

# Package ‘npsm’

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**Type** Package

**Title** Nonparametric Statistical Methods

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**Description** Accompanies the book “Nonparametric Statistical Methods Using R, 2nd Edition” by Kloke and McKean (2024, ISBN:9780367651350). Includes methods, datasets, and random number generation useful for the study of robust and/or nonparametric statistics. Emphasizes classical nonparametric methods for a variety of designs --- especially one-sample and two-sample problems. Includes methods for general scores, including estimation and testing for the two-sample location problem as well as Hogg's adaptive method.

**License** GPL (>= 2)

**LazyLoad** yes

**LazyData** yes

**URL** <https://github.com/kloke/npsm>, <https://github.com/kloke/book>

**Depends** R (>= 3.5.0), Rfit

**Imports** methods, class, plyr

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tree

**NeedsCompilation** no

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<code>acov231</code>	<i>Analysis of Covariance Example for a two by three two-way design</i>
----------------------	---

---

## Description

This is a simulated data set which is used as an example of analysis of covariance. The data frame `acov231` contains the data. The responses are in column 1, column 2 contains the levels of factor A, column 3 contains the levels of factor B, and the 4th column contains the covariate. All true parameters (effects) are 0 in this generated data set.

## Usage

```
data(acov231)
```

## Format

A data frame with 33 observations and 4 variables.

`response` numeric. the response.

`fA` numeric. factor A with 2 levels.

`fB` numeric. factor B with 3 levels.

`covariate` numeric. a covariate.

## References

Kloke, J. and McKean J.W. (2014), *Nonparametric Statistical Methods using R*, Boca Raton, FL: Chapman-Hall.

## Examples

```
levs = c(2,3)
data = acov231[,1:3]
xcov = matrix(acov231[,4],ncol=1)
temp = kancova(levs,data,xcov)
```

---

aligned.test	<i>Aligned Rank Test</i>
--------------	--------------------------

---

**Description**

Aligned rank test for a group/treatment effect after adjusting for covariates.

**Usage**

```
aligned.test(x, y, g, scores = Rfit::wscores,...)
```

**Arguments**

x	n by p design matrix
y	n by 1 response vector
g	n by 1 vector denoting group/treatment membership.
scores	Which scores should be used for the fit and the test. An object of class scores.
...	optional arguments. passed to rfit.

**Details**

Data are aligned based on the design matrix x using a rank-based fit via rfit.

**Value**

statistic	The value of the test statistic.
p.value	The p-value based on a chisq(k-1) distribution where k is the number of groups/treatments.

**Author(s)**

John Kloke

**References**

Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.

**See Also**

[rfit](#)

**Examples**

```
y<-rt(30,2)
x<-runif(30)
g<-rep(1:3,each=10)
aligned.test(x,y,g)
```

---

baseball\_players1000 *Career Information for a Random Sample of 1000 Baseball Players*

---

**Description**

Demographics and position information on 1000 randomly selected baseball players who debuted after 1945.

**Usage**

```
data("baseball_players1000")
```

**Format**

A data frame with 1000 observations on the following 28 variables.

playerID a character vector  
birthYear a numeric vector  
birthMonth a numeric vector  
birthDay a numeric vector  
birthCountry a character vector  
birthState a character vector  
nameFirst a character vector  
nameLast a character vector  
weight a numeric vector  
height a numeric vector  
bats a character vector  
throws a character vector  
debutYear a numeric vector  
G\_all a numeric vector  
G\_p a numeric vector  
G\_c a numeric vector  
G\_1b a numeric vector  
G\_2b a numeric vector  
G\_3b a numeric vector  
G\_ss a numeric vector  
G\_1f a numeric vector  
G\_cf a numeric vector  
G\_rf a numeric vector  
G\_of a numeric vector  
G\_dh a numeric vector  
G\_ph a numeric vector  
G\_pr a numeric vector  
pitcher a logical vector

**Details**

A random subset of baseball players who debuted after 1945 and played in at least 160 games. Includes information on birth (date and location); height (inches) and weight (pounds); whether they bat left (L), right (R), or switch (B); and games played at each position. The variable pitcher is a derived variable based on if the majority of games were played as a pitcher (i.e.;  $G_{pr}/G_{all} > 0.5$ ).

**Source**

<https://github.com/chadwickbureau/baseballdatabank>

**References**

<https://github.com/chadwickbureau/baseballdatabank/blob/master/readme2014.txt>

**Examples**

```
data(baseball_players1000)
hist(baseball_players1000$weight,xlab="Weight (lbs)",
      probability=TRUE, ylim=c(0,0.02),
      main="Histogram of Weight for 1000 Baseball Players")
lines(density(baseball_players1000$weight,na.rm=TRUE))
```

---

bb2010

*Batting statistics for the 2010 baseball season.*

---

**Description**

Batting (average, home runs, RBIs) statistics for 2010 full time players. By full time we mean that the batter had at least 450 official at bats during the season.

**Usage**

```
data(bb2010)
```

**Format**

A data frame with 122 observations on the following 3 variables.

ave batting average

hr home runs

rbi runs batted in

**Source**

baseballguru.com

**Examples**

```
plot(hr~ave,data=bb2010)
```

---

blood.plasma	<i>Blood plasma measurements related to total triglyceride level</i>
--------------	--

---

**Description**

Data table from Table 9.11 of Hollander and Wolfe (1999). The data consists of triglyceride levels on 13 patients. Two factors, each at two levels, were recorded: Sex and Obesity. The concomitant variables are chylomicrons, age, and three lipid variables (very low-density lipoproteins (VLDL), low-density lipoproteins (LDL), and high-density lipoproteins (HDL)).

**Usage**

```
data(blood.plasma)
```

**Format**

A data frame with 13 observations on 8 variables.

Total Triglyceride level, response

Sex Sex, 2 levels

Obese Obesity, 2 levels

Chylo Chylomicrons, covariate

VLDL Very low density, lipids, covariate

LDL Low density, lipids, covariate

HDL High density, lipids, covariate

Age Age

**Source**

Hollander, M. and Wolfe, D.A. (1999), *Nonparametric Statistical Methods*, New York: Wiley.

**References**

Hollander, M. and Wolfe, D.A. (1999), *Nonparametric Statistical Methods*, New York: Wiley.

**Examples**

```
data(blood.plasma)
plot(Total~Age,data=blood.plasma)
boxplot(Total~Obese,data=blood.plasma)
```

---

brewers1982	<i>Basic Summaries of Boxscores for the Milwaukee Brewers 1982 Season</i>
-------------	---

---

### Description

Basic Summaries of Boxscores for the Major League Baseball team Milwaukee (WI) Brewers 1982 Season. The Brewers won the American League championship that year. Brewer, Robin Yount won the Most Valueable Player (MVP) award. #Robin Yount. MVP.

### Usage

```
data("brewers1982")
```

### Format

A data frame with 163 observations on the following 8 variables.

