Package ‘senstrat’

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computep

Computes individual and pairwise treatment assignment probabilities.

Description

Of limited interest to most users, the computep function plays an internal role in 2-sample and stratified sensitivity analyses. The computep function is equations (9) and (10), page 496, in Rosenbaum and Krieger (1990).

Usage

computep(bigN, n, m, g)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>bigN</td>
<td>Total sample size in this stratum.</td>
</tr>
<tr>
<td>n</td>
<td>Treated sample size in this stratum.</td>
</tr>
<tr>
<td>m</td>
<td>The number of 1's in the vector u of unobserved covariates. Here, u has bigN-m 0's followed by m 1's.</td>
</tr>
<tr>
<td>g</td>
<td>The sensitivity parameter $\Gamma$, where $\Gamma \geq 1$.</td>
</tr>
</tbody>
</table>

Value

<table>
<thead>
<tr>
<th>Value</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$p_1$</td>
<td>Equation (9), page 496, in Rosenbaum and Krieger (1990) evaluated with $u[i]=1$.</td>
</tr>
<tr>
<td>$p_0$</td>
<td>Equation (9), page 496, in Rosenbaum and Krieger (1990) evaluated with $u[i]=0$.</td>
</tr>
<tr>
<td>$p_{10}$</td>
<td>Equation (10), page 496, in Rosenbaum and Krieger (1990) evaluated with $u[i]=1, u[j]=0$.</td>
</tr>
<tr>
<td>$p_{00}$</td>
<td>Equation (10), page 496, in Rosenbaum and Krieger (1990) evaluated with $u[i]=0, u[j]=0$.</td>
</tr>
</tbody>
</table>

Note

The function computep is called by the function ev.

Author(s)

Paul R. Rosenbaum

References

Examples

compute(c(10, 5, 6, 2))

---

ev

Computes the null expectation and variance for one stratum.

Description

Of limited interest to most users, the ev function plays an internal role in 2-sample and stratified sensitivity analyses. The expectation and variance returned by the ev function are defined in the third paragraph of section 4, page 495, of Rosenbaum and Krieger (1990).

Usage

ev(sc, z, m, g, method)

Arguments

- **sc**: A vector of scored outcomes for one stratum. For instance, for Wilcoxon's rank sum test, these would be the ranks of the outcomes in the current stratum.
- **z**: Treatment indicators, with length(z)=length(sc). Here, z[i]=1 if i is treated and z[i]=0 if i is control.
- **m**: The unobserved covariate u has length(z)-m 0's followed by m 1's.
- **g**: The sensitivity parameter \(\Gamma\), where \(\Gamma \geq 1\).
- **method**: If method="RK" or if method="BU", exact expectations and variances are used in a large sample approximation. Methods "RK" and "BU" should give the same answer, but "RK" uses formulas from Rosenbaum and Krieger (1990), while "BU" obtains exact moments for the extended hypergeometric distribution using the BiasedUrn package and then applies Proposition 20, page 155, section 4.7.4 of Rosenbaum (2002). In contrast, method="LS" does not use exact expectations and variances, but rather uses the large sample approximations in section 4.6.4 of Rosenbaum (2002). Finally, method="AD" uses method="LS" for large strata and method="BU" for smaller strata.

Details

The function ev() is called by the function evall().

Value

- **expect**: Null expectation of the test statistic.
- **vari**: Null variance of the test statistic.

Author(s)

Paul R. Rosenbaum
References

Examples
\[
eva(1:5, c(0, 1, 0, 1, 0), 3, 2, \text{"RK"})
\]
\[
eva(1:5, c(0, 1, 0, 1, 0), 3, 2, \text{"BU"})
\]

Description
Of limited interest to most users, the \text{evall()} function plays an internal role in 2-sample and stratified sensitivity analyses. The expectation and variance returned by the \text{evall()} function are defined in the third paragraph of section 4, page 495, of Rosenbaum and Krieger (1990). The function \text{evall()} calls the function \text{ev()} to determine the expectation and variance of the test statistic for an unobserved covariate \(u\) with \(\text{length}(z)-m\) 0’s followed by \(m\) 1’s, doing this for \(m=1, \ldots, \text{length}(z)-1\).

