean smoother
fitmean <- runmean(Pygmalion$Pretest, Pygmalion$Posttest)
## MOM smoother
fitmest <- rungen(Pygmalion$Pretest, Pygmalion$Posttest)
## median smoother
fitmed <- rungen(Pygmalion$Pretest, Pygmalion$Posttest, est = "median")
## bagged onestep smoother
fitbag <- runmbo(Pygmalion$Pretest, Pygmalion$Posttest, est = "onestep")

## plot smoothers
plot(Pygmalion$Pretest, Pygmalion$Posttest, col = "gray", xlab = "Pretest", ylab = "Posttest",
     main = "Pygmalion Smoothing")
orderx <- order(Pygmalion$Pretest)
lines(Pygmalion$Pretest[orderx], fitmean[orderx], lwd = 2)
lines(Pygmalion$Pretest[orderx], fitmest[orderx], lwd = 2, col = 2)
lines(Pygmalion$Pretest[orderx], fitmed[orderx], lwd = 2, col = 3)
lines(Pygmalion$Pretest[orderx], fitbag[orderx], lwd = 2, col = 4)
legend("topleft", legend = c("Trimmed Mean", "MOM", "Median", "Bagged Onestep"), col = 1:4, lty = 1)
```

---

spider *Arachnophobes*

Description

24 arachnophobes were used in all. 12 were asked to play with a big hairy tarantula spider with big fangs and an evil look. Their subsequent anxiety was measured. The remaining 12 were shown only picture of the same hairy tarantula. Again, the anxiety was measured.

Usage

```
spider
```

Format

A data frame with 2 variables and 24 observations:

`Group` picture vs. real spider

`Anxiety` anxiety measure

Details

Dataset from Field et al. book (p. 362).

References

Field, A., Miles, J., & Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
spider
```

`swimming` *Optimistic and Pessimistic Swimmers*

Description

At a swimming team practice, all participants were asked to swim their best event as far as possible, but in each case the time that was reported was falsified to indicate poorer than expected performance (i.e., each swimmer was disappointed). 30 min later, they did the same performance. The authors predicted that on the second trial more pessimistic swimmers would do worse than on their first trial, whereas optimistic swimmers would do better. The response is ratio = Time1/Time2 (> 1 means that a swimmer did better in trial 2).

Usage

```
swimming
```

Format

A data frame with 4 variables and 58 observations:

`Optim` Optimists and pessimists

`Sex` Gender of the swimmer

`Event` Swimming event: freestyle, breaststroke, backstroke

`Ratio` Ratio between the swimming times

References

Seligman, M. E. P., Nolen-Hoeksema, S., Thornton, N., & Thornton, C. M. (1990). Explanatory style as a mechanism of disappointing athletic performance. Psychological Science, 1, 143-146.

Examples

```
summary(swimming)
```

t1way *A heteroscedastic one-way ANOVA for trimmed means.*

Description

The t1way function computes a one-way ANOVA on trimmed means. Homoscedasticity assumption not required. It uses a generalization of Welch's method. Corresponding post hoc tests can be performed using lincon.

Usage

```
t1way(formula, data, tr = 0.2, alpha = 0.05, nboot = 100, ...)
lincon(formula, data, tr = 0.2, alpha = 0.05, method = "hochberg", ...)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.
alpha	alpha level for CI computation.
nboot	number of bootstrap samples for effect size CI computation.
method	method to correct the p-value (see p.adjust)
...	currently ignored.

Details

In the post hoc computations, confidence intervals and p-values are adjusted to control FWE. The default for the p-values is to use Hochberg's 1988 sharper Bonferroni procedure.

Value

t1way returns an object of class "t1way" containing:

test	value of the test statistic (F-statistic)
df1	degrees of freedom
df2	degrees of freedom
p.value	p-value
effsize	explanatory measure of effect size
effsize_ci	boostrap effect size CI
call	function call

lincon returns an object of class "mcp1" containing:

comp	inference for all pairwise comparisons
fnames	names of the factor levels

linconv2 returns an object of class "linconv2" containing:

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

med1way,t1waybt

Examples