Date a character vector

Opp a character vector

R a numeric vector

RA a numeric vector

Time a character vector

Attendance a numeric vector

home a logical vector

win a logical vector

### Examples

```
data(brewers1982)
# proportion of wins for a given number of runs scored
pwin <- with(brewers1982, tapply(win, R, mean))
pwin
# graphical display of the above
plot(names(pwin), pwin, xlab='Runs', ylab='Proportion of Wins', main='Brewers 1982')
```

---

cancertrt	<i>Survival time based on two treatments</i>
-----------	--

---

**Description**

Survival times (in days) for undergoing standard treatment (S) and a new treatment (N).

**Usage**

```
data("cancertrt")
```

**Format**

A data frame with 17 observations on the following 3 variables.

time Survival time in days

event Indicator for event

trt a factor with levels N S

**References**

Higgins (2004), *Introduction to Modern Nonparametric Statistics*, Pacific Grove, CA:Brooks/Cole-Thomson Learning

**Examples**

```
data(cancertrt)
with(cancertrt, gehan.test(time, event, trt))
```

---

centerx	<i>Center Matrix</i>
---------	----------------------

---

**Description**

Centers a matrix.

**Usage**

```
centerx(x)
```

**Arguments**

x a matrix

**Details**

Returns a centered matrix, i.e., each column of the matrix is replaced by deviations from its column mean.

**Value**

The centered matrix.

**Author(s)**

John Kloke, Joseph McKean

**See Also**

scale

**Examples**

```
x <- cbind(seq(1,5,length=5),seq(10,20,length=5))
xc <- centerx(x)
apply(xc,1,mean)
```

---

cloud

*Cloud Dewpoint*

---

**Description**

A regression example with response cloud point of a liquid and predictor the percent of Iodine 8 added to the liquid; see Chapter 3 of Hettmansperger and McKean (2011) or Exercise 4.9.10 of Kloke and McKean (2014)/Exercise 4.7.7 of Kloke and McKean (2024).

**Usage**

```
data(cloud)
```

**Format**

Nineteen observations on two variables.

cloud.point Cloud point of the liquid

I8 Percent Iodine 8 added

**Source**

Draper, N.R. and Smith, H. (1966), *Applied Regression Analysis*, New York: John Wiley and Sons.

## References

Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods Using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods Using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

## Examples

```
rfit(cloud.point ~ I8,data=cloud)
```

---

cor.boot.ci

*Confidence interval for a correlation based on a bootstrap.*

---

## Description

Returns a bootstrap confidence interval for any of the correlations available in the base R cor function.

## Usage

```
cor.boot.ci(x, y, method = "spearman", conf = 0.95, nbs = 3000)
```

## Arguments

x	n by 1 vector
y	n by 1 vector
method	Which correlation to use. Argument passed to cor.
conf	Confidence level.
nbs	number of bootstrap samples to base CI on.

## Details

Obtains a percentile bootstrap confidence interval. The bootstrap samples are obtained via the function boot.

## Value

A confidence interval.

## Author(s)

John Kloke, Joseph McKean

## See Also

See Also as [cor](#)

**Examples**

```
library(boot)
with(bb2010, cor.boot.ci(ave, hr))
```

---

energy

*Energy as a Function of temperature difference.*

---

**Description**

A regression example with response energy output in watts and the predictor temperature difference in degrees Kelvin; see Devore (2012) and Exercise 4.9.11 of Kloeke and McKean (2014)/Exercise 4.7.8 of Kloeke and McKean (2024).

**Usage**

```
data(energy)
```

**Format**

Twenty-four observations on two variables.

output Energy output in watts

temp.diff Temperature difference in K

**Source**

Devore, J. (2012), *Probability and statistics for engineering and the sciences, 8th ed.*, Boston: Brooks/Cole.

**References**

Kloeke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloeke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
rfit(output ~ temp.diff, data=energy)
```

---

`firstbase`*Rounding First Base.*

---

**Description**

The amount of time it took 22 baseball players to round first base for each of three methods of rounding.

**Usage**

```
data(firstbase)
```

**Format**

A data frame with 22 observations on the following 3 variables.

`round.out` Time when using round out method.

`narrow.angle` Time when using narrow angle method.

`wide.angle` Time when using wide angle method.

**Details**

Rounding methods are illustrated in Figure 7.1 of Hollander and Wolfe (1999).

**Source**

Hollander, M. and Wolfe, D.A. (1999), *Nonparametric Statistical Methods*, New York: Wiley.

**References**

Hollander, M. and Wolfe, D.A. (1999), *Nonparametric Statistical Methods*, New York: Wiley.

---

`fk.test`*Two-sample Fligner-Killeen test for homogeneous scales.*

---

**Description**

Returns the Fligner-Killeen test for homogeneous scales for two-samples. Also estimates of ratio of scales based on the logs of folded median-aligned samples and a corresponding confidence interval is computed. `fk.test` computes the value of the statistic based on squared-normal scores following the optimal (for normal errors) such test described in Section 2.10 of Hettmansperger and McKean (2011). Hence, it will differ from the core R routine `fligner.test`; see the discussion in Section 3.3 of Kloké and McKean (2014)/Section 3.5 of Kloké and McKean (2024).

**Usage**

```
fk.test(x,y,alternative = c("two.sided", "less", "greater"),conf.level = 0.95)
```

**Arguments**

x	vector of first sample responses
y	vector of second sample responses
alternative	alternative indicator for hypotheses
conf.level	confidence coefficient for the returned confidence intervals

**Details**

Returns the Fligner-Kileen test for the two-sample scale problem.

**Value**

statistic	chi-squared test statistic
p.value	p-value of the test
estimate	vector of estimates of ratio of scales
conf.int	table of confidence intervals

**Author(s)**

John Kloke, Joseph McKean

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.

**See Also**

fk.test

**Examples**

```
x<-rnorm(18)
y<-rnorm(22)*3
fk.test(x,y)
```

---

fkk.test	<i>k-Sample version of the Fligner-Kileen test for homogeneous scales.</i>
----------	--

---

**Description**

Returns the Fligner-Kileen test for homogeneous scales for k-samples. Also estimates of ratio of scales based on the logs of folded median-aligned samples and a corresponding confidence interval is computed. The first level (sample) is referenced. See the discussion in Section 5.7 of Kloke and McKean (2014)/Section 5.8 of Kloke and McKean (2024).

**Usage**

```
fkk.test(y, ind, conf.level = 0.95)
```

**Arguments**

y	vector of responses
ind	vector of corresponding levels
conf.level	confidence coefficient for the returned confidence intervals

**Details**

Returns the Fligner-Kileen test for the k-sample scale problem.

**Value**

statistic	chi-squared test statistic
p.value	p-value of the test
estimate	vector of estimates of ratio of scales
conf.int	table of confidence intervals
cwts	vector of weights based on the estimates difference in scales

**Author(s)**

John Kloke, Joseph McKean

**References**

Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**See Also**

fk.test

**Examples**

