Package ‘crank’

October 20, 2015

Version 1.1
Title Completing Ranks
Date 2015-10-20
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Description Functions for completing and recalculating rankings.
Imports stats
License GPL (>= 2)
NeedsCompilation no
Repository CRAN
Date/Publication 2015-10-20 07:41:31

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cats2ranks

Ordered option selections to ranks

Description
Convert ordered option selections to ranks, assigning the mean of unused ranks to unselected options.

Usage
cats2ranks(x, cats=NULL)

Arguments
x A matrix or data frame of numeric or characters labels for options. Rows are interpreted as cases or respondents and columns are interpreted as the order of option selections, beginning with the highest ranking (usually something like "Most important") and descending.
cats The range of numbers that represent options. The default is the vector of unique entries in ‘x’.

Details
‘cats2ranks’ converts ordered option selections to mean ranks. It is useful in the situation where a respondent is asked to select one of a number of options as the most important, another as the second most important, and so on. It counts the number of times each option code appears in each column and calculates the mean ranking of options. It is expected that there will be fewer selections available than there are options, thus creating the opportunity for biased rankings. This can occur when one or more options are not commonly chosen, but are given extreme (usually high) ranks when they are. The function calculates the mean of unallocated ranks and assigns this to all options not chosen by each respondent, correcting for this bias. The correction assumes that the respondent does not differentiate between unranked options, but these are all ranked lower than the options selected.

‘cats2ranks’ is especially useful when respondents do not select the same number of options. The mean of unallocated ranks is calculated for each respondent so that all options are entered into the calculation of mean ranks.

Note that ‘cats2ranks’ interprets each value in ‘x’ as a nominal level variable and its column index as the rank, while ‘meanranks’ interprets values as ordinal level (ranks). Thus if a matrix or data frame of ranks is passed to ‘cats2ranks’, it will not give the correct mean ranks or relative positions.

Value
A list with four components:
ranks The matrix of completed ranks.
fillArow

The vector of options as passed or calculated.
ranksum  The sum of ranks for each option.
rankcount The number of times each option was selected.

Author(s)
Jim Lemon

See Also
muranks, meanranks

Examples

# first a standard 1:m numerically coded selection
opchoice<-matrix(NA,nrow=40,ncol=5)
for(i in 1:40) opchoice[i,]<-sample(1:10,5)
opchoice
cats2ranks(opchoice)
# now a messy character choice with missing values
opchoice<-matrix(NA,nrow=40,ncol=5)
tencolors<-c("red", "green", "blue", "yellow", "magenta", "cyan", "purple", "orange", "brown", "pink")
for(i in 1:40) {
  nchoices<-sample(3:5,1)
  opchoice[i,1:nchoices]<-sample(tencolors,nchoices)
}
opchoice
cats2ranks(opchoice)

Description
Imputes a row of missing ranks using the Lim-Wolfe procedure

Usage
fillArow(x, ranksums=NA, Arow, maxcon=TRUE)

Arguments

x A matrix of ranks that may contain ties and NAs. Columns represent objects ranked and rows represent ranking methods.
ranksums The sums of ranks of all complete rows in ‘x’.
Arow The row of ‘x’ that is to be completed.
maxcon Whether to impute rankings maximally consistent with the existing ones (TRUE) or minimally consistent (FALSE).
fillArows

Details

‘fillArow’ imputes missing ranks in the row designated by ‘Arow’ using the information in ‘ranksums’.
If the ranks already completed provide information on the order of imputation, that is used directly
for imputed ranks of maximal consistency or inversely for imputed ranks of minimal consistency.
If the existing ranks do not provide such information, the missing ranks are permuted, and a list
of matrices with all the permutations is substituted. This may involve a recursive call to ‘fillArow’
and produce a nested list of matrices. See Lim and Wolfe (2002) for details of this process.

Value

The matrix ‘x’ with row ‘Arow’ completed or a list of such matrices, possibly nested.

