Package ‘metap’

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Description The canonical way to perform meta-analysis involves using effect sizes. When they are not available this package provides a number of methods for meta-analysis of significance values including the methods of Edgington, Fisher, Lancaster, Stouffer, Tippett, and Wilkinson; a number of data-sets to replicate published results; and a routine for graphical display.

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Description

The canonical way to perform meta-analysis involves using effect sizes. When they are not available this package provides a number of methods for meta-analysis of significance values including the methods of Edgington, Fisher, Lancaster, Stouffer, Tippett, and Wilkinson; a number of data-sets to replicate published results; and a routine for graphical display.

Details

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- allmetap: Carry out all or some of the methods in the package
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Provides a number of ways in which significance levels may be combined in a meta-analysis and includes most of the methods in Becker (1994). It includes a number of datasets taken from the
literature. It also provides a display and an informal graphical test due to Schweder and Spjotvoll (Schweder and Spjotvoll 1982) and the lowest slope line of Benjamini and Hochberg (Benjamini and Hochberg 2000).

There is a vignette. Some further documentation and, possibly, a development version may be seen at [http://www.dewey.myzen.co.uk/meta/meta.html](http://www.dewey.myzen.co.uk/meta/meta.html).

**Author(s)**

Michael Dewey
Maintainer: Michael Dewey <lists@dewey.myzen.co.uk>

**References**


**See Also**

The issue of meta-analysis of significance levels is not completely unconnected with the topic of adjustment for multiple comparisons as in for example *p.adjust*

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**allmetap**

*Carry out all or some of the methods in the package*

**Description**

Enables all or a selected number of the package methods to be executed on the same dataset

**Usage**

```r
allmetap(p, method = NULL)
## S3 method for class 'allmetap'
print(x, digits = 5, ...)
```

**Arguments**

- `p`: A vector of *p*-values
- `method`: A vector of character containing names of methods or ‘all’
- `x`: An object of class ‘allmetap’
- `digits`: How many digits to print?
- `...`: Other arguments to be passed through
invchisq

Details

The function uses each of the methods specified on the data-set in \( p \). If method contains ‘all’ then this over-rides any specific method(s) named.

Value

Returns an object of class ‘allmetap’ and ‘data.frame’ containing columns

- \( p \): The value of \( p \) returned
- valid: The number of valid \( p \) values used for that method
- eponym: The eponym, if any, for the method

The row names are the names of the methods used. If any of the methods cannot be applied to that data-set NA are returned for \( p \) and valid.

Author(s)

Michael Dewey

Examples

data(beckerp)
allmetapbeckerp, method = "all")
allmetapbeckerp, method = c("sumz", "sumlog")

Description

Combine \( p \)-values by the inverse chi-squared method, also known as Lancaster’s method.

Usage

invchisq(p, k, data = NULL, subset = NULL, na.action = na.fail)

## S3 method for class 'invchisq'
print(x, ...)

Arguments

- \( p \): A vector of significance values
- \( k \): A vector of degrees of freedom to use, see details
- data: Optional data frame containing variables
- subset: Optional vector of logicals to specify a subset of the \( p \)-values
- na.action: A function indicating what should happen when data contains NAs
- x: An object of class ‘invchisq’
- ...: Other arguments to be passed through
invchisq

Details

Defined as

\[ \sum_{i=1}^{n} \chi^2_{k_i}(p_i) > \chi^2_{\sum k_i}(\alpha) \]

If \( k \) is a single value it is used for all the \( p \) of which there are \( n \). If any value of \( k_i < 1 \) then the corresponding \( p_i \) is not included.

The values of \( p_i \) should be such that \( 0 < p_i \leq 1 \) and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain.

The plot method for class ‘metap’ calls \texttt{plotp} on the valid \( p \)-values. Inspection of the distribution of \( p \)-values is highly recommended as extreme values in opposite directions do not cancel out. See last example. This may not be what you want.

Value

An object of class ‘invchisq’ and ‘metap’, a list with entries

- \texttt{chisq} Value of chi-squared statistic
- \texttt{df} Associated degrees of freedom
- \texttt{p} Associated \( p \)-value
- \texttt{validp} The input vector with the illegal values removed

Author(s)

Michael Dewey

References


See Also

See also \texttt{sumlog} and \texttt{plotp}

Examples

data(beckerp)
invchisq(beckerp, 2) # same as sumlog
invchisq(c(0.999, 0.999, 0.001, 0.001), 4)
Description

Combine p values using the inverse t method

Usage

\[ \text{invt}(p, k, \text{data} = \text{NULL}, \text{subset} = \text{NULL}, \text{na.action} = \text{na.fail}) \]

## S3 method for class 'invt'

print(x, ...)