```

y1 <- rnorm(10)
y2 <- rnorm(12)*3
y3 <- rnorm(15)*5
y<-c(y1,y2,y3)
ind<-rep(1:3,times=c(10,12,15))
fkk.test(y,ind)

```

fp.test

*Placement Test for the Behrens-Fisher problem.***Description**

Returns the test based on placements for the Behrens-Fisher problem. This test was developed by Fligner and Policello (1981); see, also, Section 2.11 of Hettmansperger and McKean (2011) and Section 4.4 of Hollander and Wolfe (1999). The version computed by fp.test is discussed in Section 3.4 of Kloke and McKean (2014)/Section 3.6 of Kloke and McKean (2024).

**Usage**

```
fp.test(x,y,delta0=0,alternative = "two.sided")
```

**Arguments**

x	vector of first sample responses
y	vector of second sample responses
delta0	null value tested
alternative	alternative indicator for hypotheses

**Details**

Returns the Placement Test for the Behrens-Fisher problem.

**Value**

statistic	chi-squared test statistic
p.value	p-value of the test
numerator	numerator of test statistic
denominator	denominator of test statistic

**Author(s)**

John Kloke, Joseph McKean

## References

- Fligner, M.-A. and Policello, G.-E. (1981), Robust rank procedures for the Behrens-Fisher problem, *Journal of the American Statistical Association*, 76, 162–168.
- Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.
- Hollander, M. and Wolfe, D.-A. (1999), *Nonparametric statistical methods, 2nd Edition*, New York: John Wiley and Sons.
- Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

---

gehan.test

*Gehan generalization the Wilcoxon two-sample test*

---

## Description

Generalization of the Wilcoxon rank sum which allows for censored data.

## Usage

```
gehan.test(time, event, trt)
```

## Arguments

time	Time of event or of censoring
event	Indicator variable representing an event occur or not (time is censored)
trt	Variable indicating treatment group.

## Value

statistic	Value of the test statistic
p.value	p-value

## Author(s)

John Kloke

## References

- Higgins (2004), *Introduction to Modern Nonparametric Statistics*, Pacific Grove, CA:Brooks/Cole–Thomson Learning

**Examples**

```
n<-76
y<-rexp(n)
event<-rbinom(n,1,0.7) # about 30% censored
trt<-sample(c(0,1),n,replace=TRUE)
gehan.test(y,event,trt)
```

---

getxact

*Design Function for Robust Analysis of Covariance*

---

**Description**

Returns the heterogeneous slopes design matrix used in ANCOVA. It references the first level.

**Usage**

```
getxact(amat,bmat)
```

**Arguments**

amat	cell mean design matrix of factor.
bmat	matrix of covariates.

**Details**

Returns the heterogeneous slopes analysis of covariance matrix.

**Value**

cmat	heterogeneous slopes analysis of covariance matrix
------	--

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

---

`getxact2`*Design Function for Robust Analysis of Covariance*

---

**Description**

Returns the heterogeneous slopes design matrix used in ANCOVA. It references the first level. Also, column names are supplied.

**Usage**

```
getxact2(amat, bmat)
```

**Arguments**

<code>amat</code>	cell mean design matrix of factor.
<code>bmat</code>	matrix of covariates.

**Details**

Returns the heterogeneous slopes analysis of covariance matrix.

**Value**

<code>cmat</code>	heterogeneous slopes analysis of covariance matrix with columns named
-------------------	---

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

---

`hemorrhage`*Hemorrhage data from Dupont.*

---

**Description**

Hemorrhage data from Dupont.

**Usage**

```
data(hemorrhage)
```

**Format**

A data frame with 71 observations on the following 3 variables.

<code>genotype</code>	a numeric vector
<code>time</code>	a numeric vector
<code>recur</code>	a numeric vector

**References**

Dupont

**Examples**

```
data(hemorrhage)
## maybe str(hemorrhage) ; plot(hemorrhage) ...
```

---

hodges\_lehmann.ci      *Hodges-Lehmann type estimation and confidence intervals.*

---

**Description**

Hodges-Lehmann type estimation and confidence intervals.

**Usage**

```
hodges_lehmann.ci(x, y, var.equal = FALSE, conf.level = 0.95, ...)
```

**Arguments**

x	numeric vector.
y	numeric vector.
var.equal	logical. Assume scales are equal (TRUE) of not (FALSE).
conf.level	confidence level to be used for the confidence interval.
...	optional arguments. currently unused.

**Details**

Currently implements 2-sample estimation and confidence intervals based on methods purposed by Hodges and Lehmann.

**Value**

estimate	parameter point estimate
stderr	estimated standard error of point estimate
conf.int	estimated confidence interval

**Author(s)**

John Kloke, Joseph McKean

**References**

Hollander, M. and Wolfe, D.A. (1999), *Nonparametric Statistical Methods*, New York: Wiley.  
Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

**See Also**

[wilcox.test](#)

**Examples**

```
zoo<-c(390,258,298,255,324,240,416,319,225,284)
rh <- c(187,186,179,269,382,264,353 ,38,350,267,229,383,254,302,195, 43,337,390)
hodges_lehmann.ci(zoo,rh)
```

---

hodgkins

*Relapse-Free Survival Times for Hodgkin's Disease Patients*

---

**Description**

These data are described in Example~11.7 of Hollander and Wolfe (1999). Results from a clinical trial in early Hodgkin's disease. Subjects received one of two treatments: radiation of affected node (AN) or total nodal radiation (TN).

**Usage**

```
data("hodgkins")
```

**Format**

A data frame with 49 observations on the following 3 variables.

time Survival time

relapse Indicator variable for relapse

trt treatment: a factor with levels AN TN

**References**

Hollander, M. and Wolfe, D.A. (1999), *Nonparametric Statistical Methods*, New York: Wiley.

---

hogg.test	<i>Hogg's Adaptive Test</i>
-----------	-----------------------------

---

**Description**

Based on selector statistics (Q1 & Q2) one of four score functions is chosen. A rank test and p-value is then calculated based on it.

**Usage**

```
hogg.test(x, y, ...)
```

**Arguments**

x	n by 1 vector
y	m by 1 vector
...	additional arguments. currently not used

**Value**

statistic	Value of the test statistic.
p.value	p-value based on a normal approximation.
scores	Which of the score functions was chosen.

**Author(s)**

John Kloke, Patrick Kimes

**References**

Hogg, R. McKean, J, Craig, A (2013) *Introduction to Mathematical Statistics, 7th Ed.* Boston: Pearson.

**Examples**

