Package ‘moments’

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Title Moments, cumulants, skewness, kurtosis and related tests
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Author Lukasz Komsta <lukasz.komsta@umlub.pl>, Frederick Novomestky <fnovomes@poly.edu>
Maintainer Lukasz Komsta <lukasz.komsta@umlub.pl>
Description Functions to calculate: moments, Pearson's kurtosis, Geary's kurtosis and skewness; tests related to them (Anscombe-Glynn, D'Agostino, Bonett-Seier).
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Description

Performs D’Agostino test for skewness in normally distributed data.

Usage

agostino.test(x, alternative = c("two.sided", "less", "greater"))

Arguments

x  a numeric vector of data values.
alternative  a character string specifying the alternative hypothesis, must be one of "two.sided" (default), "greater" or "less". You can specify just the initial letter.

Details

Under the hypothesis of normality, data should be symmetrical (i.e. skewness should be equal to zero). This test has such null hypothesis and is useful to detect a significant skewness in normally distributed data.

Value

A list with class htest containing the following components:

statistic  the list containing skewness estimator and its transformation.
p.value  the p-value for the test.
alternative  a character string describing the alternative hypothesis.
method  a character string indicating what type of test was performed.
data.name  name of the data argument.

Author(s)

Lukasz Komsta

References


See Also

skewness
Examples

```r
set.seed(1234)
x = rnorm(1000)
skewness(x)
agostino.test(x)
```

---

**all.cumulants**  
*Statistical Cumulants*

**Description**

This function calculates the cumulants for all orders specified in the given vector, matrix or data frame of raw moments.

**Usage**

```r
all.cumulants(mu.raw)
```

**Arguments**

- `mu.raw` A numeric vector, matrix or data frame of raw moments. For a vector, `mu.raw[0]` is the order 0 raw moment, `mu.raw[1]` is the order 1 raw moment and so forth. For a matrix or data frame, row vector `mu.raw[0,]` contains the order 0 raw moments, row vector `mu.raw[1,]` contains the order 1 raw moments and so forth.

**Details**

No details are currently described.

**Value**

A vector matrix or data frame of cumulants. For matrices and data frame, column vectors correspond to different random variables.

**Author(s)**

Frederick Novomestky <fnovomes@poly.edu>

**References**


**See Also**

`moment`, `all.moments`
Examples

```r
set.seed(1234)
x <- rnorm(10000)
mu.raw.x <- all.moments( x, order.max=6 )
all.cumulants( mu.raw.x )
M <- matrix( x, nrow=1000, ncol=10 )
mu.raw.M <- all.moments( M, order.max=6 )
all.cumulants( mu.raw.M )
D <- data.frame( M )
mu.raw.D <- all.moments( D, order.max=6 )
all.cumulants( mu.raw.D )
```

### all.moments

#### Statistical Moments

**Description**

This function computes all the sample moments of the chosen type up to a given order.

**Usage**

```r
all.moments(x, order.max = 2, central = FALSE, absolute = FALSE, na.rm = FALSE)
```

**Arguments**

- `x`: A numeric vector, matrix or data frame of data. For matrices and data frames, each column is a random variable
- `order.max`: the maximum order of the moments to be computed with a default value of 2.
- `central`: a logical value, if TRUE, central moments are computed. Otherwise, raw moments are computed
- `absolute`: a logical value, if TRUE, absolute moments are computed. Otherwise, standard moments are computed
- `na.rm`: a logical value, if TRUE, remove NA values. Otherwise, keep NA values

**Details**

The minimum value for `order.max` is 2. The function stops running for values less than 2 and the message "maximum order whould be at least 2" is displayed on standard output.

**Value**

A vector, matrix or data frame of moments depending on the nature of the argument `x`. If `x` is a vector, then the value returned is a vector, say `mu`, where `mu[1]` is the order 0 moment, `mu[2]` is the order 1 moment and so forth. If `x` is a matrix or data frame, then the value returned is a matrix or data frame, respectively. In this case, suppose `mu` is the value returned. Then, row vector `mu[1,]` contains the order 0 moments, `mu[2,]` contains the order 1 moments and so forth.
Author(s)
Frederick Novomestky <fnovomes@poly.edu>