```
set.seed(123)
t1way(libido ~ dose, data = viagra)

## post hoc tests
lincon(libido ~ dose, data = viagra)
```

---

t1waybt *Bootstrap version of the heteroscedastic one-way ANOVA for trimmed means.*

Description

Test the hypothesis of equal trimmed means using a percentile t bootstrap method. Corresponding post hoc tests are provided in mcppb20.

Usage

```
t1waybt(formula, data, tr = 0.2, nboot = 599, ...)
mcppb20(formula, data, tr = 0.2, nboot = 599, ...)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.
nboot	number of bootstrap samples.
...	currently ignored.

Value

Returns an object of class t1waybt containing:

test	value of the test statistic
p.value	p-value
Var.Explained	explained amount of variance
Effect.Size	effect size
nboot.eff	effective number of bootstrap samples

call	function call

mcppb20 returns an object of class "mcp1" containing:

comp	inference for all pairwise comparisons
fnames	names of the factor levels

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t1way,med1way

Examples

```
t1waybt(libido ~ dose, data = viagra)

## post hoc
mcppb20(libido ~ dose, data = viagra)
```

---

t2way *A two-way ANOVA for trimmed means, M-estimators, and medians.*

Description

The t2way function computes a two-way ANOVA for trimmed means with interactions effects. Corresponding post hoc tests are in mcp2atm. pbad2way performs a two-way ANOVA using M-estimators for location with mcp2a for post hoc tests.

Usage

```
t2way(formula, data, tr = 0.2, ...)
pbad2way(formula, data, est = "mom", nboot = 599, pro.dis = FALSE, ...)
mcp2atm(formula, data, tr = 0.2, ...)
mcp2a(formula, data, est = "mom", nboot = 599, ...)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.
est	Estimate to be used for the group comparisons: either "onestep" for one-step M-estimator of location using Huber's Psi, "mom" for the modified one-step (MOM) estimator of location based on Huber's Psi, or "median".
nboot	number of bootstrap samples.

pro.dis	If FALSE, Mahalanobis distances are used; if TRUE projection distances are computed.
...	currently ignored.

Details

t2way does not report any degrees of freedom since an adjusted critical value is used. pbad2way returns p-values only; if it happens that the variance-covariance matrix in the Mahalanobis distance computation is singular, it is suggested to use the projection distances by setting pro.dis = TRUE.

Value

The functions t2way and pbad2way return an object of class t2way containing:

Qa	first main effect
A.p.value	p-value first main effect
Qb	second main effect
B.p.value	p-value second main effect
Qab	interaction effect
AB.p.value	p-value interaction effect
call	function call
varnames	variable names
dim	design dimensions

The functions mcp2atm and mcp2a return an object of class mcp containing:

effects	list with post hoc comparisons for all effects
contrasts	design matrix

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t1way, med1way, t2way

Examples

```
## 2-way ANOVA on trimmed means
t2way(attractiveness ~ gender*alcohol, data = goggles)

## post hoc tests
mcp2atm(attractiveness ~ gender*alcohol, data = goggles)

## 2-way ANOVA on MOM estimator
pbad2way(attractiveness ~ gender*alcohol, data = goggles)
```

```
## post hoc tests
mcp2a(attractiveness ~ gender*alcohol, data = goggles)

## 2-way ANOVA on medians
pbad2way(attractiveness ~ gender*alcohol, data = goggles, est = "median")

## post hoc tests
mcp2a(attractiveness ~ gender*alcohol, data = goggles, est = "median")

## extract design matrix
model.matrix(mcp2a(attractiveness ~ gender*alcohol, data = goggles, est = "median"))
```

`t3way` *A three-way ANOVA for trimmed means.*

Description

This function computes a three-way ANOVA for trimmed means with all interactions effects.

Usage