Usage
\[
eval(s, z, g, \text{method})
\]

Arguments
\text{sc} \hspace{1cm} \text{A vector of scored outcomes for one stratum. For instance, for Wilcoxon’s rank sum test, these would be the ranks of the outcomes in the current stratum.}
\text{z} \hspace{1cm} \text{Treatment indicators, with \text{length}(z)=\text{length}(sc). Here, \(z[i]=1\) if \(i\) is treated and \(z[i]=0\) if \(i\) is control.}
\text{g} \hspace{1cm} \text{The sensitivity parameter} \(\Gamma\), where \(\Gamma \geq 1\).
\text{method} \hspace{1cm} \text{If \text{method}="RK" or if \text{method}="BU", exact expectations and variances are used in a large sample approximation. Methods "RK" and "BU" should give the same answer, but "RK" uses formulas from Rosenbaum and Krieger (1990), while "BU" obtains exact moments for the extended hypergeometric distribution using the BiasedUrn package and then applies Proposition 20, page 155, section 4.7.4 of Rosenbaum (2002). In contrast, \text{method}="LS" does not use exact expectations and variances, but rather uses the large sample approximations in section 4.6.4 of Rosenbaum (2002). Finally, \text{method}="AD" uses \text{method}="LS" for large strata and \text{method}="BU" for smaller strata.}

Details
The \text{evall()} function is called by the \text{sen2sample()} function and the \text{senstrat()} function.
Value

A data.frame with length(z)-1 rows and three columns. The first column, m, gives the number of 1’s in the unobserved covariate vector, u. The second column, expect, and the third column, var, give the expectation and variance of the test statistic for this u.

Note

The example is from Table 1, page 497, of Rosenbaum and Krieger (1990). The example is also Table 4.15, page 146, in Rosenbaum (2002). The example refers to Cu cells. The data are originally from Skerfving et al. (1974).

Author(s)

Paul R. Rosenbaum

References


Examples

```r
z<-(c(rep(0,16),rep(1,23))
CuCells<-c(2.7,.5,0,0,0,0,0,1.3,0,1.8,0,0,1.0,1.8,
        0,3.1,.7,4.6,0,1.7,5.2,0,5,9.5,2,3,1,3.5,
        2,5,5.5,2,3,4,0,2,2.2,0,2)
evalr(rank(CuCells),z,2,"RK")
```

---

**hodgeslehmann**

*Computes Hodges-Lehmann Aligned Ranks.*

Description

Computes Hodges-Lehmann (1962) aligned ranks for use in stratified sensitivity analyses. For instance, the scores, sc, used in function senstrat() might be Hodges-Lehmann aligned ranks.

Usage

```r
hodgeslehmann(y,z,st,align="median",tau=0)
```
Arguments

- **y**: A vector outcome. An error will result if y contains NAs.

- **z**: Treatment indicators, with length(z)=length(y). Here, z[i]=1 if i is treated and z[i]=0 if i is control.

- **st**: A vector of stratum indicators with length(st)=length(y). The vector st may be numeric, such as 1,2,..., or it may be a factor.

- **align**: Within each stratum, the observations are aligned or centered by subtracting a location measure computed from observations in that stratum. If align="median", then the median is subtracted. If align="mean", then the mean is subtracted. If align="huber", then the Huber’s m-estimate is subtracted, as computed by the function huber() in the MASS package. If align="hl", then the one-sample Hodges-Lehmann estimate is subtracted, as suggested by Mehrotra et al. (2010), and as computed by the wilcox.test() function in the stats package. The wilcox.test() command may generate numerous warnings about situations that are not hazardous, such as ties. When align="hl", warnings produced by wilcox.test() are suppressed.

- **tau**: If tau=0, then the null hypothesis is Fisher’s sharp null hypothesis of no treatment effect. If tau is nonzero, then tau is subtracted from the y’s for treated responses before aligning and ranking. If tau is nonzero, the null hypothesis is that the treatment has a constant additive effect tau, the same for all strata.