Author(s)

Jim Lemon

References


See Also

lwscreen, listBuilder, fillArows

Examples

# The first example matrix from Lim and Wolfe (2002)
lwmat<-matrix(c(3,1,2,4,NA,2,1,NA,2,NA,1,NA),nrow=3,byrow=TRUE)
# complete the second row with maximal consistency
fillArow(lwmat,lwmat[1,],2)
# now with minimal consistency
fillArow(lwmat,lwmat[1,],2,maxcon=FALSE)

fillArows  Impute ranks using the existing values of rankings

Description

Imputes missing ranks using the Lim-Wolfe procedure

Usage

fillArows(x,maxcon=TRUE)
Arguments

x A matrix of ranks that may contain ties and NAs. Columns represent objects ranked and rows represent ranking methods.

maxcon Whether to impute rankings maximally consistent with the existing ones (TRUE) or minimally consistent (FALSE).

Details

‘fillArows’ imputes missing ranks by examining the completed ranks for each set of rows that have the same number of missing ranks. If more than one row has the minimum number of missing values, the order of these rows is permuted and the matrix ‘x’ becomes a list of matrices in which the values in the rows will be imputed in different orders. Another level of permutation and multiplication of matrices may occur in ‘fillArow’ to which the matrices are passed for the actual imputation. The function ‘getLWargs’ is called to get the arguments for ‘fillArow’. See Lim and Wolfe (2002) for details of this process.

Value

A list of one or more completed matrices of ranks, possibly nested.

Author(s)

Jim Lemon

References


See Also

lwscreen, getLWargs, fillArow

Examples

# The first example matrix from Lim and Wolfe (2002)
lwmat<-matrix(c(3,1,2,4,NA,2,1,NA,2,NA,1,NA),nrow=3,byrow=TRUE)
# complete with maximal consistency, permuting row order
fillArows(lwmat)
# now with minimal consistency as above
fillArows(lwmat,maxcon=FALSE)
getLWargs  Get the information about a matrix of ranks.

Description
Get the information required for imputing missing ranks.

Usage
getLWargs(x)

Arguments
x  A matrix of ranks, usually containing missing values.

Details
‘getLWargs’ calculates the information required for ‘fillArows’ and ‘fillARow’ to impute the missing ranks in a matrix.

Value
A list containing the following:

- ranksums  The column sums of the complete rows of the matrix.
- Arows  The indices of the row(s) with the minimal number of missing values.
- nArows  The number of Arows.
- Brows  The indices of the complete rows.

Author(s)
Jim Lemon

See Also
listBuilder

Examples
# The first example matrix from Lim and Wolfe (2002)
lwmat<-matrix(c(3,1,2,4,NA,2,1,NA,2,NA,1,NA),nrow=3,byrow=TRUE)
getLWargs(lwmat)
**listBuilder**  

Build a possibly nested list using the result of a function.

**Usage**

```r
listBuilder(x,FUN=NULL,fargs=NULL)
```

**Arguments**

- `x` The object that will be the first argument of ‘FUN’, or a possibly nested list of such objects.
- `FUN` A function that can accept ‘x’ as its first argument.
- `fargs` A list of the remaining arguments to ‘FUN’.

**Details**

‘listBuilder’ descends the list structure of ‘x’ if it is a list until it encounters a non-list element. It then passes that element as the first argument to ‘FUN’ and returns the value of ‘FUN’. This may be a list of elements, replacing the original element, hence the name.

**Value**

If ‘x’ is not a list and ‘FUN’ is NULL, ‘x’ is returned. If ‘FUN’ creates a list from one or more elements of ‘x’, a list or nested list will be returned. Successive calls to ‘listBuilder’ can rapidly create very large, deeply nested list structures.