```
t3way(formula, data, tr = 0.2, ...)
```

Arguments

`formula`	an object of class formula.
`data`	an optional data frame for the input data.
`tr`	trim level for the mean.
`...`	currently ignored.

Value

Returns an object of class `t3way` containing:

`Qa`	first main effect
`A.p.value`	p-value first main effect
`Qb`	second main effect
`B.p.value`	p-value second main effect
`Qc`	third main effect
`C.p.value`	p-value third main effect
`Qab`	first two-way interaction effect
`AB.p.value`	p-value first two-way interaction effect
`Qac`	second two-way interaction effect
`AC.p.value`	p-value second two-way interaction effect

Qbc	third two-way interaction effect
BC.p.value	p-value third two-way interaction effect
Qabc	three-way interaction effect
ABC.p.value	p-value three-way interaction effect
call	function call
varnames	variable names

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

t1way, t2way

Examples

```
t3way(aggressive ~ degree*gender*type, data = movie)
```

---

trimcibt *Bootstrap-t method for one-sample test*

Description

Compute a 1-alpha confidence interval for the trimmed mean using a bootstrap percentile t method.

Usage

```
trimcibt(x, nv = 0, tr = 0.2, alpha = 0.05, nboot = 200, ...)
```

Arguments

x	a numeric vector.
nv	value under H0.
tr	trim level for the mean.
alpha	alpha level.
nboot	number of bootstrap samples.
...	currently ignored.

Value

Returns an object of class "trimcibt" containing:

ci	95% confidence interval
estimate	trimmed mean
p.value	p-value
test.stat	t-statistic
tr	trimming level
n	number of effective observations

References

Wilcox, R. (2017). Introduction to Robust Estimation and Hypothesis Testing (4th ed.). Elsevier.

See Also

onesampb

Examples

```
set.seed(123)
x <- rnorm(30)
trimcibt(x, nboot = 100)    ## H0: Psi = 0
```

---

trimse *Robust location measures and their standard errors (se).*

Description

The following functions for estimating robust location measures and their standard errors are provided: winmean for the Winsorized mean, winse for its se, trimse for the trimmend mean se, msmedse for the median se, mest for the M-estimator with se in mestse. The functions onestep and mom compute the one-step and modified one-step (MOM) M-estimator. The Winsorized variance is implemented in winvar.

Usage

```
winmean(x, tr = 0.2, na.rm = FALSE, ...)
winvar(x, tr = 0.2, na.rm = FALSE, STAND = NULL, ...)
winse(x, tr = 0.2, ...)
trimse(x, tr = 0.2, na.rm = FALSE, ...)
msmedse(x, sewarn = TRUE, ...)
mest(x, bend = 1.28, na.rm = FALSE, ...)
mestse(x, bend = 1.28, ...)
onestep(x, bend = 1.28, na.rm = FALSE, MED = TRUE, ...)
mom(x, bend = 2.24, na.rm = TRUE, ...)
```

Arguments

x	a numeric vector containing the values whose measure is to be computed.
tr	trim lor Winsorizing level.
na.rm	a logical value indicating whether NA values should be stripped before the computation proceeds.
sewarn	a logical value indicating whether warnings for ties should be printed.
bend	bending constant for M-estimator.
MED	if TRUE, median is used as initial estimate.
STAND	no functionality, kept for WRS compatibility purposes.
...	currently ignored.

Details

The standard error for the median is computed according to McKean and Shrader (1984).

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

McKean, J. W., & Schrader, R. M. (1984). A comparison of methods for studentizing the sample median. Communications in Statistics - Simulation and Computation, 13, 751-773.

Dana, E. (1990). Salience of the self and salience of standards: Attempts to match self to standard. Unpublished PhD thesis, Department of Psychology, University of Southern California.

Examples

