

Package ‘neurostat’

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Type Package

Title Neutrosophic Statistics

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Description Analyzes data involving imprecise and vague information. Provides summary statistics and describes the characteristics of neutrosophic data, as defined by Florentin Smarandache (2013).<ISBN:9781599732749>.

License GPL (>= 2)

Encoding UTF-8

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URL <https://github.com/kzst/neurostat>

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citytemp	<i>Temperature Data of Five Different Cites in Pakistan for July 2022</i>
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Description

This dataset provides low and high recordings of daily temperature for five different cities (Gujranwala, Lahore, Islamabad, Karachi and Sialkot) of Pakistan for the specified period July 2022

Usage

```
data("citytemp")
```

Format

A data frame with 28 observations on the following 12 variables.

Day a character vector
 Date a numeric vector
 Gujranwala_Low a numeric vector
 Gujranwala_High a numeric vector
 Lahore_Low a numeric vector
 Lahore_High a numeric vector
 Karachi_Low a numeric vector
 Karachi_High a numeric vector
 Islamabad_Low a numeric vector
 Islamabad_High a numeric vector
 Sialkot_Low a numeric vector
 Sialkot_High a numeric vector

Details

The data was collected for each city over 31 days in July 2022. It includes both the lower and upper temperature values, and can be analyzed using neutrosophic statistical approach.

Source

<https://www.gismeteo.com/>

References

Ishmal Shahzadi (2023): Neutrosophic Statistical Analysis of Temperature of Different Cities of Pakistan. *Neutrosophic Sets and Systems*, 53(1). doi:10.5281/zenodo.7535991

Examples

```
# list of temperature data for Gujranwala city
G <- mapply(function(low, high) list(c(low, high)),
            citytemp$Gujranwala_Low,
            citytemp$Gujranwala_High)
# Neutrosophic mean and standard deviation of temperature data for Gujranwala city
nmean(G)
nstd(G)
```

dioxin	<i>Average Daily Ingestion of Dioxin in Food Samples with Uncertainties</i>
--------	---

Description

This dataset contains the estimated average daily ingestion of dioxins from food samples collected across Japan, including uncertainties in the values. Dioxins are toxic chemical compounds that pose significant health risks.

Usage

```
data("dioxin")
```

Format

The format is: List of 17 numeric interval values

Details

This data provides an analysis of dioxin intake and its potential health impacts including exposure levels from various food sources in Japan.

Source

The dataset was collected and monitored by the Ministry of Environment, Japan, as reported in their environmental statistics

References

Zahid Khan, Mohammed M. A. Almazah, Omalsad Hamood Odhah, and Huda M. Alshanbari (2022): Generalized Pareto Model: Properties and Applications in Neutrosophic Data Modeling. *Mathematical Problems in Engineering*, 2022(1). doi:10.1155/2022/3686968

Examples

```
data(dioxin)
# Provide neutrosophic summary statistics
nsummary(dioxin)
```

goldprice	<i>Gold Prices Across Six Indian Cities from February 2022 to January 2023</i>
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Description

The dataset provides the monthly high and low prices (in rupees per gram) of 22-carat gold in six Indian cities: Chennai, Kolkatta, Bangal. .Data were collected from February 2022 to January 2023. This data can be used for neutrosophic statistical analysis of gold price trends.

Usage

```
data("goldprice")
```

Format

A data frame with 12 observations on the following 13 variables.

Month a character vector
Chennai_Low a numeric vector
Chennai_High a numeric vector
Kolkatta_Low a numeric vector
Kolkatta_High a numeric vector
Bangalore_Low a numeric vector
Bangalore_High a numeric vector
Madurai_Low a numeric vector
Madurai_High a numeric vector
Hyderabad_Low a numeric vector
Hyderabad_High a numeric vector
Delhi_Low a numeric vector
Delhi_High a numeric vector

Details

Monthly high and low gold prices in Chennai, Kolkatta, and Bangalore. These can be analyzed using neutrosophic statistical methods to evaluate variations and trends.

Source

Indian Daily Gold Prices Android App

References

Kala Raja Mohan, R. Narmada Devi, Nagadevi Bala Nagaram, T. Bharathi, and Suresh Rasappan (2023): Neutrosophic Statistical Analysis on Gold Rate. *Neutrosophic Sets and Systems*, 60(1). doi:10.5281/zenodo.7535991

Examples

```
#list of low and high gold price for Chennai City
ch<- mapply(function(low, high) list(c(low, high)),
            goldprice$Chennai_Low,
            goldprice$Chennai_High)

# neutrosophic coefficient of variation
ncv(ch)
```

interval_add

Interval addition of neutrosophic numbers

Description

This function is used to find sum of more than one imprecise data values.

Usage

```
interval_add(data)
```

Arguments

data List of neutrosophic numbers. This numeric list contains at least two neutrosophic intervals. Each interval value should contain two elements, lower and upper. If a crisp value is used, it is considered as an interval with same upper and lower value.

