Package ‘normtest’

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Title Tests for Normality

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Description Tests for the composite hypothesis of normality

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`ajb.norm.test` *Adjusted Jarque–Bera test for normality*

Description

Performs adjusted Jarque–Bera test for the composite hypothesis of normality, see Urzua (1996).

Usage

```
ajb.norm.test(x, nrepl=2000)
```

Arguments

`x`	a numeric vector of data values.
`nrepl`	the number of replications in Monte Carlo simulation.

Details

The adjusted Jarque–Bera test for normality is based on the following statistic:

$$AJB = \frac{(\sqrt{b_1})^2}{\mathrm{Var}\left(\sqrt{b_1}\right)} + \frac{(b_2 - \mathrm{E}\,(b_2))^2}{\mathrm{Var}\,(b_2)},$$

where

$$\sqrt{b_1} = \frac{\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^3}{\left(\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2\right)^{3/2}}, \quad b_2 = \frac{\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^4}{\left(\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2\right)^2},$$

$$\mathrm{Var}\left(\sqrt{b_1}\right) = \frac{6(n-2)}{(n+1)(n+3)}, \quad E\,(b_2) = \frac{3(n-1)}{n+1}, \quad \mathrm{Var}\,(b_2) = \frac{24n(n-2)(n-3)}{(n+1)^2(n+3)(n+5)}.$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the adjusted Jarque–Bera statistic.
`p.value`	the p-value for the test.
`method`	the character string "Adjusted Jarque-Bera test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Urzua, C. M. (1996): On the correct use of omnibus tests for normality. — Economics Letters, vol. 53, pp. 247–251.

Examples

```
ajb.norm.test(rnorm(100))
ajb.norm.test(abs(runif(100,-2,5)))
```

`frosini.norm.test` *Frosini test for normality*

Description

Performs Frosini test for the composite hypothesis of normality, see e.g. Frosini (1987).

Usage

```
frosini.norm.test(x, nrepl=2000)
```

Arguments

`x`	a numeric vector of data values.
`nrepl`	the number of replications in Monte Carlo simulation.

Details

The Frosini test for normality is based on the following statistic:

$$B_n = \frac{1}{\sqrt{n}} \sum_{i=1}^{n} \left| \Phi(Y_i) - \frac{i - 0.5}{n} \right|,$$

where

$$Y_i = \frac{X_{(i)} - \overline{X}}{s}, \quad s^2 = \frac{1}{n} \sum_{i=1}^{n} (X_i - \overline{X})^2.$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the Frosini statistic.
`p.value`	the p-value for the test.
`method`	the character string "Frosini test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Frosini, B.V. (1987): On the distribution and power of a goodness-of-fit statistic with parametric and nonparametric applications, "Goodness-of-fit". (Ed. by Revesz P., Sarkadi K., Sen P.K.) — Amsterdam-Oxford-New York: North-Holland. — Pp. 133–154.

Examples

```
frosini.norm.test(rnorm(100))
frosini.norm.test(runif(100,-1,1))
```

`geary.norm.test` *Geary test for normality*

Description

Performs Geary test for the composite hypothesis of normality, see Geary (1935).

Usage

```
geary.norm.test(x, nrepl=2000)
```

Arguments

`x`	a numeric vector of data values.
`nrepl`	the number of replications in Monte Carlo simulation.

Details

The Geary test for normality is based on the following statistic:

$$d = \frac{1}{ns}\sum_{i=1}^{n}|X_i - \overline{X}|,$$

where

$$s^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2.$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the Geary statistic.
`p.value`	the p-value for the test.
`method`	the character string "Geary test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Geary, R. C. (1935): The ratio of the mean deviation to the standard deviation as a test of normality. — Biometrika, vol. 27, pp. 310–332.

Examples

```
geary.norm.test(rnorm(100))
geary.norm.test(runif(100,-1,1))
```

---

hegazy1.norm.test *Hegazy–Green test for normality*

Description

Performs Hegazy–Green test for the composite hypothesis of normality, see e.g. Hegazy and Green (1975).

Usage

```
hegazy1.norm.test(x, nrepl=2000)
```

Arguments

x	a numeric vector of data values.
nrepl	the number of replications in Monte Carlo simulation.