```
## Self-awareness data (Dana, 1990): Time persons could keep a portion of an
## apparatus in contact with a specified range.
self <- c(77, 87, 88, 114, 151, 210, 219, 246, 253, 262, 296, 299, 306, 376,
          428, 515, 666, 1310, 2611)
mean(self, 0.1)     ## .10 trimmed mean
trimse(self, 0.1)   ## se trimmed mean
winmean(self, 0.1)  ## Winsorized mean (.10 Winsorizing amount)
winse(self, 0.1)    ## se Winsorized mean
winvar(self, 0.1)   ## Winsorized variance
median(self)        ## median
msmedse(self)       ## se median
mest(self)          ## Huber M-estimator
mestse(self)
onestep(self)       ## one-step M-estimator
mom(self)           ## modified one-step M-estimator
```

`twocor` *Confidence intervals for two-sided tests on correlation coefficients.*

Description

The `twopcor` function tests whether the difference between two Pearson correlations is 0. The `twocor` function performs the same test on a robust correlation coefficient (percentage bend correlation or Winsorized correlation).

Usage

```
twopcor(x1, y1, x2, y2, nboot = 599, ...)
twocor(x1, y1, x2, y2, corfun = "pbcor", nboot = 599, tr = 0.2, beta = 0.2, ...)
```

Arguments

`x1`	a numeric vector.
`y1`	a numeric vector.
`x2`	a numeric vector.
`y2`	a numeric vector.
`nboot`	number of bootstrap samples.
`corfun`	Either `"pbcor"` for percentage based correlation or `"wincor"` for Winsorized correlation.
`tr`	amount of Winsorization.
`beta`	bending constant.
`...`	currently ignored.

Details

It is tested whether the first correlation coefficient (based on `x1` and `y1`) equals to the second correlation coefficient (based on `x2` and `y2`). Both approaches return percentile bootstrap CIs.

Value

`twopcor` and `twocor` return an object of class `"twocor"` containing:

`r1`	robust correlation coefficient
`r2`	value of the test statistic
`ci`	confidence interval
`p.value`	p-value
`call`	function call

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

pbcor, wincor

Examples

```
ct1 <- subset(hangover, subset = (group == "control" & time == 1))$symptoms
ct2 <- subset(hangover, subset = (group == "control" & time == 2))$symptoms
at1 <- subset(hangover, subset = (group == "alcoholic" & time == 1))$symptoms
at2 <- subset(hangover, subset = (group == "alcoholic" & time == 2))$symptoms

set.seed(111)
twopcor(ct1, ct2, at1, at2)
set.seed(123)
twocor(ct1, ct2, at1, at2, corfun = "pbcor", beta = 0.15)
set.seed(224)
twocor(ct1, ct2, at1, at2, corfun = "wincor", tr = 0.15, nboot = 50)
```

---

viagra *Effects of Viagra*

Description

Participants were assigned randomly to three viagra dosages (placebo, low dosage, high dosage). The dependent variable was an objective measure of libido.

Usage

```
viagra
```

Format

A data frame with 2 variables and 15 observations:

`dose` viagra dosage

`libido` objective measure of libido

Details

Artificial dataset from Field et al. book (p. 401).

References

Field, A., Miles, J., & Field, Z. (2012). Discovering Statistics Using R. Sage.

Examples

```
viagra
```

WineTasting *Wine Tasting*

Description

In this hypothetical dataset we have three types of wine (A, B and C). We asked 22 friends to taste each of the three wines (in a blind fold fashion), and then to give a grade of 1 to 7. We asked them to rate the wines 5 times each, and then averaged their results to give a number for a persons preference for each wine.

Usage

```
WineTasting
```

Format

A data frame with 3 variables and 66 observations:

`Taste` Taste Rating

`Wine` Wine (A, B, C)

`Taster` Taster (index)

Examples

```
WineTasting
summary(WineTasting)
```

wmcpAKP *Effect size for dependent samples ANOVA*

Description

Compute an AKP-type effect size for dependent sample ANOVA

Usage

```
wmcpAKP(x, tr = 0.2, nboot = 200, ...)
```

Arguments

`x`	data frame in wide format (no missing values allowed)
`tr`	trim level for the means.
`nboot`	number of bootstrap samples.
`...`	currently ignored.

Details

The computation is based on a modification of the Algina-Keselman-Penfield effect size for J dependent samples.

References

Algina, J., Keselman, H.J., & Penfield, R.D. (2005). An alternative to Cohen's standardized mean difference effect size: A robust parameter and confidence interval in the two independent groups case. Psychological Methods, 10, 317-328.

See Also

rmanova, yuend

Examples