```
hogg.test(rt(20,1),rt(22,1)+0.2)
```

---

HoggsQs

*Hogg's Q1 and Q2.*

---

**Description**

Q1 is a measure of skewness and Q2 is a measure of tail heaviness.

**Usage**

Q1(z)

**Arguments**

z                      n by 1 vector

**Details**

Used as selector statistics in adaptive schemes. Both Q1 and Q2 are ratios. For Q1, the numerator is upper 5% mean minus the middle 50% mean, while the denominator is difference between the middle 5% mean and the lower 5% mean. For Q2, the numerator is upper 5% mean minus the lower 5% mean, while the denominator is difference between the upper 50% mean and the lower 50% mean. These statistics are not robust.

**Value**

Returns the calculated ratio as a numeric scalar.

**Author(s)**

John Kloke

**References**

Hogg, R. McKean, J, Craig, A (2013) *Introduction to Mathematical Statistics, 7th Ed.* Boston: Pearson.

**See Also**

[hogg.test](#)

**Description**

A data set presented on Page 496 of huitema (2011). The design is a 2 by 2 with one covariate.

**Usage**

```
data(huitema496)
```

**Format**

A 16 by 4 array with the following 4 columns:

y number of novel responses.

i type of reinforcement (2 levels).

j type of program (2 levels).

x covariate, a measure of verbal fluency.

**Details**

Discussion can be found in both references listed below.

**Source**

Huitema, B.E. (2011), *The analysis of covariance and alternatives, 2nd ed.*, New York: Wiley.

**References**

Huitema, B.E. (2011), *The analysis of covariance and alternatives, 2nd ed.*, New York: Wiley.

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
huitema496 <- data.frame(huitema496)
fit <- rfit(y~factor(i)+factor(j)+x,data=huitema496)
summary(fit)
```

---

insulation	<i>Insulating Fluid Data</i>
------------	------------------------------

---

**Description**

Study the breakdown time of an electrical insulating fluid subject to seven different levels of voltage stress.

**Usage**

```
data("insulation")
```

**Format**

A data frame with 76 observations on the following 2 variables.

log.stress log of voltage stress

log.time log of failure time

**Source**

Nelson, W. (1982), *Applied lifetime data analysis*, New York: John Wiley and Sons.

Lawless, J.F. (1982), *Statistical models and methods for lifetime data*, New York: John Wiley and Sons.

**References**

Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.

**Examples**

```
myscores <- logGFscores  
myscores@param <- c(1,5)  
fit <- rfit(log.time ~ log.stress,scores=myscores,data=insulation)  
summary(fit)  
fit$tauhat
```

---

internal

*Internal Functions*

---

**Description**

Internal functions not intended for general use. Used in calculation of Hogg's Qs.

**Usage**

`lmean(z, p)`

**Arguments**

`z`                    n by 1 vector  
`p`                    scalar

**Value**

Returns the calculated value as a numeric scalar.

**Author(s)**

John Kloke, Joseph McKean

**See Also**

[hogg.test](#), [HoggsQs](#)

---

jonckheere

*Jonckheere's Test for Ordered Alternatives*

---

**Description**

Computes Jonckheere's Test for Ordered Alternatives; see Section 5.6 of Kloke and McKean (2014)/Section 5.7 of Kloke and McKean (2024).

**Usage**

`jonckheere(y, groups)`

**Arguments**

`y`                    vector of responses  
`groups`            vector of associated groups (levels)

**Details**

Computes Jonckheere's Test for Ordered Alternatives. The main source was downloaded from the site:

[smtp.biostat.wustl.edu/sympa/biostat/arc/s-news/2000-10/msg00126.html](mailto:smtp.biostat.wustl.edu/sympa/biostat/arc/s-news/2000-10/msg00126.html)

**Value**

Jonckheere	test statistic
ExpJ	null expectation
VarJ	null variance
p	p-value

**Author(s)**

John Kloke, Joseph McKean

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

[smtp.biostat.wustl.edu/sympa/biostat/arc/s-news/2000-10/msg00126.html](mailto:smtp.biostat.wustl.edu/sympa/biostat/arc/s-news/2000-10/msg00126.html)

**Examples**

```
r<-rnorm(30)
gp<-c(rep(1,10),rep(2,10),rep(3,10))
jonckheere(r,gp)
```

---

kancova

*Robust Analysis of Covariance under Heterogeneous Slopes for a k-way layout*

---

**Description**

Returns a robust rank-based analysis of covariance for a k-way layout assuming heterogenous slopes; see Section 5.4 of Kloke and McKean (2014)/Sections 5.6 and 7.3 of Kloke and McKean (2024). Currently only wilcoxon scores are used.

**Usage**

```
kancova(levs,data,xcov,print.table=TRUE)
```

**Arguments**

levs	vector of levels corresponding to the factors A, B, C, etc.
data	matrix with response in column 1 and level in column 2
xcov	matrix of covariates
print.table	logical indicating a table should be printed

**Details**

Returns the analysis of covariance table assuming heterogenous slopes for a k-way layout.

**Value**

tab2	analysis of covariance
fint	rank-based ful model (heterogenous slopes)
fithomog	rank-based ful model (homogeneous slopes)

**Author(s)**

John Kloke, Joseph McKean

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
levels <- c(2,2)
y.group <- huitema496[,c('y','i','j')]
xcov <- huitema496[, 'x']
kancova(levels,y.group,xcov)
```

---

kancovarown

*routine used in the ANCOVA table obtained by kancova*

---

**Description**

routine used in making the display of the ANCOVA table obtained by kancova.

**Usage**

```
kancovarown(vec)
```

**Arguments**

vec                    vector to be labeled.

**Details**

Returns the labels.

**Value**

nm                    vector of labels

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

---

knn\_cv                    *Train a k nearest neighbors (knn) classifier via cross validation (cv).*

---

**Description**

Train a k nearest neighbors (knn) classifier via cross validation (cv). The number of folds and the set of the number of neighbors to consider may be specified.

**Usage**

```
knn_cv(xy, k.cv = 5, kvec = seq(1, 47, by = 2))
```

**Arguments**

xy                    Data frame with the data matrix x as the first set of columns and the vector y as the last column.

k.cv                  scalar. number of folds to use. default is 5.

kvec                  vector. set of neighbors to consider. default is odd integers between 1 and 47 (inclusive).

**Value**

kvec                  set of neighbors considered

error                  vector of misclassification error rates corresponding to kvec

k.best                  number of neighbors with lowest error rate

k.cv                  number of folds to used

**Author(s)**

John Kloke

## References

Hastie, T., Tibshirani, R., and Friedman, J. (2017), *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, Second Edition, New York: Springer.

James, G., Witten, D., Hastie, T., and Tibshirani, R. (2013), *An Introduction to Statistical Learning with Applications in R*, New York: Springer.

Venables, W. N. and Ripley, B. D. (2002) *Modern Applied Statistics with S*. Fourth edition. Springer.

## See Also

[knn](#)

## Examples

```
train_set <- sim_class2[sim_class2$train==1,-1]
set.seed(19180511)
fit_cv <- knn_cv(train_set,k.cv=10)
fit_cv
```

---

latour

*Chateau Latour Wine Data*

---

## Description

The response variable is the quality of a vintage based on a scale of 1 to 5 over the years 1961 to 2004. The predictor is end of harvest, days between August 31st and the end of harvest for that year, and the factor of interest is whether or not it rained at harvest time.

## Usage