References

See Also
\texttt{moment, raw2central}

Examples
\begin{verbatim}
set.seed(1234)
x <- rnorm(10000)
all.moments( x, order.max=4 )
all.moments( x, central=TRUE, order.max=4 )
all.moments( x, absolute=TRUE, order.max=4 )
all.moments( x, central=TRUE, absolute=TRUE, order.max=4 )
M <- matrix( x, nrow=1000, ncol=10 )
all.moments( M, order.max=4 )
all.moments( M, central=TRUE, order.max=4 )
all.moments( M, absolute=TRUE, order.max=4 )
all.moments( M, central=TRUE, absolute=TRUE, order.max=4 )
D <- data.frame( M )
all.moments( D, order.max=4 )
all.moments( D, central=TRUE, order.max=4 )
all.moments( D, absolute=TRUE, order.max=4 )
all.moments( D, central=TRUE, absolute=TRUE, order.max=4 )
\end{verbatim}

\begin{verbatim}
anscombe.test
\end{verbatim}
\begin{verbatim}
Anscombe-Glynn test of kurtosis
\end{verbatim}

Description
Performs Anscombe-Glynn test of kurtosis for normal samples

Usage
\begin{verbatim}
anscombe.test(x, alternative = c("two.sided", "less", "greater"))
\end{verbatim}

Arguments
\begin{verbatim}
x
alternative
\end{verbatim}
a numeric vector of data values.
a character string specifying the alternative hypothesis, must be one of "two.sided" (default), "greater" or "less". You can specify just the initial letter.
Details
Under the hypothesis of normality, data should have kurtosis equal to 3. This test has such null hypothesis and is useful to detect a significant difference of kurtosis in normally distributed data.

Value
A list with class htest containing the following components:

- statistic: the list containing kurtosis estimator and its transformation.
- p.value: the p-value for the test.
- alternative: a character string describing the alternative hypothesis.
- method: a character string indicating what type of test was performed.
- data.name: name of the data argument.

Author(s)
Lukasz Komsta

References

See Also
kurtosis

Examples
set.seed(1234)
x = rnorm(1000)
kurtosis(x)
anscombe.test(x)

---

bonett.test  Bonett-Seier test of Geary’s kurtosis

Description
This function performs Bonett-Seier test of Geary’s measure of kurtosis for normally distributed data.

Usage
bonett.test(x, alternative = c("two.sided", "less", "greater"))
Arguments

- `x` a numeric vector of data values.
- `alternative` a character string specifying the alternative hypothesis, must be one of "two.sided" (default), "greater" or "less". You can specify just the initial letter.

Details

Under the hypothesis of normality, data should have Geary's kurtosis equal to \( \sqrt{R/\pi} \) (0.7979). This test has such null hypothesis and is useful to detect a significant difference of Geary's kurtosis in normally distributed data.

Value

A list with class `htest` containing the following components:

- `statistic` the list containing Geary's kurtosis estimator and its transformation.
- `p.value` the p-value for the test.
- `alternative` a character string describing the alternative hypothesis.
- `method` a character string indicating what type of test was performed.
- `data.name` name of the data argument.

Author(s)

Lukasz Komsta

References


See Also

- `geary`

Examples

```r
set.seed(1234)
x = rnorm(1000)
geary(x)
bonett.test(x)
```
central2raw

Central to raw moments

Description

This function transforms a vector, matrix or data frame of central moments to a vector, matrix or data frame of raw moments.

Usage

central2raw(mu.central, eta)

Arguments

mu.central A numeric vector, matrix or data frame of central moments. For a vector, mu.central[0] is the order 0 central moment, mu.central[1] is the order 1 central moment and so forth. For a matrix or data frame, row vector mu.central[0,] contains the order 0 central moments, row vector mu.central[1,] contains the order 1 central moments and so forth.

eta A numeric vector of sample mean or expected values

Value

A vector matrix or data frame of raw moments. For matrices and data frame, column vectors correspond to different random variables.

Author(s)

Frederick Novomestky <fnovomes@poly.edu>

References


See Also

moment, all.moments, raw2central

Examples

set.seed(1234)
x <- rnorm(10000)
mu.raw.x <- all.moments(x, order.max=4)
eta.x <- mu.raw.x[2]
mu.central.x <- all.moments(x, central=TRUE, order.max=4)
central2raw(mu.central.x, eta.x)
mu.raw.x
M <- matrix(x, nrow=1000, ncol=10)
mu.raw.M <- all.moments(M, order.max=4)
eta.M <- mu.raw.M[2,]
mu.central.M <- all.moments(M, central=TRUE, order.max=4)
central2raw(mu.central.M, eta.M)
mu.raw.M

D <- data.frame(M)
mu.raw.D <- all.moments(D, order.max=4)
eta.D <- mu.raw.D[2,]
mu.central.D <- all.moments(D, central=TRUE, order.max=4)
central2raw(mu.central.D, eta.D)
mu.raw.D

geary                Geary's measure of kurtosis

Description
This function computes an estimator of Geary’s measure of kurtosis.