Details

The Hegazy–Green test for normality is based on the following statistic:

$$T_1 = \frac{1}{n}\sum_{i=1}^{n}\left|Y_i - \Phi^{-1}\left(\frac{i}{n+1}\right)\right|,$$

where

$$Y_i = \frac{X_{(i)} - \overline{X}}{s}, \quad s^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2.$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the Hegazy–Green statistic.
`p.value`	the p-value for the test.
`method`	the character string "Hegazy-Green test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Hegazy, Y. A. S. and Green, J. R. (1975): Some new goodness-of-fit tests using order statistics. — Journal of the Royal Statistical Society. Series C (Applied Statistics), vol. 24, pp. 299–308.

Examples

```
hegazy1.norm.test(rnorm(100))
hegazy1.norm.test(runif(100,-1,1))
```

`hegazy2.norm.test` *Hegazy–Green test for normality*

Description

Performs Hegazy–Green test for the composite hypothesis of normality, see e.g. Hegazy and Green (1975).

Usage

```
hegazy2.norm.test(x, nrepl=2000)
```

Arguments

`x`	a numeric vector of data values.
`nrepl`	the number of replications in Monte Carlo simulation.

Details

The Hegazy–Green test for normality is based on the following statistic:

$$T_2 = \frac{1}{n}\sum_{i=1}^{n}\left(Y_i - \Phi^{-1}\left(\frac{i}{n+1}\right)\right)^2.$$

where

$$Y_i = \frac{X_{(i)} - \overline{X}}{s}, \quad s^2 = \frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2.$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the Hegazy–Green statistic.
`p.value`	the p-value for the test.
`method`	the character string "Hegazy-Green test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Gavrilov Ilya and Ruslan Pusev

References

Hegazy, Y. A. S. and Green, J. R. (1975): Some new goodness-of-fit tests using order statistics. — Journal of the Royal Statistical Society. Series C (Applied Statistics), vol. 24, pp. 299–308.

Examples

```
hegazy2.norm.test(rnorm(100))
hegazy2.norm.test(runif(100,-1,1))
```

`jb.norm.test` *Jarque–Bera test for normality*

Description

Performs Jarque–Bera test for the composite hypothesis of normality, see Jarque and Bera (1987).

Usage

```
jb.norm.test(x, nrepl=2000)
```

Arguments

`x`	a numeric vector of data values.
`nrepl`	the number of replications in Monte Carlo simulation.

Details

The Jarque–Bera test for normality is based on the following statistic:

$$JB = \frac{n}{6}\left((\sqrt{b_1})^2 + \frac{(b_2-3)^2}{4}\right),$$

where

$$b_1 = \frac{\frac{1}{n}\sum_{i=1}^{n}(X_i-\overline{X})^3}{\frac{1}{n}(\sum_{i=1}^{n}(X_i-\overline{X})^2)^{3/2}},$$

$$b_2 = \frac{\frac{1}{n}\sum_{i=1}^{n}(X_i-\overline{X})^4}{\frac{1}{n}(\sum_{i=1}^{n}(X_i-\overline{X})^2)^{2}}.$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the Jarque–Bera statistic.
`p.value`	the p-value for the test.
`method`	the character string "Jarque-Bera test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Jarque, C. M. and Bera, A. K. (1987): A test for normality of observations and regression residuals. — International Statistical Review, vol. 55, pp. 163–172.

Examples

```
jb.norm.test(rnorm(100))
jb.norm.test(abs(runif(100,-2,5)))
```

`kurtosis.norm.test` *Kurtosis test for normality*

Description

Performs kurtosis test for the composite hypothesis of normality, see, e.g., Shapiro, Wilk and Chen (1968).

Usage

```
kurtosis.norm.test(x, nrepl=2000)
```

Arguments

`x`	a numeric vector of data values.
`nrepl`	the number of replications in Monte Carlo simulation.