Value

A vector of length(y) containing the aligned ranks.

Author(s)

Paul R. Rosenbaum

References


Examples

data("homocyst")
attach(homocyst)
sc<-hodgeslehmann(log2(homocysteine),z,stf,align="hl")
summary(sc)
length(sc)
detach(homocyst)
Data from NHANES 2005-2006 concerning homocysteine levels in daily smokers \((z=1)\) and never smokers \((z=0)\), aged 20 and older. Daily smokers smoked every day for the last 30 days, smoking on average of at least 10 cigarettes per day. Never smokers smoked fewer than 100 cigarettes in their lives, do not smoke now, and had no tobacco use in the previous 5 days.

Usage

```r
data("homocyst")
```

Details

Bazzano et al. (2003) noted higher homocysteine levels in smokers than in nonsmokers. See also Pimentel et al. (2016) for a related analysis. The example below is from Rosenbaum (2017).

Source

References


Examples

```r
data(homocyst)
# Homocysteine levels for daily smokers and nonsmokers.
boxplot(log(homocyst$homocysteine) ~ homocyst$z)
```

---

**mscores**  
*Computes M-Scores for Two-Sample or Stratified Permutation Inference.*

**Description**

Computes M-scores for two-sample or stratified permutation inference and sensitivity analyses. For instance, the scores may be used in functions `sen2sample()` and `senstrat()`.

**Usage**

```r
mscores(y, z, st = NULL, inner = 0, trim = 3, lambda = 0.5, tau = 0)
```

**Arguments**

- `y`  
  A vector outcome. An error will result if `y` contains NAs.

- `z`  
  Treatment indicators, with `length(z)=length(y)`. Here, `z[i]=1` if `i` is treated and `z[i]=0` if `i` is control.

- `st`  
  For an unstratified two-sample comparison, `st = NULL`. For a stratified comparison, `st` is a vector of stratum indicators with `length(st)=length(y)`. The vector `st` may be numeric, such as 1,2,..., or it may be a factor.

- `inner`  
  See `trim` below.

- `trim`  
  The two parameters, `inner>=0` and `trim>inner`, determine the odd `ψ`-function of the M-statistic. Huber favored an M-statistic similar to a trimmed mean, with `inner=0, trim>0`, so that `ψ(y)` is `max(-trim, min(trim,y))`. Setting `inner>0` ignores `y` near zero and is most useful for matched pairs; see Rosenbaum (2013). In general, `ψ(y)` is `sign(y)*trim*min(trim-inner,max(0,abs(y)-inner))/(trim-inner)`, so it is zero for `y` in the interval `[-inner,inner]`, and rises linearly from 0 to `trim` on the interval `y=inner` to `y=trim`, and equals trim for `y>trim`. If `trim=Inf`, then no trimming is done, and `ψ(y) = y`.
The $\psi$-function is applied to a treated-minus-control difference in responses after scaling by the lambda quantile of the within-strata absolute differences. Typically, lambda=1/2 for the median.

If tau=0, then the null hypothesis is Fisher’s sharp null hypothesis of no treatment effect. If tau is nonzero, then tau is subtracted from the y’s for treated responses before scoring the y’s. If tau is nonzero, the null hypothesis is that the treatment has a constant additive effect tau, the same for all strata.

A vector of length(y) containing the M-scores. The M-scores may be used in senstrat() or sen2Sample().

The ith response in stratum s, R[si], is compared to the jth response in stratum s, R[sj], as $\psi((R[si]-R[sj])/\sigma)$, and for each fixed i these values are averaged over the n[s]-1 choices of j in stratum s, where n[s] is the size of stratum s, thereby producing the M-score for R[si]. Here, $\sigma$ is the lambda quantile, usually the median, of |R[si]-R[sj]|, taken over all within stratum comparisons. This extension to stratified comparisons of the method of Maritz (1979) for matched pairs is described in Rosenbaum (2007, 2017).