Value

A numeric vector of length 2, indicating a summed value of neutrosophic intervals

Author(s)

Zahid Khan

References

Moore, R. E. (1979): Methods and applications of interval analysis.SIAM. doi:10.1137/1.9781611970906
 Smarandache, F (2022):Neutrosophic Statistics is an extension of Interval Statistics, while Plithogenic Statistics is the most general form of statistics(second version).Internation journal of neutrosophic science. 19(1),pp.148-165. doi:10.54216/IJNS.190111

See Also

[interval_sub](#).

Examples

```
#Addition of to neutrosopic numbers
x=list(c(5,10),c(10,20))
interval_add(x)
```

interval_df

Interval conversion for neutrosophic numbers

Description

Interval conversion for neutrosophic numbers

Usage

```
interval_df(data)
```

Arguments

data data is a vector or a list of neutrosophic numbers

Value

Data frame of neutrosophic numbers.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749

Examples

```
# values are interval forms as required in neutrosophic data

data <- list(c(6, 6), c(2, 8), c(30,50), c(18, 24))

interval_df(data)
```

interval_div	<i>Division of the neutrosophic numbers</i>
--------------	---

Description

This function is used to find an interval division of the neutrosophic numbers

Usage

```
interval_div(data)
```

Arguments

data	List of neutrosophic numbers.This numeric list contains at least two neutrosophic intervals. Each interval value should contains two elements, lower and upper.If it crisp value is used,it is considered as an interval with same upper and lower value.
------	---

Value

A numeric vector of length 2,indicating a divided value of neutrosophic intervals

Author(s)

Zahid Khan

References

Moore, R. E. (1979): Methods and applications of interval analysis.SIAM. doi:10.1137/1.9781611970906.
Smarandache, F (2022):Neutrosophic Statistics is an extension of Interval Statistics, while Plithogenic Statistics is the most general form of statistics(second version).Internation journal of neutrosophic science. 19(1),pp.148-165. doi:10.54216/IJNS.190111

See Also

[interval_mul](#).

Examples

```
#Division of neutrosopic numbers  
x=list(c(8,4),c(2,4))  
interval_div(x)
```

`interval_mul`*Multiplication of the neutrosophic numbers*

Description

Interval multiplication of the neutrosophic numbers

Usage

```
interval_mul(data)
```

Arguments

<code>data</code>	List of neutrosophic numbers. This numeric list contains at least two neutrosophic intervals. Each interval value should contain two elements, lower and upper. If it is a crisp value, it is considered as an interval with the same upper and lower value.
-------------------	--

Value

A numeric vector of length 2, indicating a product value of neutrosophic intervals

Author(s)

Zahid Khan

References

Moore, R. E. (1979): Methods and applications of interval analysis. SIAM. doi:10.1137/1.9781611970906.
Smarandache, F (2022): Neutrosophic Statistics is an extension of Interval Statistics, while Plithogenic Statistics is the most general form of statistics (second version). International journal of neutrosophic science. 19(1), pp.148-165. doi:10.54216/IJNS.190111

See Also

[interval_sub](#).

Examples

```
#Multiplication of the neutrosophic numbers  
x=list(c(2,5),c(7,8))  
interval_mul(x)
```

interval_sort	<i>Sorting of the neutrosophic data</i>
---------------	---

Description

Sorting of neutrosophic values in the ascending order

Usage

```
interval_sort(data)
```

Arguments

data data is a list of neutrosophic numbers

Value

List of intervals in ascending order.

Author(s)

Zahid Khan

References

Moore, R. E. (1979): Methods and applications of interval analysis.SIAM. doi:10.1137/1.9781611970906

See Also

[interval_add](#),[interval_div](#).

Examples

```
data <- list(c(5, 10), c(4,6), c(2, 3))
sort <- interval_sort(data)
print(sort)
```

interval_sub	<i>This function is used to find subtraction of more than one neutrosophic number</i>
--------------	---

Description

Interval subtraction of neutrosophic numbers.

Usage

```
interval_sub(data)
```

Arguments

data	List of neutrosophic numbers.This numeric list contains at least two neutrosophic intervals. Each interval value should contains two elements, lower and upper.If it crisp value is used,it is considered as an interval with same upper and lower value.
------	---

Value

A numeric vector of length 2,indicating a subtracted value of neutrosophic intervals

Author(s)

Zahid Khan

References

Moore, R. E. (1979): Methods and applications of interval analysis.SIAM. doi:10.1137/1.9781611970906

Smarandache, F (2022):Neutrosophic Statistics is an extension of Interval Statistics, while Plithogenic Statistics is the most general form of statistics(second version).Internation journal of neutrosophic science. 19(1),pp.148-165. doi:10.54216/IJNS.190111.

See Also

[interval_add](#).