**Author(s)**

Jim Lemon

**See Also**

- `list`

**Examples**

```r
# define a function that splits a vector into a list
splitvec<-function(x) {
  xlen<-length(x)
  if(xlen > 1) {
    newx<-vector("list",xlen)
    for(newlist in 1:xlen) newx[[newlist]]<-x[newlist]
    return(newx)
  }
}
```
listCrawler

Descend a list, applying a function to each element.

Description
Descend a possibly nested list, seeking the element that has the extreme value of a function.

Usage

```r
listCrawler(x,FUN=NULL,maxval=TRUE,
          retval=list(indx=vector("numeric",0),element=NULL,value=NA))
```

Arguments

- `x` The object that will be the first argument of ‘FUN’, or a possibly nested list of such objects.
- `FUN` A function that can accept ‘x’ as its first argument.
- `maxval` Whether to look for maximal (TRUE) or minimal (FALSE) values of the function ‘FUN’.
- `retval` The list that is eventually returned.

Details
‘listCrawler’ descends the list structure of ‘x’ applying ‘FUN’ to any non-list elements it encounters. If the value of ‘FUN’ is larger or smaller than the current extremum (depending upon the value of ‘maxval’), the new value becomes the current extremum. The default value of ‘FUN’ just takes the value of the elements.

Value

A list containing:

- `indx` the indices of the element producing the extreme value of ‘FUN’.
- `element` The element that produced the extremum.
- `value` The extreme value of ‘FUN’.

Author(s)

Jim Lemon

See Also

list, listBuilder
Examples

# a simple example using the square root function
testlist<-list(list(9,16),list(25,list(36,49)))
# first get the default maximum
listCrawler(testlist,sqrt)
# then the minimum
listCrawler(testlist,sqrt,maxval=FALSE)

Description

Wrapper for the Friedman test function.

Usage

lw.FriedmanTest(x)

Arguments

x A matrix of ranks.

Details

Calls `friedman.test` and returns a vector containing the statistic and p value.

Value

The statistic and p value returned by `friedman.test`.

Author(s)

Jim Lemon

See Also

friedman.test
## lwscreen

**Impute ranks using the existing values of rankings**

### Description
Completes a matrix with missing ranks for the values maximally and minimally consistent with existing values using the Lim-Wolfe procedure.

### Usage

```r
lwscreen(x, scrtest = "lw.FriedmanTest")
```

### Arguments
- **x**: A matrix of ranks that may contain ties and NAs. Columns represent objects ranked and rows represent ranking methods.
- **scrtest**: What test to use to determine the maximally and minimally consistent imputed values.

### Details
- `'lwscreen` calls `fillArows` to impute the missing ranks in the matrix `x`. It then applies `scrtest` to all the matrices returned and finds the minimum and maximum values. See Lim and Wolfe (2002) for details of the algorithm.
- The algorithm for finding the maximally consistent and inconsistent rank imputations is extremely computer intensive, creating large numbers of permuted matrices when tied ranksums or multiple rows with the same number of missing values are encountered. The APA election example in Lim and Wolfe (2002) is beyond the capability of the average PC in the present implementation.

### Value
The maximal and minimal statistics and p values for the list of completed rank matrices obtained.

### Author(s)
Jim Lemon

### References

### See Also
- `lw.FriedmanTest`, `listBuilder`, `fillArows`
meanranks

Examples

# The first example matrix from Lim and Wolfe (2002)
lwmat<-matrix(c(3,1,2,4,NA,2,1,NA,2,NA,1,NA),nrow=3,byrow=TRUE)
lwscreen(lwmat)

Description

Calculate mean ranks with possible missing values

Usage

meanranks(x,allranks=NULL,labels=NULL,rankx=FALSE)

Arguments

x A matrix of ranks that may contain ties and NAs. Objects ranked are assumed to be columns and ranking methods rows.
allranks An optional list of all ranks that might have been made.
labels Optional labels for the ranks.
rankx Whether to convert competition ranks, or any other set of numeric values, into the usual mean rankings for ties.