```
data(latour)
```

## Format

A data frame with 44 rows and 4 columns.

year Year of harvest

quality Rating on a scale of 1-5

end.of.harvest Days August 31 and the end of harvest

rain indicator variable for rain

## References

Sheather, SJ (2009), *A Modern Approach to Regression with R*, New York: Springer.

**Examples**

```
data(latour)
plot(quality~end.of.harvest,pch='',data=latour)
points(quality~end.of.harvest,data=latour[latour$rain==0,],pch=3)
points(quality~end.of.harvest,data=latour[latour$rain==1,],pch=4)
```

mood.ci

*Mood Median Confidence Interval***Description**

Mood's classical nonparametric method for calculating a difference in population medians.

**Usage**

```
mood.ci(x, y, var.equal = FALSE, conf.level = 0.95, ...)
```

**Arguments**

x	n x 1 vector
y	m x 1 vector
var.equal	Logical. Assume scale of the two populations are equal.
conf.level	numeric value. confidence level for the confidence interval.
...	not currently implmented

**Value**

A vector of length 2 containing the lower and upper endpoints of the confidence interval.

**Author(s)**

John Kloke, Joseph McKean

**References**

Hollander, M. and Wolfe, D.A. (1999), *Nonparametric Statistical Methods*, New York: Wiley.  
 Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

**See Also**

[hl.ci](#), [wilcox.test](#)

**Examples**

```
x <- rt(101,9)
y <- rt(108,9)+0.3
mood.ci(x,y)
```

---

onecova

*Robust Analysis of Covariance under Heterogeneous Slopes*

---

### Description

Returns tests for homogeneous slopes and also assuming homogeneous slopes a test for differences in level. Currently only wilcoxon scores are used.

### Usage

```
onecova(levs, data, xcov, print.table=TRUE)
```

### Arguments

levs	Number of levels of the one-way design
data	matrix with response in column 1 and level in column 2
xcov	matrix of covariates
print.table	logical indicating a table should be printed

### Details

Returns the analysis of covariance table.

### Value

tab	analysis of covariance
-----	------------------------

### References

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

### Examples

```
data=latour[,c('quality', 'rain')]
xcov<-cbind(latour['end.of.harvest'])
onecova(2,data,xcov,print.table=TRUE)
```

**Description**

Returns a robust rank-based analysis of covariance for a one-way layout assuming heterogenous slopes; see Section 5.4 of Kloke and McKean (2014)/Sections 5.6 and 7.3 of Kloke and McKean (2024). Currently only wilcoxon scores are used.

**Usage**

```
onecovaheter(levs,data,xcov,print.table=TRUE)
```

**Arguments**

levs	Number of levels of the one-way design
data	matrix with response in column 1 and level in column 2
xcov	matrix of covariates
print.table	logical indicating a table should be printed

**Details**

Returns the analysis of covariance table assuming heterogenous slopes.

**Value**

tab	analysis of covariance
fit	rank-based ful model (heterogenous slopes)

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
data=latour[,c('quality','rain')]
xcov<-cbind(latour['end.of.harvest'])
onecovaheter(2,data,xcov,print.table=TRUE)
```

**Description**

Returns a robust rank-based analysis of covariance for a one-way layout assuming homogeneous slopes; see Section 5.4 of Kloke and McKean (2014)/Sections 5.6 and 7.3 of Kloke and McKean (2024). Currently only wilcoxon scores are used.

**Usage**

```
onecovahomog(levs, data, xcov, print.table=TRUE)
```

**Arguments**

levs	Number of levels of the one-way design
data	matrix with response in column 1 and level in column 2
xcov	matrix of covariates
print.table	logical indicating a table should be printed

**Details**

Returns the analysis of covariance table assuming homogeneous slopes.

**Value**

tab	analysis of covariance
fit	rank-based ful model (homogeneous slopes)

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
data=latour[,c('quality', 'rain')]
xcov<-cbind(latour['end.of.harvest'])
onecovahomog(2, data, xcov, print.table=TRUE)
```

---

place

*Placements.*

---

### Description

Returns the placements of the first vector in terms of the second vector used the R function `fp.test`; see Section 2.11 of Hettmansperger and McKean (2011) and Section 4.4 of Hollander and Wolfe (1999). The version computed by `fp.test` is discussed in Section 3.4 of Kloke and McKean (2014)/Section 3.6 of Kloke and McKean (2024).

### Usage

```
place(x,y)
```

### Arguments

x	first vector
y	second vector of second sample responses

### Details

Returns the Placements for the routine `fp.test`.

### Value

ic                    vector of placements.

### Author(s)

John Kloke, Joseph McKean

### References

- Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.
- Hollander, M. and Wolfe, D.~A. (1999), *Nonparametric statistical methods, 2nd Edition*, New York: John Wiley and Sons.
- Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

---

plank	<i>Plank data</i>
-------	-------------------

---

**Description**

Abebe et al. (2001) discuss a dataset resulting from a three-way layout for a neurological experiment in which the time required for a mouse to exit a narrow elevated wooden plank is measured. The response is the log of time (in seconds) to exit. Interest lies in assessing the effects of three factors: the Mouse Strain (Tg+, Tg-), the mouse's Gender (female, male), and the mouse's Age (Aged, Middle, Young). The design is a 2 by 2 by 3 factorial design.

**Usage**

```
data(plank)
```

**Format**

A data frame with 64 observations on the following 4 variables.

response a numeric vector

strain a factor with levels 1 2

gender a factor with levels 1 2

age a factor with levels 1 2 3

**References**

Abebe, A., Crimin, K., McKean, J. W., Vidmar, T. J., and Haas, J. V. (2001) "Rank-Based Procedures for Linear Models: Applications to Pharmaceutical Science Data" *Drug Information Journal*,

**Examples**

```
data(plank)
boxplot(response~strain,data=plank)
raov(response~strain:gender:age,data=plank)
```

---

plot.knn_cv	<i>plot function for knn_cv</i>
-------------	---------------------------------

---

**Description**

plots the misclassification error rate versus number of neighbors based on call to knn\_cv

**Usage**

```
## S3 method for class 'knn_cv'
plot(x, ...)
```

**Arguments**

x                    object of class `knn_cv`.  
...                   additional arguments. currently not used.

**Details**

The list `x` is assumed to have attributes `kvec` and `error` representing the number of neighbors and the corresponding misclassification rate, respectively.

**Value**

No return value, called for side effects of creating plot.

**Author(s)**

John Kloke

**References**

Hastie, T., Tibshirani, R., and Friedman, J. (2017), *The Elements of Statistical Learning: Data Mining, Inference, and Prediction*, Second Edition, New York: Springer.

James, G., Witten, D., Hastie, T., and Tibshirani, R. (2013), *An Introduction to Statistical Learning with Applications in R*, New York: Springer.

Venables, W. N. and Ripley, B. D. (2002) *Modern Applied Statistics with S.* Fourth edition. Springer.

**See Also**

[knn\\_cv](#)

---

poly

*A Simulated Polynomial Data Set.*

---

**Description**

A simulated polynomial (3rd degree) model discussed in Section 4.7.1 of Kloke and McKean (2014)/4.6.1 of Kloke and McKean (2024).

**Usage**

```
data(poly)
```

**Format**

One-hundred observations on two variables.

y response variable

x predictor

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
plot(y ~ x, data=poly)
```

---

polydeg	<i>Degree of Polynomial Determination</i>
---------	---

---

**Description**

Tests for the degree of a polynomial. This test was suggested by Graybill (1976) and is discussed from a robust point-of-view in Section 4.7.1. of Kloke and McKean (2014)/4.6.1 of Kloke and McKean (2024).