```
## Not run:
require(reshape)
WineLong <- cast(WineTasting, Taster ~ Wine, value = "Taste")[,-1]
set.seed(123)
effsize <- wmcpAKP(WineLong, nboot = 20)
effsize

## End(Not run)
```

---

yuen *Independent samples t-tests on robust location measures including effect sizes.*

Description

The function yuen performs Yuen's test for trimmed means, yuenbt is a bootstrap version of it. akp.effect and yuen.effect.ci can be used for effect size computation. The pb2gen function performs a t-test based on various robust estimators, medpb2 compares two independent groups using medians, and qcomhd compares arbitrary quantiles.

Usage

```
yuen(formula, data, tr = 0.2, ...)
yuenbt(formula, data, tr = 0.2, nboot = 599, side = TRUE, ...)
akp.effect(formula, data, EQVAR = TRUE, tr = 0.2, nboot = 200, alpha = 0.05, ...)
yuen.effect.ci(formula, data, tr = 0.2, nboot = 400, alpha = 0.05, ...)
pb2gen(formula, data, est = "mom", nboot = 599, ...)
medpb2(formula, data, nboot = 2000, ...)
qcomhd(formula, data, q = c(0.1, 0.25, 0.5, 0.75, 0.9),
       nboot = 2000, alpha = 0.05, ADJ.CI = TRUE, ...)
```

Arguments

formula	an object of class formula.
data	an optional data frame for the input data.
tr	trim level for the mean.
nboot	number of bootstrap samples.
side	side = TRUE indicates two-sided method using absolute value of the test statistics within the bootstrap; otherwise the equal-tailed method is used.
est	estimate to be used for the group comparisons: either "onestep" for one-step M-estimator of location using Huber's Psi, "mom" for the modified one-step (MOM) estimator of location based on Huber's Psi, or "median", "mean".
q	quantiles to be used for comparison.
alpha	alpha level.
ADJ.CI	whether CIs should be adjusted.
EQVAR	whether variances are assumed to be equal across groups.
...	currently ignored.

Details

If yuenbt is used, p-value computed only when side = TRUE. medpb2 is just a wrapper function for pb2gen with the median as M-estimator. It is the only known method to work well in simulations when tied values are likely to occur.qcomhd returns p-values and critical p-values based on Hochberg's method.

Value

Returns objects of classes "yuen" or "pb2" containing:

test	value of the test statistic (t-statistic)
p.value	p-value
conf.int	confidence interval
df	degress of freedom
diff	trimmed mean difference
effsize	explanatory measure of effect size
call	function call

qcomhd returns an object of class "robtab" containing:

partable	parameter table

References

Algina, J., Keselman, H.J., & Penfield, R.D. (2005). An alternative to Cohen's standardized mean difference effect size: A robust parameter and confidence interval in the two independent groups case. Psychological Methods, 10, 317-328.

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

Wilcox, R., & Tian, T. (2011). Measuring effect size: A robust heteroscedastic approach for two or more groups. Journal of Applied Statistics, 38, 1359-1368.

Yuen, K. K. (1974). The two sample trimmed t for unequal population variances. Biometrika, 61, 165-170.

See Also

t1way,t1waybt

Examples

```
set.seed(123)
## Yuen's test
yuen(Anxiety ~ Group, data = spider)

## Bootstrap version of Yuen's test (symmetric CIs)
yuenbt(Anxiety ~ Group, data = spider)

## Robust Cohen's delta
akp.effect(Anxiety ~ Group, data = spider)

## Using an M-estimator
pb2gen(Anxiety ~ Group, data = spider, est = "mom")
pb2gen(Anxiety ~ Group, data = spider, est = "mean")
pb2gen(Anxiety ~ Group, data = spider, est = "median")