Examples

```
#Substraction of two neutrosopic numbers
x=list(c(10,15),c(5,10))
interval_sub(x)
```

ncv

CV of the neutrosophic data

Description

Neutrosophic coefficient of variation is an interval value of the neutrosophic numbers

Usage

```
ncv(data)
```

Arguments

data data is a list of neutrosophic numbers

Value

Interval cv value.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749
Hussein Al-Marshadi, Ali and Aslam, Muhammad and Abdullah, Alharbey (2021): Uncertainty-Based Trimmed Coefficient of Variation with Application, Journal of Mathematics, 2021(1), pages 5511904. Wiley Online Library. doi:10.1155/2021/5511904

Kandemir, Hacer Şengül and Aral, Nazlım Deniz and Karakaş, Murat and Et, Mikail (2024): Neutrosophic Statistical Analysis of Temperatures of Cities in the Southeastern Anatolia Region of Turkey, Neutrosophic Systems with Applications, 14, pp. 50-59. doi:10.61356/j.nswa.2024.119

See Also

[nmean,nstd](#).

Examples

```
data <- list(c(1, 2), c(4), c(2, 3))  
mean <- nmean(data)  
print(mean)
```

nkur

Neutrosophic Coefficient of Kurtosis

Description

Neutrosophic kurtosis is an interval value that measures the flatness and peakedness of neutrosophic data using the method of moments

Usage

```
nkur(data)
```

Arguments

data data is a list of neutrosophic numbers

Value

An interval value of coefficient of Kurtosis.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749
Aslam, Muhammad (2021): A study on skewness and kurtosis estimators of wind speed distribution under indeterminacy, Theoretical and Applied Climatology, 143(3), pp. 1227-1234. doi:10.1007/s00704-020-03509-5

See Also

[nsk](#).

Examples

```
data <- list(c(1, 2), c(4), c(2, 3),c(6,8),c(12,20),c(20,30))  
k <- nkur(data)  
print(k)
```

nmean	<i>Mean of the neutrosophic data</i>
-------	--------------------------------------

Description

Neutrosophic mean is an interval value of the neutrosophic numbers

Usage

```
nmean(data)
```

Arguments

data data is a list of neutrosophic numbers

Value

Interval mean value.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749

See Also

[interval_add,interval_div.](#)

Examples

```
data <- list(c(1, 2), c(4), c(2, 3))
mean <- nmean(data)
print(mean)
```

nmedian	<i>Median of the neutrosophic data</i>
---------	--

Description

Finding the median of the neutrosophic interval values

Usage

```
nmedian(data)
```

Arguments

data list of neutrosophic numbers

Value

interval median value.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749

See Also

[interval_sort](#).

Examples

```
data <- list(c(5, 10), c(4,6), c(2, 3))
med <- nmedian(data)
print(med)
```

nquant

Quantiles of the neutrosophic data

Description

Neutrosophic quantiles provide three quantile interval values of the neutrosophic data

Usage

```
nquant(data)
```

Arguments

data A list of neutrosophic numbers. Each neutrosophic number is represented by an interval.

Value

A named list containing the first, second and third quantile interval values where each quantile is represented as an interval value

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749

See Also

[nmedian](#).

Examples

```
data <- list(c(5, 10), c(4,6), c(2, 3),c(4,8))
q <- nquant(data)
print(q)
```

nsk

Neutrosophic Pearson Coefficient of Skewness

Description

Neutrosophic skewness is imprecise value that measures the asymmetry of neutrosophic data using the method of moments

Usage

```
nsk(data)
```

Arguments

data data is a list of neutrosophic numbers

Value

An interval value of Pearson coefficeint of skewness.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749
Aslam, Muhammad (2021): A study on skewness and kurtosis estimators of wind speed distribution under indeterminacy, Theoretical and Applied Climatology, 143(3), pp. 1227-1234.doi:10.1007/s00704-020-03509-5

See Also

[nmean,nstd.](#)

Examples

```
data <- list(c(1, 2), c(4), c(2, 3),c(6,8),c(12,20))  
s <- nsk(data)  
print(s)
```

nstd	<i>Standard deviation of the neutrosophic data</i>
------	--

Description

Neutrosophic standard deviation is an interval value of the neutrosophic numbers

Usage

```
nstd(data)
```

Arguments

data data is a list of neutrosophic numbers

Value

Interval dispersion value.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749

See Also

[nmean, interval_add.](#)

Examples

```
data <- list(6, c(2, 5), 30, c(18, 24))
sd <- nstd(data)
print(sd)
```

nsummary *summary of the neutrosophic data*

Description

Descriptive summary of the neutrosophic numbers

Usage

```
nsummary(data)
```

Arguments

data data is a list of neutrosophic numbers

Value

Data frame of descriptive neutrosophic statistics.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749

See Also

[interval_add](#), [interval_div](#).

Examples

```
data <- list(c(1, 2), c(4), c(2, 3), c(5, 11), c(4, 8), c(20, 25))
s <- nsummary(data)
print(s)
```

nvar	<i>Variance of the neutrosophic data</i>
------	--

Description

Neutrosophic variance is an interval value of the neutrosophic numbers

Usage

```
nvar(data)
```

Arguments

data data is a list of neutrosophic numbers

Value

Interval dispersion value.

Author(s)

Zahid Khan

References

Florentin Smarandache (2014): Introduction to Neutrosophic Statistics. ISBN: 9781599732749

See Also

[nmean, interval_add](#).

Examples

```
data <- list(6, c(2, 5), 30, c(18, 24))
variance <- nvar(data)
print(variance)
```

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