**Usage**

```
polydeg(y, x, P, alpha = 0.05)
```

**Arguments**

y	vector of responses
x	Predictor
P	Super degree of polynomial which provides a satisfactory fit
alpha	Level of the testing

**Details**

Returns the degree of the polynomial based on the algorithm.

**Value**

deg	The determined degree
coll	Matrix of step information
fitf	Fit of the polynomial based on the determined degree

**References**

Graybill, F.A. (1976), *Theory and application of the linear model*, North Scituate, Ma: Duxbury Press.

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
x <- 1:20
xc <- x - mean(x)
y<- .2*xc + xc^3 +rt(20,3)*90
plot(y~x)
polydeg(y,xc,6)
```

---

print

*Internal print functions*

---

**Description**

Internal print functions

**Usage**

```
## S3 method for class 'hogg.test'
print(x, digits = max(5, .Options$digits - 2), ...)
## S3 method for class 'rank.test'
print(x,...)
## S3 method for class 'fkk.test'
print(x,...)
## S3 method for class 'knn_cv'
print(x,...)
## S3 method for class 'npsm.ci'
print(x, estimate=FALSE,stderr=FALSE,digits = max(5, .Options$digits - 2),...)
```

**Arguments**

x	Object to be printed.
digits	Number of digits to present. Passed to print function.
...	Additional arguments.
estimate	not currently implemented.
stderr	not currently implemented.

**Value**

No return value, called for side effects

**Author(s)**

John Kloke, Joseph McKean

---

prostate

*DES for treatment of prostate cancer.*

---

### Description

Under investigation in this clinical trial was the pharmaceutical agent diethylstilbestrol DES; subjects were assigned treatment to 1.0 mg DES (treatment = 2) or to placebo (treatment = 1).

### Usage

```
data(prostate)
```

### Format

A data frame with 38 observations on the following 8 variables.

```
patient a numeric vector  
treatment a numeric vector  
time a numeric vector  
status a numeric vector  
age a numeric vector  
shb a numeric vector  
size a numeric vector  
index a numeric vector
```

### Source

<http://www.crcpress.com/product/isbn/9781584883258>

### References

Collett, D. (2003) *Modeling survival data in medical research* CRC press.

### Examples

```
data(prostate)  
boxplot(size~treatment, data=prostate)
```

---

`qhic`*qhic*

---

**Description**

A regression example with response yearly upkeep of a home and the predictor value of home; see Bowerman et al. (2005) and Exercise 4.9.8 of Kloeke and McKean (2014)/Exercise 7.6.2 of Kloeke and McKean (2024).

**Usage**

```
data(qhic)
```

**Format**

Forty observations on two variables.

upkeep annual upkeep expenditure of home (y)

value value of the home (x)

**References**

Bowerman, B.L., O'Connell, R.T., and Koehler, A.B. (2005), *Forecasting, time series, and regression: An applied approach*, Australia: Thomson.

Kloeke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloeke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
plot(upkeep~value,data=qhic,xlab='Value (in $1000s)',ylab='Annual upkeep (in $10s)')
```

---

`quail2`*Quail from a two-factor experiment.*

---

**Description**

Two sample quail data.

**Usage**

```
data(quail2)
```

**Format**

A data frame with 30 observations on the following 2 variables.

treat indicator variable for treatment

ldl ldl measurement

**References**

Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.

McKean J.W., Vidmar, T.J., and Sievers, G.L. (1989), A robust two stage multiple comparison procedure with application to a random drug screen, *Biometrics*, 45, 1281–1297.

**Examples**

```
data(quail2)
boxplot(ldl~treat,data=quail2)
```

---

rank.test

*General scores rank test for two sample problem*

---

**Description**

A generalization of the Wilcoxon rank-sum test where a score function is applied to the ranks. Any scores from Rfit can be used as well as user defined. Default is to perform a Wilcoxon analysis.

**Usage**

```
rank.test(x, y, alternative = "two.sided", scores = Rfit::wscores,
  conf.int = FALSE, conf.level = 0.95)
```

**Arguments**

x	m x 1 vector
y	n x 1 vector
alternative	one of 'two.sided', 'less', or 'greater'
scores	an object of class scores
conf.int	logical indicating if a confidence interval should be estimated
conf.level	desired level of confidence for interval

**Details**

Test is based on  $T = \sum_i a(R(y_i))$  where R is the rank based on the combined sample and  $a(t) = \varphi(t/(N+1))$ . Confidence interval, if requested, is based on call to Rfit.

**Value**

statistic	Standardized value of test statistics
Sphi	Test statistic
p.value	p-value
conf.int	confidence interval for shift in location
estimate	point estimate for shift in location

**Author(s)**

John Kloke, Joseph McKean

**References**

Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.

**See Also**

[wilcox.test](#)

**Examples**

```
rank.test(rt(20,1),rt(22,1)+0.2)
```

---

rcn	<i>random contaminated normal deviates</i>
-----	--

---

**Description**

Generate a random sample from a contaminated normal distribution.

**Usage**

```
rcn(n, eps, sigmac)
rcn_5_5(n)
```

**Arguments**

n	sample size
eps	proportion of proportion of contamination
sigmac	standard deviation of contaminated component

**Details**

With probability  $(1-\text{eps})$  a deviates are drawn from a standard normal distribution. With probability  $\text{eps}$  deviates are drawn from a normal distribution with mean 0 and standard deviation  $\text{sigmac}$ . `rcn_5_5` is a special case where  $\text{eps}=0.05$  and  $\text{sigma}=5$ .

**Value**

n x 1 numeric vector containing the random deviates.

**Author(s)**

John Kloke, Joseph McKean

**References**

Hogg, R. McKean, J, Craig, A (2013) *Introduction to Mathematical Statistics, 7th Ed.* Boston: Pearson.