Details

The kurtosis test for normality is based on the following statistic:

$$b_2 = \frac{\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^4}{\left(\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2\right)^2},$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the test statistic.
`p.value`	the p-value for the test.
`method`	the character string "Kurtosis test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Shapiro, S. S., Wilk, M. B. and Chen, H. J. (1968): A comparative study of various tests for normality. — Journal of the American Statistical Association, vol. 63, pp. 1343–1372.

Examples

```
kurtosis.norm.test(rnorm(100))
kurtosis.norm.test(runif(100,-1,1))
```

skewness.norm.test *Skewness test for normality*

Description

Performs skewness test for the composite hypothesis of normality, see, e.g., Shapiro, Wilk and Chen (1968).

Usage

```
skewness.norm.test(x, nrepl=2000)
```

Arguments

x	a numeric vector of data values.
nrepl	the number of replications in Monte Carlo simulation.

Details

The skewness test for normality is based on the sample skewness:

$$\sqrt{b_1} = \frac{\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^3}{\left(\frac{1}{n}\sum_{i=1}^{n}(X_i - \overline{X})^2\right)^{3/2}},$$

The p-value is computed by Monte Carlo simulation.

Value

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

statistic	the value of the sample skewness.
p.value	the p-value for the test.
method	the character string "Skewness test for normality".
data.name	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Shapiro, S. S., Wilk, M. B. and Chen, H. J. (1968): A comparative study of various tests for normality. — Journal of the American Statistical Association, vol. 63, pp. 1343–1372.

Examples

```
skewness.norm.test(rnorm(100))
skewness.norm.test(abs(runif(100,-2,5)))
```

`spiegelhalter.norm.test` *Spiegelhalter test for normality*

Description

Performs Spiegelhalter test for the composite hypothesis of normality, see Spiegelhalter (1977).

Usage

```
spiegelhalter.norm.test(x, nrepl=2000)
```

Arguments

`x`	a numeric vector of data values.
`nrepl`	the number of replications in Monte Carlo simulation.

Details

The Spiegelhalter test for normality is based on the following statistic:

$$T = \left((c_n u)^{-(n-1)} + g^{-(n-1)} \right)^{1/(n-1)},$$

where

$$u = \frac{X_{(n)} - X_{(1)}}{s}, \quad g = \frac{\sum_{i=1}^{n} |X_i - \overline{X}|}{s\sqrt{n(n-1)}}, \quad c_n = \frac{(n!)^{1/(n-1)}}{2n}, \quad s^2 = \frac{1}{n-1}\sum_{i=1}^{n}(X_i - \overline{X})^2.$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the Geary statistic.
`p.value`	the p-value for the test.
`method`	the character string "Spiegelhalter test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Spiegelhalter, D. J. (1977): A test for normality against symmetric alternatives. — Biometrika, vol. 64, pp. 415–418.

Examples

```
spiegelhalter.norm.test(rnorm(100))
spiegelhalter.norm.test(rexp(100))
```

`wb.norm.test` *Weisberg–Bingham test for normality*

Description

Performs Weisberg–Bingham test for the composite hypothesis of normality, see Weisberg and Bingham (1975).

Usage

```
wb.norm.test(x, nrepl=2000)
```

Arguments

`x`	a numeric vector of data values.
`nrepl`	the number of replications in Monte Carlo simulation.

Details

The Weisberg–Bingham test for normality is based on the following statistic:

$$WB = \frac{(\sum_{i=1}^{n} m_i X_{(i)})^2 / \sum_{i=1}^{n} m_i^2}{\sum_{i=1}^{n} (X_i - \overline{X})^2},$$

where

$$m_i = \Phi^{-1}\left(\frac{i - 3/8}{n + 1/4}\right).$$

The p-value is computed by Monte Carlo simulation.

Value

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

`statistic`	the value of the Weisberg–Bingham statistic.
`p.value`	the p-value for the test.
`method`	the character string "Weisberg-Bingham test for normality".
`data.name`	a character string giving the name(s) of the data.

Author(s)

Ilya Gavrilov and Ruslan Pusev

References

Weisberg, S. and Bingham, C. (1975): An approximate analysis of variance test for non-normality suitable for machine calculation. — Technometrics, vol. 17, pp. 133–134.

Examples

```
wb.norm.test(rnorm(100))
wb.norm.test(runif(100,-1,1))
```

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