Details

‘meanranks’ calls ‘muranks’ to complete the rank matrix before calculating the mean ranks for each column if there are any NAs in ‘x’.

Note that ‘cats2ranks’ interprets each value in ‘x’ as a nominal level variable and its index as the rank, while ‘meanranks’ interprets values as ordinal level (ranks). Thus if a matrix or data frame of category labels is passed to ‘meanranks’, it will not give the correct mean ranks.

Value

A list with the following components:

ranks ‘x’ with any NAs replaced by the mean of unallocated ranks for each row.
labels The vector of labels, defaulting to the integers 1:allranks.
mean.ranks A vector of mean ranks for each value of allranks.

Author(s)

Jim Lemon
See Also

muranks, rank, cats2ranks

Examples

# simulate "best/worst" ranking
x<-matrix(NA,nrow=10,ncol=10)
for(i in 1:10) {
  nbest<-sample(2:5,1)
  best<-1:nbest
  nworst<-sample(1:5,1)
  worst<-((11-nworst):10
  rankpos<-sample(1:10,nbest+nworst)
  x[i,rankpos]<-c(best,worst)
}
x
meanranks(x)

muranks

Complete a matrix of rankings

Description

Fills an incomplete matrix of rankings with means of unallocated ranks

Usage

muranks(x,allranks=NULL,rankx=FALSE)

Arguments

x A vector or matrix of rankings that may contain ties and NAs. Objects ranked are assumed to be columns and ranking methods rows.
allranks An optional list of all ranks that might have been allocated. Defaults to the unique values in ‘x’.
rankx Whether to apply the ‘rank’ function (see Details).

Details

‘muranks’ assumes that the values in ‘x’ are rankings with values in the set ‘allranks’ or if that is NULL, between 1 and the number of columns or values in ‘x’. If any values in ‘x’ are outside this range, or if the missing ranks are not sequential, the function will drop that row with a warning.

For each row, the function finds the mean of those ranks in ‘allranks’ that were not allocated and substitutes that value for any missing values in the row.

If ‘rankx’ is TRUE, each row is passed to ‘rank’. This will convert competition ranks or any set of numbers to the usual mean rankings. This will also override the rejection of rows in which the missing ranks are not sequential, and may produce counterintuitive imputed ranks.
Value

A matrix similar to ‘x’ in which any NAs are replaced by the mean of unallocated ranks for each row.

Note

‘muranks’ will impute ranks for "best/worst" ranking, where the method (rater) allocates the highest ranks to the most preferred data objects and the lowest ranks to the least preferred. The mean of all unallocated ranks is imputed for unranked data objects. It is assumed that unranked data objects are considered less preferred than those allocated high ranks, more preferred than those allocated low ranks, and not differentiated from each other. If this assumption is not satisfied, ‘muranks’ will warn the operator that one or more rows have been dropped. To explain this behavior, consider the case in which a method allocates the ranks 1,2,3,5,7,8 to eight data objects. Two ranks have not been allocated, 4 and 6. It would be possible to impute the mean, 5, to both, but this ignores the implicit information that the two data objects were differentiated by the rank 5, which is "between" them. Only in the unlikely case that both were considered equivalent to the object ranked 5 would this be correct, as there is no way to establish which was more or less preferred. The operator should be aware that if ‘rankx’ is TRUE, the unranked objects will be allocated the lowest ranks, which is unlikely to be correct.

Author(s)

Jim Lemon

See Also

meanranks,rank

Examples

```r
# simulate ranking from the top with variable completion
x <- matrix(NA, nrow = 10, ncol = 10)
for (i in 1:10) {
  nx <- sample(2:10, 1)
  xx <- sample(1:10, nx)
  x[i, xx] <- 1:nx
}
x
muranks(x)
```

Description

calculates the Page test for ordered alternatives.
Usage

`page.trend.test(x, ranks=TRUE)`

Arguments

- `x`: a 2D matrix of ranks or observations.
- `ranks`: Whether the values in `x` are ranks or observations.