Paul R. Rosenbaum


Maritz, J. S. (1979) Exact robust confidence intervals for location. Biometrika 1979, 66, 163-166. Maritz proposed small adjustments to M-statistics for matched pairs that permit them to be used in exact permutation tests and confidence intervals.


See Also

The packages sensitivitymv, sensitivitymw and sensitivityfull use M-scores in matched sets. The
M-scores from those packages are similar, but are weighted differently, particularly when matched
sets have varying sizes.

Examples

data("homocyst")
attach(homocyst)
sc<-mscores(log2(homocysteine),z,st=stf)
par(mfrow=c(1,2))
boxplot(log2(homocysteine)~z,main="Data")
boxplot(sc~z,main="Mscores")
detach(homocyst)

sen2sample  Treatment versus control sensitivity analysis without strata.

Description

Performs a two-sample, treated-versus-control sensitivity analysis without strata or matching. The
method is described in Rosenbaum and Krieger (1990) and Rosenbaum (2002, Section 4.6). The
example in those references is used below to illustrate use of the sen2sample() function.

Usage

sen2sample(sc, z, gamma = 1, alternative = "greater", method="BU")

Arguments

sc  A vector of scored outcomes for one stratum. For instance, for Wilcoxon’s rank
    sum test, these would be the ranks of the outcomes.

z  Treatment indicators, with length(z)=length(sc). Here, z[i]=1 if i is treated and
    z[i]=0 if i is control.

gamma  The sensitivity parameter Γ, where Γ ≥ 1.

alternative  If alternative="greater", then the test rejects for large values of the test statistic.
    If alternative="less" then the test rejects for small values of the test statistic. In a
    sensitivity analysis, it is safe but somewhat conservative to perform a two-sided
    test at level α by doing two one-sided tests each at level α/2.

method  If method="RK" or if method="BU", exact expectations and variances are used
    in a large sample approximation. Methods "RK" and "BU" should give the same
    answer, but "RK" uses formulas from Rosenbaum and Krieger (1990), while
    "BU" obtains exact moments for the extended hypergeometric distribution using
    the BiasedUrn package and then applies Proposition 20, page 155, section
    4.7.4 of Rosenbaum (2002). In contrast, method="LS" does not use exact expec-
    tations and variances, but rather uses the large sample approximations in section
    4.6.4 of Rosenbaum (2002). Finally, method="AD" uses method="LS" for large
    strata and method="BU" for smaller strata.
Value

sc A vector of scored outcomes for one stratum. For instance, for Wilcoxon’s rank sum test, these would be the ranks of the outcomes in the current stratum.

z Treatment indicators, with length(z)=length(sc). Here, z[i]=1 if i is treated and z[i]=0 if i is control.

g The sensitivity parameter \( \Gamma \), where \( \Gamma \geq 1 \).

Note

The example is from Table 1, page 497, of Rosenbaum and Krieger (1990). The example is also Table 4.15, page 146, in Rosenbaum (2002). The data are originally from Skerfving et al. (1974).

Author(s)

Paul R. Rosenbaum

References


See Also

For binary responses, use the sensitivity2x2xk package. For matched responses, use one of the following packages: sensitivitymult, sensitivitymv, sensitivitymw, sensitivityfull.

Examples

```r
mercury<-c(5.3, 15, 11, 5.8, 17, 7, 8.5, 9.4, 7.8, 12, 8.7, 4, 3, 12.2, 6.1, 10.2,
100, 70, 196, 69, 370, 270, 150, 60, 330, 1100, 40, 100, 70,
150, 200, 304, 236, 178, 41, 120, 330, 62, 12.0)
z<-c(rep(0,16),rep(1,23))
CuCells<-c(2.7, .5, 0, 0, 5, 0, 0, 1.3, 0, 1.8, 0, 0, 1.0, 1.8,
0, 3.1, .7, 4.6, 0, 1.7, 5.2, 0, 5, 9.5, 2, 3, 1, 3.5,
2, 5, 5.5, 2, 3, 4, 0, 2, 2.2, 0, 2)

#Reproduces Rosenbaum and Krieger (1990), page 497
sen2sample(rank(mercury),z, gamma=5)

#Reproduces Rosenbaum and Krieger (1990), page 497
sen2sample(rank(CuCells),z, gamma=2)

(551.500000-492.334479)/sqrt(1153.775252) # Computation of the deviate

#Intermediate calculations: expectation and variance are in row 21.
evall(rank(CuCells),z,2,method="RK")

#The following three examples, if run, reproduce the
Sensitivity Analysis With Strata.

Description

Performs a sensitivity analysis with strata. The underlying method is described in Rosenbaum (2017), and the main example illustrates calculations from that paper. Use sen2sample() if there are no strata.

Usage