Usage
geary(x, na.rm = FALSE)

Arguments
  x           a numeric vector, matrix or data frame.
  na.rm       logical. Should missing values be removed?

Details
The Geary’s kurtosis is computed by dividing average difference between observation and the mean
by standard deviation of the sample.

Author(s)
Lukasz Komsta

References
Geary, R.C. (1936). Moments of the ratio of the mean deviation to the standard deviation for normal

See Also
kurtosis, bonett.test
Examples

```r
set.seed(1234)
geary(rnorm(1000))
```

---

**jarque.test**  
*Jarque-Bera test for normality*

**Description**

This function performs the Jarque-Bera test on the given data sample to determine if the data are sample drawn from a normal population.

**Usage**

```r
jarque.test(x)
```

**Arguments**

- `x` a numeric vector of data

**Details**

Under the hypothesis of normality, data should be symmetrical (i.e. skewness should be equal to zero) and have skewness close to three. The Jarque-Bera statistic is chi-square distributed with two degrees of freedom.

**Value**

A list with class htest containing the following components:

- `statistic` the list containing the Jarque-Bera statistic
- `p.value` the p-value for the test.
- `alternative` a character string describing the alternative hypothesis.
- `method` a character string indicating what type of test was performed.
- `data.name` name of the data argument.

**Author(s)**

Frederick Novomestky <fnovomes@poly.edu>

**References**

**kurtosis**

**Examples**

```r
set.seed(1234)
x <- rnorm(1000)
jarque.test(x)
```

<table>
<thead>
<tr>
<th>kurtosis</th>
<th>Pearson’s measure of kurtosis</th>
</tr>
</thead>
</table>

**Description**

This function computes the estimator of Pearson’s measure of kurtosis.

**Usage**

```r
kurtosis(x, na.rm = FALSE)
```

**Arguments**

- `x`: a numeric vector, matrix or data frame.
- `na.rm`: logical. Should missing values be removed?

**Author(s)**

Lukasz Komsta

**See Also**

- `geary`, `anscombe.test`

**Examples**

```r
set.seed(1234)
kurtosis(rnorm(1000))
```

<table>
<thead>
<tr>
<th>moment</th>
<th>Statistical Moments</th>
</tr>
</thead>
</table>

**Description**

This function computes the sample moment of specified order.

**Usage**

```r
moment(x, order = 1, central = FALSE, absolute = FALSE, na.rm = FALSE)
```
Arguments

x               a numeric vector of data.
order          order of the moment to be computed
central        a logical value - if central moments are to be computed.
absolute       a logical value - if absolute moments are to be computed.
norm           a logical value - remove NA values?

Author(s)

Lukasz Komsta

Examples

set.seed(1234)
x <- rnorm(10)
moment(x)
moment(x,order=3,absolute=TRUE)

raw2central          Raw to central moments

Description

This function transforms a vector, matrix or data frame of raw moments to a vector, matrix or data frame of central moments.

Usage

raw2central(mu.raw)

Arguments

mu.raw          A numeric vector, matrix or data frame of raw moments. For a vector, mu.raw[0] is the order 0 raw moment, mu.raw[1] is the order 1 raw moment and so forth. For a matrix or data frame, row vector mu.raw[0,] contains the order 0 raw moments, row vector mu.raw[1,] contains the order 1 raw moments and so forth.

Value

A vector matrix or data frame of central moments. For matrices and data frame, column vectors correspond to different random variables.

Author(s)

Frederick Novomestky <fnovomes@poly.edu>
skewness

References


See Also

moment, all.moments, central2raw

Examples

```r
set.seed(1234)
x <- rnorm(10000)
mu.raw.x <- all.moments(x, order.max=4)
mu.central.x <- all.moments(x, central=TRUE, order.max=4)
raw2central(mu.raw.x)
mu.central.x
M <- matrix(x, nrow=1000, ncol=10)
mu.raw.M <- all.moments(M, order.max=4)
mu.central.M <- all.moments(M, central=TRUE, order.max=4)
raw2central(mu.raw.M)
mu.central.M
D <- data.frame(M)
mu.raw.D <- all.moments(D, order.max=4)
mu.central.D <- all.moments(D, central=TRUE, order.max=4)
raw2central(mu.raw.D)
mu.central.D
```

---

**skewness**

*Skewness of the sample*

**Description**

This function computes skewness of given data.

**Usage**

```r
skewness(x, na.rm = FALSE)
```

**Arguments**

- `x` a numeric vector, matrix or data frame.
- `na.rm` logical. Should missing values be removed?

**Author(s)**

Lukasz Komsta
See Also

agostino.test

Examples

set.seed(1234)
skewness(rnorm(1000))
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