Arguments

- \( p \): A vector of significance values
- \( k \): A vector of degrees of freedom to use, see details
- \( \text{data} \): Optional data frame containing variables
- \( \text{subset} \): Optional vector of logicals to specify a subset of the \( p \)-values
- \( \text{na.action} \): A function indicating what should happen when data contains NAs
- \( x \): An object of class ‘invt’
- \…\: Other arguments to be passed through

Details

Defined as

\[ \frac{\sum_{i=1}^{n} t_{k_i}(p_i)}{\sqrt{\sum_{i=1}^{n} \frac{k_i}{k_i-2}}} > z(\alpha) \]

If \( k \) is a single value it is used for all the \( p \) of which there are \( n \). If any value of \( k_i < 1 \) then the corresponding \( p_i \) is not included.

The values of \( p_i \) should be such that \( 0 < p_i \leq 1 \) and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain.

The plot method for class ‘metap’ calls \texttt{plotp} on the valid \( p \)-values.

Value

An object of class ‘invt’ and ‘metap’, a list with entries

- \( z \): Value of \( z \)
- \( p \): Associated \( p \)-value
- \( \text{validp} \): The input vector with the illegal values removed
logitp

Author(s)
Michael Dewey

References

See Also
See also plotp

Examples
data(beckerp)
invt(beckerp, 50)

logitp Combine p values using logit method

Description
Combine p values using logit method

Usage
logitp(p)
## S3 method for class 'logitp'
print(x, ...)

Arguments
p A vector of significance values
x An object of class 'logitp'
... Other arguments to be passed through

Details
Defined as
\[ t = -\frac{\sum_{i=1}^{k} \log \frac{p_i}{1-p_i}}{C} \]
where
\[ C = \sqrt{\frac{k\pi^2(5k^2 + 2)}{3(5k + 4)}} \]
and \( k \) is the number of studies.
The values of \( p_i \) should be such that \( 0 < p_i < 1 \) and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain.
The plot method for class ‘metap’ calls plotp on the valid p-values.
Value

An object of class ‘logitp’ and ‘metap’, a list with entries

- **t**: Value of Student’s $t$
- **df**: Associated degrees of freedom
- **p**: Associated $p$-value
- **validp**: The input vector with illegal values removed

Author(s)

Michael Dewey

References


See Also

See also *plotp*

Examples

data(teachexpect)
logitp(teachexpect) # t = 2.763, df = 99, p = 0.0034, from Becker
data(beckerp)
logitp(beckerp) # t = 1.62, df = 29, NS, from Becker
data(validity)
logitp(validity) # t = 9.521, df = 104, p = 3.89 $\times 10^{-16}$

meanp

*Combine $p$ values by the mean $p$ method*

Description

Combine $p$ values by the mean $p$ method

Usage

```r
meanp(p)
```

## S3 method for class 'meanp'

```r
print(x, ...)
```

Arguments

- **p**: A vector of significance values
- **x**: An object of class ‘meanp’
- **...**: Other arguments to be passed through
**Details**

Defined as

\[ z = (0.5 - \bar{p}) \sqrt{\frac{12}{k}} \]

which is a standard normal and due to Edgington (1972)

The values of \( p_i \) should be such that \( 0 \leq p_i \leq 1 \) and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than four values remain.

The plot method for class ‘metap’ calls `plotp` on the valid \( p \)-values.

**Value**

An object of class ‘meanp’ and ‘metap’, a list with entries

- `z`: Value of \( z \)
- `p`: Associated \( p \)-value
- `validp`: The input vector with illegal values removed

**Author(s)**

Michael Dewey

**References**


**See Also**

See also `plotp`

**Examples**

```r
data(rosenthal)
meanp(rosenthal$p) # 2.17, p = 0.015 one tailed
```
meanz

Combine p values using mean z method

Description

Combines p values using the mean of z method

Usage

meanz(p)

# S3 method for class 'meanz'

print(x, ...)