```r
senstrat(sc, z, st, gamma = 1, alternative = "greater", level = 0.05, method="BU", detail = FALSE)
```

Arguments

- `sc`: A vector of scored outcomes. For instance, these scored outcomes might be produced by the hodgeslehmann() function or the mscores() function. An error will result if `sc` contains NAs.
- `z`: Treatment indicators, with `length(z)=length(sc)`. Here, `z[i]=1` if `i` is treated and `z[i]=0` if `i` is control.
- `st`: Vector of stratum indicators, with `length(st)=length(sc)`. The vector `st` may be numeric, say 1, 2, ..., or it may be a factor. A factor will be converted to integers for computations. If there is only one stratum with data, then it is better to use sen2sample, not senstrat, and a warning will be given.
- `gamma`: The sensitivity parameter $\Gamma$, where $\Gamma \geq 1$.
- `alternative`: If `alternative="greater"`, then the test rejects for large values of the test statistic. If `alternative="less"` then the test rejects for small values of the test statistic. In a sensitivity analysis, it is safe but somewhat conservative to perform a two-sided test at level $\alpha$ by doing two one-sided tests each at level $\alpha/2$.
- `level`: The sensitivity analysis is for a test of the null hypothesis of no treatment effect performed with the stated level, conventionally `level=0.05`. If there is no treatment effect, so the null hypothesis is true, and if the bias in treatment assignment is at most $\Gamma$, then the chance that the sensitivity analysis will falsely reject the null hypothesis is at most 0.05 if `level=0.05`. It would be common to report that rejection of the null hypothesis at conventional `level=0.05` is insensitive to a bias of $\Gamma$ if this $\Gamma$ is the largest $\Gamma$ leading to rejection. Determining this largest
\( \Gamma \) would entail running \texttt{senstrat} several times with different values of \( \Gamma \). It is perfectly reasonable, if less conventional, to conduct a sensitivity analysis with some other level, say level=0.01, and this might be necessary if one were testing several hypotheses, correcting for multiple testing using the Bonferroni or Holm procedures.

**method**

If method="RK" or if method="BU", exact expectations and variances are used in a large sample approximation. Methods "RK" and "BU" should give the same answer, but "RK" uses formulas from Rosenbaum and Krieger (1990), while "BU" obtains exact moments for the extended hypergeometric distribution using the BiasedUrn package and then applies Proposition 20, page 155, section 4.7.4 of Rosenbaum (2002). In contrast, method="LS" does not use exact expectations and variances, but rather uses the large sample approximations in section 4.6.4 of Rosenbaum (2002). Finally, method="AD" uses method="LS" for large strata and method="BU" for smaller strata.

**detail**

If detail=FALSE, concise practical output is produced. The option detail=TRUE provides additional details about the computations, which may be useful in understanding the computations or in trouble shooting, but the additional details are not useful in data analysis.

**Details**

The method uses a Normal approximation to the distribution of the test statistic. If method is not "LS", then this approximation is suitable for either a few strata containing many people or for many strata each stratum containing only a few people. In contrast, method="LS" is useful only if every single stratum contains a large sample.

**Value**

**Conclusion**

An English sentence stating the conclusion of the sensitivity analysis. This sentence says whether the null hypothesis has been rejected at the stated level, defaulting to level=0.05, in the presence of a bias of at most \( \Gamma \). This statement is correct, if perhaps ever so slightly conservative. This statement should be understood as the conclusion produced by \texttt{senstrat}, with the remaining output being descriptive or approximate.

**Result**

Numeric results, including an approximate P-value, the deviate that was compared with the Normal distribution to produce the P-value, the test statistic formed as the sum of the scores for treated individuals, its null expectation and variance, and the value of \( \Gamma \).