**See Also**

[rnorm](#)

**Examples**

```
qqnorm(rcn(100, .25, 10))

set.seed(101); rcn(10, 0.05, 5)
set.seed(101); rcn_5_5(10)
```

---

rcnx

*Fat-Finger Error Contaminated Normal Deviates*

---

**Description**

Generate random data from a contaminated normal distribution where the contamination is a multiplicative factor. As, for example, in cases of data recorded in incorrect units or incorrect decimal point.

**Usage**

```
rcnx100(n, eps=0.001, x=100, mu=0, sigma=1, ...)
rcnx(...)
rcnx_01_100(n)
```

**Arguments**

n	sample size to be drawn.
eps	amount (probability) of contaminated observations
x	multiplier for the contaminated observations
mu	mean of uncontaminated samples
sigma	standard deviation of uncontaminated samples
...	optional arguments.

**Details**

Samples are drawn from a random normal distribution with mean  $\mu$  and standard deviations. A fraction of the observations ( $\text{eps}$ ) are multiplied by the factor  $x$ . `rcnx` is an alias for `rcnx100`. `rcnx_01_100` is a special case where the observations are drawn from a standard normal distribution (i.e.,  $\mu=0$  and  $\sigma=1$  — the defaults in `rcnx100`) and  $\text{eps}$  and  $x$  are specified as 0.01 and 100, respectively.

**Value**

Numeric vector of length  $n$  is returned.

**Author(s)**

John Kloke

**References**

[https://en.wikipedia.org/wiki/Fat-finger\\_error](https://en.wikipedia.org/wiki/Fat-finger_error)

**See Also**

[rcn](#)

**Examples**

```
set.seed(101); x1 <- rcnx100(10)
set.seed(101); x2 <- rcnx(10)
set.seed(101); x3 <- rcnx_01_100(10)

qqnorm(rcnx(10000, eps=0.005, x=10))
qqnorm(rcnx(10000, eps=0.05, x=1/100))
```

---

rlaplace

*Random Laplace.*

---

**Description**

Random generation for the Laplace (double exponential) data with location 0 and scale 1.

**Usage**

```
rlaplace(n)
```

**Arguments**

`n` scalar. number of random draws.

**Details**

A Laplace or double exponential distribution has heavier tails than a normal distribution and so a sample will tend to have additional outliers.

**Value**

A vector of length  $n$  is returned containing the random data.

**Author(s)**

John Kloke, Joseph McKean

**References**

Hogg, Robert V.; McKean, Joseph; and Craig, Allen T., "Introduction to Mathematical Statistics (6th Edition)" (2005).

**Examples**

```
x <- rlaplace(100)
qqnorm(x)
```

---

rs

*Simulated Regression Model*

---

**Description**

A simulated regression model with one response and one predictor. It is discussed in Exercise 6.5.6 of Kloke and McKean (2014)/Exercise 8.11.23 of Kloke and McKean (2024).

**Usage**

```
data(rs)
```

**Format**

Fifty observations on two variables.

y simulated response

x simulated predictor

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
rfit(y ~ x, data=rs)
```

---

SCUD

*Cyclone Data*

---

### Description

A data set discussed in Hollander and Wolfe (1999) and Exercise 5.8.9 of Kloeke and McKean (2014)/Exercise 5.9.15 of Kloeke and McKean (2024). It contains part of a study on the effects of cloud seeding of cyclones.

### Usage

```
data(SCUD)
```

### Format

Twenty-one observations on three variables.

trt treatment indicator (1) is Seeded and (2) is control

M predictor M, the geostrophic meridional circulation index

RI measure of precipitation

### References

Hollander, M. and Wolfe, D.A. (1999), *Nonparametric Statistical Methods*, New York: Wiley.

Kloeke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloeke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

### Examples

```
plot(RI ~ M, data=SCUD)
```

---

seinfeld

*Seinfeld — the sitcom — viewership counts by episode*

---

### Description

Counts of viewers for 9 seasons of Seinfeld

### Usage

```
data("seinfeld")
```

**Format**

A data frame with 180 observations on the following 4 variables.

episodeNumberOverall a numeric vector

season a numeric vector

episodeNumberSeason a numeric vector

viewers a numeric vector

**Source**

Wikipedia [https://en.wikipedia.org/wiki/List\\_of\\_Seinfeld\\_episodes](https://en.wikipedia.org/wiki/List_of_Seinfeld_episodes) (date unknown).

**Examples**

```
data(seinfeld)
#Comparison boxplots of views versus season
boxplot(viewers~season,data=seinfeld,ylab='Number of Viewers (in millions)',xlab='Season')

# Normal q-q plots for selected seasons.
oldpar_mfrow <- par()$mfrow
par(mfrow=c(2,2))
seasons2display <- c(4,5,6,9)
for( s in seasons2display) {
  v <- seinfeld[seinfeld$season==s,'viewers']
  qqnorm(v,main=paste("Season",s))
  abline(a=median(v),b=mad(v))
}
par(mfrow=oldpar_mfrow)

# Normal q-q plots for selected seasons
# using centered and scaled residuals.
oldpar_mfrow <- par()$mfrow
par(mfrow=c(2,2))
seasons2display <- c(4,5,6,9)
for( s in seasons2display) {
  v0 <- seinfeld[seinfeld$season==s,'viewers']
  v1 <- (v0 - median(v0))/mad(v0)
  qqnorm(v1,main=paste("Season",s))
  abline(a=0,b=1)
}
par(mfrow=oldpar_mfrow)
```

**Description**

Doksum and Sievers (1976) describe an experiment involving the effect of ozone on weight gain of rats. The experimental group consisted of 22 rats which were placed in an ozone environment for seven days, while the control group contained 21 rats which were placed in an ozone-free environment for the same amount of time. The response was the weight gain in a rat over the time period.

**Usage**

```
data(sievers)
```

**Format**

A data frame with 45 observations on the following 2 variables.

```
group indicator variable for treatment
weight.gain response variable of weight gain
```

**References**

Hettmansperger, T.P. and McKean J.W. (2011), *Robust Nonparametric Statistical Methods, 2nd ed.*, New York: Chapman-Hall.

Doksum, K. A. and Sievers, G. L. (1976), Plotting with confidence: Graphical comparisons of two populations, *Biometrika*, 63, 421-434.

**Examples**

```
data(sievers)
boxplot(weight.gain~group,data=sievers)
```

---

signtest_pvalue	<i>p-value for a one sample sign test</i>
-----------------	---

---

**Description**

p-value for a one sample sign test based on the binomial distribution.

**Usage**

```
signtest_pvalue(x, alternative = "two.sided", theta0 = 0, ...)
```

**Arguments**

x	number vector.
alternative	type of alternative hypothesis
theta0	null value of the parameter
...	optional arguments. currently ignored.

**Details**

Returns p-value using the binomial distribution.

**Value**

a numeric scalar — the p-value — is returned

**Author(s)**

John Kloke, Joseph McKean

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
x <- round(rt(19,9) + 2,1)
signtest_pvalue(x,alternative='greater')
S <- sum(x > 0)
M <- sum(x != 0)
1-pbinom(S-1,M,0.5)
x <- round(rt(19,9) + 0,1)
signtest_pvalue(x)
S <- sum(x > 0)
M <- sum(x != 0)
2*min(pbinom(S,M,0.5), 1-pbinom(S-1,M,0.5))
```

---

simon

*Simon (the memory game) dataset*

---

**Description**

An experiment in which the members of two groups of students each played the game Simon twice.