Arguments

p  
A vector of significance values

x  
An object of class 'meanz'

...  
Other arguments to be passed through

Details

Let

\[ \bar{z} = \frac{1}{k} \sum_{i=1}^{k} z(p_i) \]

and

\[ s_{\bar{z}} = \frac{s_z}{\sqrt{k}} \]

Defined as

\[ \frac{\bar{z}}{s_{\bar{z}}} > t_{k-1}(\alpha) \]

The values of \( p_i \) should be such that \( 0 \leq p_i \leq 1 \) and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain. As can be seen if all the \( p_i \) are equal or close to equal this gives a \( t = \pm \infty \) leading to a returned value of 0 or 1.

The plot method for class 'metap' calls plotp on the valid p-values.

Value

An object of class 'meanz' and 'metap', a list with entries

z        The value of the mean z statistic
p        The associated p value
validp   The input vector with illegal values removed
Author(s)
Michael Dewey

References

See Also
See also plotp

Examples

data(beckerp)
meanz(beckerp)

data(cholest)

Format
beckerp  A vector of length 5
cholest  A vector of length 34
edgington A vector of length 7
naep    A data frame with 34 observations on the following 2 variables.
        state  a factor with levels AL, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IN, KY, LA, MD, MI, MN, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, TX, VA, WI, WV, WY,
        p  a numeric vector
mourning A data frame with 9 observations on the following 3 variables.

Description
The package contains the following datasets: beckerp, cholest, edgington, mourning, naep, rosenthal, teachexpect, and validity.

Usage

data(beckerp)
data(cholest)
data(edgington)
data(mourning)
data(naep)
data(rosenthal)
data(teachexpect)
data(validity)

Example data

package-data  Example data

data(beckerp)
meanz(beckerp)

Format
beckerp  A vector of length 5
cholest  A vector of length 34
edgington A vector of length 7
naep    A data frame with 34 observations on the following 2 variables.
        state  a factor with levels AL, AR, AZ, CA, CO, CT, DE, FL, GA, HI, IA, ID, IN, KY, LA, MD, MI, MN, NC, ND, NE, NH, NJ, NM, NY, OH, OK, PA, RI, TX, VA, WI, WV, WY,
        p  a numeric vector
mourning A data frame with 9 observations on the following 3 variables.
stance a factor with levels No, stand, Opponent, Supporter
grade a factor with levels G11-12, G7-8, G9-10
p a numeric vector

rosenthal A data frame with 5 observations on the following 3 variables.
  t A numeric vector of values of t
  df a numeric vector of degrees of freedom
  p a numeric vector of one sided p values

teachexpect A vector of length 19
validity A vector of length 20

Details

beckerp Hypothetical p values from Becker (1994)
cholest p-values from studies of cholesterol lowering from Sutton et al. (2000)
edgington Hypothetical p values from Edgington (1972)
mourning Results from a study of mourning practices of Israeli youth from Benjamini and Hochberg (2000)
aepep Results on the National Assessment of Educational Progress from Benjamini and Hochberg (2000)
rosenthal Hypothetical example from Rosenthal (1978)
teachexpect p-values from studies of the effect of manipulating teacher expectancy from Becker (1994)
validity p-values from studies of validity of student ratings from Becker (1994)

References

Description

Produces a Q–Q plot of the p-values supplied

Usage

plotp(pvals, ...)

Arguments

pvals A vector of p–values
... Other parameters to pass through to qqplot and qqline

Details

After eliminating out of range p–values and missing values produces a Q–Q plot and the line through the quantiles (by default the 0.25 and 0.75).

Value

Invisibly returns a list consisting of

validp The valid p–values

Author(s)

Michael Dewey

See Also

qqplot and qqline

Examples

data(cholest)
plotp(cholest)
Description

Produces the plot suggested by Schweder and Spjotvoll to display a collection of $p$-values and also optionally draws the lowest slope line suggested by Benjamini and Hochberg.