**Description**

The number of nondegenerate strata used in computations and the total number of treated individuals and controls in those strata.

**StrataUse**

An English sentence stating whether all strata were used or alternatively describing degenerate strata that were not used. See the Note.

**LinearBound**

If detail=TRUE, then the Result above is labeled as the LinearBound; it is a safe but perhaps slightly conservative P-value.

**Separable**

If detail=TRUE, then separable approximation of Gastwirth et al. (2000) is reported; it is a slightly liberal P-value. In many if not most examples, LinearBound and Separable are in close agreement, so the issue of liberal versus
conservative does not arise. The stated Conclusion is based on the conservative LinearBound.

**Remark**
If detail=TRUE, then Remark contains an English sentence commenting upon the agreement of the LinearBound and the Separable approximation.

**lambda**
If detail=TRUE, then the values of the separable $\lambda(b)$ and the linear Taylor bound $\lambda(b) + \sum \eta_s$ from Rosenbaum (2017). The Remark above says there is agreement if these two quantities have the same sign.

**Note**
Strata that contain only treated subjects or only controls do not affect permutation inferences. These strata are removed before computations begin. Inclusion of these strata would not alter the permutation inference. A message will indicate whether any strata have been removed; see StrataUse in the value section above. You can avoid strata that do not contribute by using full matching in place of conventional stratification; see Rosenbaum (1991) and Hansen (2004) and R packages optmatch and sensitivityfull.

The output produces a rejection or acceptance of the null hypothesis at a stated level=$\alpha$ in the presence of a bias of at most $\Gamma$. This statement is entirely safe, in the sense that it is at worst a tad conservative, falsely rejecting a true null hypothesis with probability at most $\alpha$ in the presence of a bias of at most $\Gamma$. To produce a true P-value, you would need to run the program several times to find the smallest level=$\alpha$ that leads to rejection, and the P-value produced in this standard way would share the property of the test in being, at worst, slightly conservative. To save time, the output contains an approximate P-value that agrees with the accept/reject decision, but if this P-value is much smaller than the level – say, rejection at 0.05 with a P-value of 0.00048, then unlike the reject/accept decision, the 0.00048 P-value may not be conservative. I have never found the approximate P-value to be misleading. However, having seen an approximate P-value of 0.00048, it is easy to check whether you are formally entitled to reject at $\alpha=0.0005$ by rerunning the program with level=0.0005 and basing the conclusion on the reject/accept decision at level $\alpha=0.0005$.

When there are many small strata, Gastwirth, Krieger and Rosenbaum (2000, GKR) proposed a separable approximation to the sensitivity bound. In principle, this separable approximation is a tad liberal: it does not find the absolute worst unobserved covariate $u$, but rather a very bad $u$, such that as the number of strata increases the difference between the worst $u$ and the very bad $u$ becomes negligible. The current function senstrat() improves upon the separable approximation in the following way. This improvement is discussed in Rosenbaum (2017). It makes a one-step linear Taylor correction to the separable approximation which is guaranteed to be slightly conservative, rather than slightly liberal, so it is always safe to use: it falsely rejects at level=0.05 with probability at most 0.05 in the presence of a bias of at most $\Gamma$. More precisely, unlike the method of GKR, the one-step LinearBound correction does not require many small strata: in large samples, it falsely rejects at level=0.05 with probability at most 0.05 whether there are few or many strata, even if some of the strata are much larger than others. If detail=FALSE, conclusions are based on the LinearBound without further comments. This is reasonable, because the LinearBound is safe to use in all cases, being at worst slightly conservative. If detail=TRUE, the LinearBound and the Separable approximation are compared. Usually, the LinearBound and the Separable approximation yield conclusions that are very close, providing some reassurance that the LinearBound is not very conservative and the Separable approximation is not very liberal. The option detail=TRUE is an aid to someone who wants to understand the LinearBound, but it is not a tool required for data analysis.