## Using the median
medpb2(Anxiety ~ Group, data = spider)

## Quantiles
set.seed(123)
qcomhd(Anxiety ~ Group, data = spider, q = c(0.8, 0.85, 0.9), nboot = 500)
```

---

yuend *Paired samples robust t-tests.*

Description

The function yuend performs Yuen's test on trimmed means for dependent samples. Dqcomhd compares the quantiles of the marginal distributions associated with two dependent groups via hd estimator. Tied values are allowed. dep.effect computes various effect sizes and confidence intervals for two dependent samples (see Details).

Usage

```
yuend(x, y, tr = 0.2, ...)
Dqcomhd(x, y, q = c(1:9)/10, nboot = 1000, na.rm = TRUE, ...)
dep.effect(x, y, tr = 0.2, nboot = 1000, ...)
```

Arguments

x	an numeric vector of data values (e.g. for time 1).
y	an numeric vector of data values (e.g. for time 2).
tr	trim level for the means.
q	quantiles to be compared.
nboot	number of bootstrap samples.
na.rm	whether missing values should be removed.
...	currently ignored.

Details

The test statistic is a paired samples generalization of Yuen's independent samples t-test on trimmed means.

dep.effect computes the following effect sizes:

AKP: robust standardized difference similar to Cohen's d

QS: Quantile shift based on the median of the distribution of difference scores,

QStr: Quantile shift based on the trimmed mean of the distribution of X-Y

SIGN: P(X<Y), probability that for a random pair, the first is less than the second.

Value

yuend returns an object of class "yuen" containing:

test	value of the test statistic (t-statistic)
p.value	p-value
conf.int	confidence interval
df	degress of freedom
diff	trimmed mean difference
call	function call

Dqcomhd returns an object of class "robtab" containing:

partable	parameter table

dep.effect returns a matrix with the null value of the effect size, the estimated effect size, small/medium/large conventions, and lower/upper CI bounds.

References

Wilcox, R. (2012). Introduction to Robust Estimation and Hypothesis Testing (3rd ed.). Elsevier.

See Also

yuen, qcomhd

Examples

```
## Cholesterol data from Wilcox (2012, p. 197)
before <- c(190, 210, 300,240, 280, 170, 280, 250, 240, 220)
after <- c(210, 210, 340, 190, 260, 180, 200, 220, 230, 200)
yuend(before, after)

set.seed(123)
Dqcomhd(before, after, nboot = 200, q = c(0.25, 0.5, 0.75))

set.seed(123)
dep.effect(before, after)
```

ZYmediate *Robust mediation test*

Description

Performs a robust mediation test according to the method proposed by Zu & Yuan (2010).

Usage

```
ZYmediate(x, y, med, nboot = 2000, alpha = 0.05, kappa = 0.05, ...)
```

Arguments

x	vector with predictor values.
y	vector with response values.
med	vector with mediator values.
nboot	number of bootstrap samples.
alpha	alpha level.
kappa	the percent of cases to be controlled when robust method is used.
...	currently ignored.

Value

ZYmediate returns an object of class "robmed" containing:

a.est	effect of predictor on mediator)
b.est	effect of mediator on response (in multiple regression model which includes the predictor as well)
ab.est	indirect effect (mediation effect)
CI.ab	confidence interval mediation effect
p.value	p-value mediation test
call	function call

References

Zu J., Yuan, K.-H. (2010). Local influence and robust procedures for mediation analysis. Multivariate Behavioral Research, 45, 1-44.

Examples

```
## Leerkes data:
## Y: Efficacy
## X: MatCare
## M: Esteem

## fitting robust mediator regressions
require(MASS)
summary(rlm(Efficacy ~ MatCare, data = Leerkes))
summary(rlm(Esteem ~ MatCare, data = Leerkes))
summary(rlm(Efficacy ~ MatCare + Esteem, data = Leerkes))

## robust testing of mediating effect (indirect effect)
with(Leerkes, ZYmediate(MatCare, Efficacy, Esteem))
```

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