Usage

```r
schweder(p, xlab = "Rank of p", ylab = "p", drawline = NULL,
    bh.lwd = 1, bh.lty = "solid", bh.col = "black",
    ls.control = list(frac = NULL),
    ls.lwd = 1, ls.lty = "dotted", ls.col = "black",
    ab.control = list(a = NULL, b = NULL),
    ab.lwd = 1, ab.lty = "dashed", ab.col = "black", ...)
```

Arguments

- `p`: A vector of $p$-values
- `xlab`: Label for plot $x$-axis
- `ylab`: Label for plot $y$-axis
- `drawline`: Which line, if any, to draw. See Details
- `bh.lwd`: Width of the lowest slope line
- `bh.lty`: Line type of the lowest slope line
- `bh.col`: Colour of the lowest slope line
- `ls.control`: A list containing a named element `frac`. See Details
- `ls.lwd`: Width of the least squares line
- `ls.lty`: Line type of the least squares line
- `ls.col`: Colour of the least squares line
- `ab.control`: A list containing two elements `a` and `b`. See Details
- `ab.lwd`: Width of the specified line
- `ab.lty`: Line type of the specified line
- `ab.col`: Colour of the specified line
- `...`: Further parameters to be passed through to `plot`
Details

After removing invalid \( p \)-values plots them. Any graphics parameters passed in . . . affect this part of the plot only. Note that the axes are chosen according to the scheme of Benjamini and Hochberg, Schweder and Spjøtvoll used a different system.

By setting `drawline` appropriately up to three lines may be drawn.

If `drawline` includes the string "bh" the lowest slope line of Benjamini and Hochberg is drawn. No further parameters are needed here but the characteristics of the line may be set: width, line type, and colour.

If `drawline` includes the string "ls" a least squares line is drawn passing through the point \( k + 1, 1 \). The parameter `frac` specified what fraction of the values be used for this and may need experimentation to obtain a suitable line. The characteristics of the line may be set: width, line type, and colour.

If `drawline` includes the string "ab" a user specified line is drawn. The parameters \( a \) and \( b \) specify the intercept and slope. The characteristics of the line may be set: width, line type, and colour.

Value

A list containing

\[ p \]

The values of \( p \) plotted

\[ bh\params \]

A list containing at least items \( a \) and \( b \) the intercept and slope of the line drawn. This is only included if the lowest slope line was drawn

\[ ls\params \]

A list containing at least items \( a \) and \( b \) the intercept and slope of the line drawn. This is only included if the least squares line was drawn

\[ ab\params \]

A list containing at least items \( a \) and \( b \) the intercept and slope of the line drawn. This is only included if the user specified line was drawn

Author(s)

Michael Dewey

References


Examples

\[ \text{data(teachexpect)} \]
\[ \text{schweder(teachexpect)} \]
**sumlog**  
*Combine p-values by the sum of logs (Fisher’s) method*

**Description**

Combine p-values by the sum of logs method, also known as Fisher’s method, and sometimes as the chi-square (2) method.

**Usage**

```r
sumlog(p)  
## S3 method for class 'sumlog'
print(x, ...)
```

**Arguments**

- `p`: A vector of significance values
- `x`: An object of class ‘sumlog’
- `...`: Other arguments to be passed through

**Details**

The method relies on the fact that

$$\sum_{i=1}^{k} -2 \log p_i$$

is a chi-squared with $2k$ df where $k$ is the number of studies (Fisher 1925).

The values of $p_i$ should be such that $0 < p_i \leq 1$ and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain.

The plot method for class ‘metap’ calls `plotp` on the valid $p$-values. Inspection of the distribution of $p$-values is highly recommended as extreme values in opposite directions do not cancel out. See last example. This may not be what you want.

**Value**

An object of class ‘sumlog’ and ‘metap’, a list with entries

- `chisq`: Value of chi-squared statistic
- `df`: Associated degrees of freedom
- `p`: Associated $p$-value
- `validp`: The input vector with the illegal values removed

**Author(s)**

Michael Dewey
References


See Also

See also plotp

Examples

data(teachexpect)
sumlog(teachexpect) # chisq = 69.473, df = 38, p = 0.0014, from Becker
data(beckerp)
sumlog(beckerp) # chisq = 18.533, df = 10, sig
data(rosenthal)
sumlog(rosenthal$p) # chisq = 22.97, df = 10, p = 0.006 one sided
data(cholest)
sumlog(cholest) # chisq = 58.62, df = 68, p = 0.78
data(validity)
sumlog(validity) # chisq = 159.82, df = 40, p = 2.91 \times 10^{-16}
sumlog(c(0.0001, 0.0001, 0.9999, 0.9999)) # is significant