Author(s)
Paul R. Rosenbaum

References


Rosenbaum, P. R. and Small, D. S. (2017) An adaptive Mantel-Haenszel test for sensitivity analysis in observational studies. Biometrics, 73, 422–430. <doi:10.1111/biom.12591> The 2x2x2 BRCA example from Satagopan et al. (2001) in this paper can be used to compare the senstrat() function and the mhLS() function in the sensitivity2x2xk package for the Mantel-Haenszel test. The 2x2x2 table is in the documentation for mhLS(), but must be reformatted as individual data for use by senstrat. With binary outcomes, the extreme unobserved covariate is known from theory. Not knowing this theory, senstrat() computes the same answer as mhLS() for gamma=7.


See Also
If outcomes are binary, then use the sensitivity2x2xk package. If there are no strata – that is, if everyone is in the same stratum, so there is a single stratum – then use the function sen2sample() in this package. If the strata are matched pairs or matched sets, then use one of the packages sensitivitymult, sensitivityfull, sensitivitymv, sensitivitymw.
Examples

data("homocyst")
attach(homocyst)
sc<-hodgeslehmann(log2(homocystine),z,stf,align="h1")
senstrat(sc,z,stf,gamma=1.8)
# Compare this with:
senstrat(sc,z,stf,gamma=1.8,detail=TRUE)
# With detail=TRUE, it is seen that the separable and Taylor bounds
# on the maximum P-value are nearly identical. The Taylor upper bound
# is safe -- i.e., at worst conservative -- in all cases.
detach(homocyst)
#
# The following example compares senmw in the sensitivitymw package
# to senstrat in an example with 397 matched triples, one treated,
# two controls. We expect the separable approximation to work well
# with S=397 small strata, and indeed the results are identical.
library(sensitivitymw)
data(mercury)
senmw(mercury,gamma=15)
# Reformats mercury for use by senstrat().
z<-c(rep(1,397),rep(0,397),rep(0,397))
st<-rep(1:397,3)
y<-as.vector(as.matrix(mercury))
sc<-mscores(y,z,st=st)
senstrat(sc,z,st,gamma=15,detail=TRUE)
# The separable approximation from senmw() and senstrat() are identical,
# as they should be, and the Taylor approximation in senstrat()
# makes no adjustment to the separable approximation.
#
# The following example from the sensitivitymw package
# is for 39 matched pairs, so the separable algorithm
# and the Taylor approximation are not needed, yet
# they both provide exactly the correct answer.
library(sensitivitymw)
data(erpcp)
senmw(erpcp,gamma=3)
# Reformats erpcp for use by senstrat().
z<-c(rep(1,39),rep(0,39))
st<-rep(1:39,2)
y<-as.vector(as.matrix(erpcp))
sc<-mscores(y,z,st=st)
senstrat(sc,z,st,gamma=3,detail=TRUE)

Description

Of limited interest to most users, the zeta function plays an internal role in 2-sample and stratified sensitivity analyses. The zeta function is equation (8), page 495, in Rosenbaum and Krieger (1990).
Usage

\texttt{zeta(bigN, n, m, g)}

Arguments

\texttt{bigN} \hspace{1cm} \text{Total sample size in this stratum.} \\
\texttt{n} \hspace{2cm} \text{Treated sample size in this stratum.} \\
\texttt{m} \hspace{2cm} \text{The number of 1’s in the vector u of unobserved covariates. Here, u has bigN-m} \\
\hspace{3cm} \text{0’s followed by m 1’s.} \\
\texttt{g} \hspace{2cm} \text{The sensitivity parameter } \Gamma, \text{ where } \Gamma \geq 1.

Value

The value of the zeta function.

Note

The zeta function is called by computep.

Author(s)

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References


Examples

\texttt{zeta(10, 5, 6, 2)}
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