**Usage**

```
data("simon")
```

**Format**

A data frame with 31 observations on the following 3 variables.

game1 score on first trial  
game2 score on second trial  
class group variable

**Details**

Demonstrates the concept of regression toward the mean. Simulated data to represent a realistic realization of the experiment. See Problem 4.9.20 of Kloeke and McKean (2014)/Problem 4.7.17 of Kloeke and McKean (2024).

**References**

Kloeke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloeke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
data(simon)
plot(game2~game1,data=simon)
rfit(game2~game1,data=simon)
```

---

sim_class2	<i>A simulated classification example with two variables and two classes (labels).</i>
------------	--

---

**Description**

A simulated classification example with two variables and two classes (labels).

**Usage**

```
data("sim_class2")
```

**Format**

A data frame with 1000 observations on the following 4 variables.

train an indicator for training and test sets

x1 an explanatory variable

x2 an explanatory variable

y response variable - a factor with levels 0 1

**Details**

Random points in the x1,x2 plane were generated. Class labels based on location relative to two circles in the x1,x2 plane with some random variation in the labels simulated.

**Examples**

```
data(sim_class2)
dim(sim_class2)

train_set <- sim_class2[sim_class2$train==1,]
dim(train_set)

with(train_set,plot(x1,x2,main='Training Set',cex=0.625))
with(train_set,points(x1,x2,main='Training Set',pch=20,col=y,cex=0.625))
```

---

sincos

*Sine Cosine Model*

---

**Description**

Simulated dataset

**Usage**

```
data("sincos")
```

**Format**

A data frame with 197 observations on the following 2 variables.

x independent variable

y dependent variable

**Details**

The data were generated using  $x \leftarrow \text{seq}(1, 50, \text{by}=.25)$  ;  $y \leftarrow 5*\sin(3*x) + 6*\cos(x/4)+\text{rnorm}(\text{length}(x), 0, 10)$

**References**

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

**Examples**

```
data(sincos)
plot(y~x,sincos)

### code to create Figure 4.9 of Kloke & McKean 2014 ###
my.sincos<-sincos
my.sincos$y3<-my.sincos$y
my.sincos$y3[137] <- 800
```

```
plot(y3~x,ylim=c(-50,50),data=my.sincos)
fit4 <- loess(y3 ~ x,data=my.sincos)
# lines(fit4$x,fit4$fitted,lty=2)
with(fit4,lines(x,fitted,lty=2))
fit5 <- loess(y3 ~ x,family="symmetric",data=my.sincos)
with(fit5,lines(x,fitted,lty=1))
legend('bottomleft',legend=c('Local Robust Fit','Local LS Fit'),lty=1:2)
title("loess Fits of Sine-Cosine Data")
```

---

speed

*Predict top speed based on miles per gallon*

---

### Description

A sample of 82 cars with variables speed and miles per gallon collected.

### Usage

```
data("speed")
```

### Format

A data frame with 82 observations on the following 2 variables.

mpg Miles per gallon

sp a numeric vector

### Source

Higgins (2003) Introduction to modern nonparametric statistics.

### References

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall.

### Examples

```
data(speed)
plot(sp~mpg,data=speed)
rfit(sp~mpg+I(mpg^2),data=speed)
```

turtle

*Turtle Data*

---

**Description**

A data frame containing measurements of 48 turtles. The first three columns are the Length, Width, and Height measurements of the carapace of the turtle. The fourth column is a categorical variable sex with values of female and male. Data are drawn from Johnson and Wichern (2007).

**Usage**

```
data(turtle)
```

**Format**

48 observations on four variables.

**Length** numeric vector.

**Width** numeric vector.

**Height** numeric vector.

**sex** character vector.

**References**

Johnson, R.A. and Wichern, D.W. (2007), *Applied Multivariate Statistical Analysis, 6th ed.*, Upper Saddle River, NJ: Pearson.

**Examples**

```
with(turtle, boxplot(Length~sex))
with(turtle, boxplot(Length~sex, ylab='Length (units)'))
```

---

vanElteren.test*vanElteren test for stratified analysis*

---

**Description**

Performs the vanElteren extension of the Wilcoxon rank sum test for stratified experiments.

**Usage**

```
vanElteren.test(g, y, b)
```

**Arguments**

<code>g</code>	<code>n x 1</code> vector: treatment/group indicator
<code>y</code>	<code>n x 1</code> vector: responses
<code>b</code>	<code>n x 1</code> vector: denotes strata

**Value**

<code>statistic</code>	Value of the test statistic.
<code>p.value</code>	p-value based on a normal approximation.

---

<code>weather</code>	<i>January Weather Data for Kalamazoo</i>
----------------------	---

---

**Description**

January weather data for Kalamazoo, MI for the years 1900 to 1995. It is discussed in Example 4.7.4, page 105-106, of Kloke and McKean (2014)/Example 4.6.4, p.177-178, of Kloke and McKean (2024).

**Usage**

```
data(weather)
```

**Format**

Ninety-six observations (1900-1995) for twelve weather variables.

```
avemax avemax
avemin avemin
coldestmax coldestmax
hihest hihest
lowest lowest
maxdayprec maxdayprec
maxdaysnowfall maxdaysnowfall
meantmp meantmp
totalprec totalprec
totalsnow totalsnow
warmest warmest
year year
```

**Source**

<http://weather-warehouse.com/WeatherHistory/>

## References

Kloke, J. and McKean, J.W. (2014), *Nonparametric statistical methods using R*, Boca Raton, FL: Chapman-Hall. Kloke, J. and McKean, J.W. (2024), *Nonparametric statistical methods using R, Second Edition*, Boca Raton, FL: Chapman-Hall.

## Examples

```
plot(avemax ~ year, data=weather)
```

---

wilson.ci

*Wilson (score) confidence interval for a population proportion.*

---

## Description

Wilson (score) confidence interval for a population proportion.

## Usage

```
wilson.ci(x, n, conf.level = 0.95)
```

## Arguments

x	number of events
n	number of samples
conf.level	confidence level

## Details

Uses definition in Agresti.

## Value

conf.int	estimated confidence interval
----------	-------------------------------

## Author(s)

John Kloke, Joseph McKean

## References

Agresti (2002), *Categorical data analysis*, New York: John Wiley & Sons, Inc.

## See Also

[prop.test](#)

**Examples**

```
n <- 100  
x <- rbinom(1,n,0.33)  
wilson.ci(n,x)
```

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