---

**Description**

Combine p-values using the sum p method

**Usage**

```r
sump(p)

## S3 method for class 'sump'
print(x, ...)
```

**Arguments**

- `p` A vector of significance values
- `x` An object of class ‘sump’
- `...` Other arguments to be passed through
Details

Defined as

\[ \frac{(\sum_{i=1}^{k} p_i)^k}{k!} - \frac{k}{1!} \left( \frac{(\sum_{i=1}^{k} p_i - 1)^k}{k!} \right) + \frac{k-2}{2!} \left( \frac{\sum_{i=1}^{k} p_i - 2)^k}{k!} \right) \ldots \]

where there are \( k \) studies and the series continues until the numerator becomes negative (Edgington 1972).

Some authors use a simpler version

\[ \frac{(\sum_{i=1}^{k} p_i)^k}{k!} \]

but this can be very conservative when \( \sum_{i=1}^{k} p_i > 1 \). There seems no particular need to use this method but it is returned as the value of \texttt{conservativep} for use in checking published values.

The values of \( p_i \) should be such that \( 0 \leq p_i \leq 1 \) and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain. A warning is given when the internal calculations are likely to have been subject to numerical error and an alternative method should be used to check the result.

The plot method for class ‘\texttt{metap}’ calls \texttt{plotp} on the valid \( p \)-values.

Value

An object of class ‘\texttt{sump}’ and ‘\texttt{metap}’, a list with entries

- \texttt{p} The transformed sum of the \( p \)-values
- \texttt{conservativep} See details
- \texttt{validp} The input vector with illegal values removed

Author(s)

Michael Dewey

References


See Also

See also \texttt{plotp}

Examples

data(edgington)
sump(edgington) # p = 0.097
Combine p-values using the sum of z (Stouffer’s) method

Description

Combine p-values using the sum z method

Usage

sumz(p, weights = NULL, data = NULL, subset = NULL, na.action = na.fail)

## S3 method for class 'sumz'
print(x, ...)

Arguments

p A vector of significance values
weights A vector of weights
data Optional data frame containing variables
subset Optional vector of logicals to specify a subset of the p-values
na.action A function indicating what should happen when data contains NAs
x An object of class 'sumz'
... Other arguments to be passed through

Details

Defined as

$$z = \frac{\sum_{i=1}^{k} w_i z(p_i)}{\sqrt{\sum_{i=1}^{k} w_i^2}}$$

is a z where k is the number of studies and w are the weights (Stouffer et al. 1949). By default the weights are equal. In the absence of effect sizes (in which case a method for combining effect sizes would be more appropriate anyway) best results are believed to be obtained with weights proportional to the square root of the sample sizes (Zaykin 2011)

The values of p_i should be such that 0 < p_i < 1 and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain. If the omitted p values had supplied weights a further warning is issued.

The plot method for class ‘metap’ calls plotp on the valid p-values.

Value

An object of class ‘sumz’ and ‘metap’, a list with entries

z Transformed sum of z values
p Associated p-value
validp The input vector with illegal values removed
weights The weight vector corresponding to validp
Author(s)

Michael Dewey

References


See Also

See also plotp

Examples

data(teachexpect)
sumz(teachexpect) # z = 2.435, p = 0.0074, from Becker
data(becker)
sumz(becker) # z = 1.53, NS, from Becker

data(rosenthal)
sumz(rosenthal$p) # 2.39, p = 0.009
sumz(p, df, rosenthal) # 3.01, p = 0.0013

data(validity)
sumz(validity) # z = 8.191, p = 1.25 * 10^{-16}

twozone

Convert two-sided p-values to one-sided

description

Convert two-sided p-values to one-sided

Usage

twozone(p, two = NULL, invert = NULL)

Arguments

p A vector of p-values

two A logical vector defining which p-values are two-sided and to be converted

invert A logical vector defining which p-values are to be inverted
votep

Details

The \( p \)-values supplied to the other functions should be one-sided and all in the same direction. This convenience function will convert two-sided to one-sided and invert as necessary. By default it is assumed that all \( p \)-values are two-sided and the function converts them all to one-sided. Use `invert` to specify if some of the tests resulted in outcomes in the other direction. So for example a value of 0.05 will be converted to 0.025 unless `invert` is TRUE in which case it is converted to 0.975.