Details

`page.trend.test` will accept a matrix of ranks where the rows represent methods (usually raters) and the columns represent related data objects. It apparently handles ties, but not missing values. For small values of `k` (methods) or `N` (data objects), `page.trend.test` will try to look up the tabled values (as in Siegel & Castellan (1988) for significance. For `'k,N > 3,20'` or `'k,N > 4,10,12'`, a normal approximation is returned. Only one of these values will be returned.

If `ranks` is FALSE, the function ranks the values in `x` and then calculates the test. If the values are already ranks, it usually makes no difference.

Value

- `ranks`: matrix of ranks
- `mean.ranks`: mean ranks of data objects
- `L`: value of the L statistic
- `p.table`: whether the obtained L exceeded the table value for small `k,N`
- `Z`: The normal approximation for larger `k,N`
- `pZ`: the probability of the obtained normal value for larger `k,N`

Note

The Page test for ordered alternatives is slightly more powerful than the Friedman analysis of variance by ranks.

Author(s)

Jim Lemon - thanks to Mikhail Trofimov for discovering a major error in the function and supplying the correction

References

permute

Examples

# Craig's data from Siegel & Castellan, p 186
soa.mat<-matrix(c(.797,.873,.888,.923,.942,.956,
.794,.772,.908,.982,.946,.913,
.838,.801,.853,.951,.883,.837,
.815,.801,.747,.859,.887,.902),nrow=4,byrow=TRUE)
page.trend.test(soa.mat)

Description

Permute the values contained in a vector.

Usage

permute(x)

Arguments

x The vector of values that are to be permuted.

Details

`permute` calculates the number of permutations and creates a matrix with that number of rows. It fills the first column with the elements of `x` in groups large enough to cover the permutations of a vector with one less value. It then fills the remaining columns by calling itself with all values except the one in the first row of the current block. If `x` has only two values, it returns the trivial permutation of `x` and its reverse.

Value

A matrix in which each row is a permutation of the values in `x`.

Author(s)

Jim Lemon

See Also

fillArows, fillArow

Examples

permute(c(5,8,3,9))
print.cats2ranks  

Print the result of cats2ranks

Description

Print the result of cats2ranks.

Usage

```r
## S3 method for class 'cats2ranks'
print(x, ...)
```

Arguments

- `x`: The result of `cats2ranks`.
- `...`: a dummy argument to keep S3 methods happy

Details

Displays the names and mean ranks of the output of `cats2ranks` in order of numerically ascending ranks.

Value

`nil`

Author(s)

Jim Lemon

See Also

cats2ranks

print.lwstat  

Print the result of lwscreen

Description

Print the result of lwscreen.

Usage

```r
## S3 method for class 'lwstat'
print(x, ...)
```
**print.meanranks**

**Arguments**
- `x` : The result of `lwscreen`.
- `...` : a dummy argument to keep S3 methods happy

**Details**
Displays the output of `lwscreen`.

**Value**
`nil`

**Author(s)**
Jim Lemon

**See Also**
- `lwscreen`
- `printNmeanranks`

---

**Description**
Print the result of meanranks.

**Usage**
```r
## S3 method for class 'meanranks'
print(x,...)
```

**Arguments**
- `x` : The result of meanranks.
- `...` : a dummy argument to keep S3 methods happy

**Details**
Displays the names and mean ranks of the output of `meanranks` in order of numerically ascending ranks.

**Value**
`nil`
print.page.trend.test

Author(s)

Jim Lemon

See Also

meanranks

print.page.trend.test  prints the L statistic for Page’s trend test

Description

prints the obtained L statistic and the associated probability for the normal approximation if the sample size is sufficiently large

Usage

### S3 method for class ‘page.trend.test’
print(x,...)

Arguments

x  an object returned from ‘page.trend.test’

... arguments to be passed to ‘print’

Value

nil

Author(s)

Jim Lemon
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