Value

A vector of one-sided \( p \)-values all in the correct direction

Author(s)

Michael Dewey

Examples

data(rosenthal)
twop <- with(rosenthal, (pt(t, df)))

\[
\text{votep} \quad \text{Combine } p\text{-values by the vote counting method}
\]

Description

Combine \( p \)-values by the vote counting method

Usage

\[
votep(p, \text{alpha} = c(0.5, 0.5))
\]

\#

S3 method for class 'votep'

print(x, ...)

Arguments

\( p \) A vector of significance values
\( \text{alpha} \) A vector of length 2 defining the significance value limits
\( x \) An object of class 'votep'
\( \ldots \) Other arguments to be passed through
Details

By default splits the \( p \)-values at 0.5 with those below counting as positive and those above counting as negative. However setting alpha allows for a different choice of cut-off and also by specifying two different values for a neutral zone. If either value of alpha is greater than unity it is assumed to be a percentage.

The values of \( p_i \) should be such that \( 0 < p_i < 1 \) and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain.

The plot method for class ‘metap’ calls \texttt{plotp} on the valid \( p \)-values.

Value

An object of class ‘votep’ and ‘votep’, a list with entries

\[
\begin{align*}
p & \quad \text{\( p \) value} \\
pos & \quad \text{Number of positives} \\
neg & \quad \text{Number of negatives} \\
alpha & \quad \text{A vector of length 2 defining the significance values and lying in the range 0 to 1} \\
validp & \quad \text{The input vector with illegal values removed}
\end{align*}
\]

Author(s)

Michael Dewey

References


See Also

See also \texttt{plotp}

Examples

\[
\begin{align*}
data(beckerp) \\
votep(beckerp)
\end{align*}
\]
**wilkinsonp**

*Combine p-values using Wilkinson's method*

**Description**

Combine p-values using Wilkinson’s method

**Usage**

```r
wilkinsonp(p, r = 1, alpha = 0.05)
maximump(p, alpha = 0.05)
minimump(p, alpha = 0.05)
## S3 method for class 'wilkinsonp'
print(x, ...)
## S3 method for class 'maximump'
print(x, ...)
## S3 method for class 'minimump'
print(x, ...)
```

**Arguments**

- `p` A vector of significance values
- `r` Use the rth smallest p value
- `alpha` The significance level
- `x` An object of class `wilkinsonp` or of class `maximump` or of class `minimump`
- `...` Other arguments to be passed through

**Details**

Wilkinson (Wilkinson 1951) originally proposed his method in the context of simultaneous statistical inference: the probability of obtaining r or more significant statistics by chance in a group of k. The values are obtained from the Beta distribution, see `pbeta`.

If alpha is greater than unity it is assumed to be a percentage. Either values greater than 0.5 (assumed to be confidence coefficient) or less than 0.5 are accepted.

The values of $p_i$ should be such that $0 \leq p_i \leq 1$ and a warning is given if that is not true. An error is given if, possibly as a result of removing illegal values, fewer than two values remain.

`maximump` and `minimump` each provide a wrapper for `wilkinsonp` for the special case when $r = \text{length}(p)$ or $r = 1$ respectively and each has its own print method. The method of minimum $p$ is also known as Tippett’s method (Tippett 1931).

The plot method for class `metap` calls `plotp` on the valid p-values. Inspection of the distribution of p-values is highly recommended as extreme values in opposite directions do not cancel out. See last example. This may not be what you want.
Value

An object of class ‘wilkinsonp’ and ‘metap’ or of class ‘maximump’ and ‘metap’ or of class ‘minimump’ and ‘metap’, a list with entries

- **p**: The p-value resulting from the meta-analysis
- **pr**: The $r$th smallest $p$ value used
- **r**: The value of $r$
- **critp**: The critical value at which the $r$th value would have been significant for the chosen alpha
- **validp**: The input vector with illegal values removed

Author(s)

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References


See Also

See also **plotp**

Examples

data(beckerp)
minimump(beckerp) # signif = FALSE, critp = 0.0102, minp = 0.016
data(teachexpect)
minimump(teachexpect) # crit 0.0207, note Becker says minp = 0.0011
wilkinsonp(c(0.223, 0.223), r = 2) # Birnbaum, just signif
data(validity)
minimump(validity) # minp = 0.00001, critp = 1.99 * 10^-4
minimump(c(0.0001, 0.0001, 0.9999, 0.9999)) # is significant
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