Package ‘MultiOrd’

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MultiOrd-package  

**Generation of multivariate ordinal data.**

**Description**

A package for multivariate ordinal data generation given marginal distributions and correlation matrix based on the methodology proposed by Demirtas (2006).

**Details**

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<th>MultiOrd</th>
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</thead>
<tbody>
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</tbody>
</table>

This package can be used to generate multivariate ordinal data. Two main input required are the matrix of marginal probabilities of each variable and the correlation matrix of the ordinal variables. Due to the limitation on the magnitude of the binary correlations which depends on the marginal probabilities, off-diagonal entries of ordinal correlation matrix are not free to vary between -1 and 1.

The main function in this package is `gen0rd` which generates the multivariate ordinal data. Another important function is `simBinCorr` which calculates the intermediate binary correlation.

**Author(s)**

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**References**


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**BinToOrd**  

**Converts multivariate binary data to multivariate ordinal data**

**Description**

Converts multivariate binary data to multivariate ordinal data using original ordinal probabilities.
**Usage**

BinToOrd(prop.vec.bin, ordPmat, Mlocation, bin.data)

**Arguments**

- **prop.vec.bin**: Vector of marginal probabilities. It is usually a first component of the list returned by `find.binary.prob`
- **ordPmat**: Input matrix of ordinal marginal probabilities
- **Mlocation**: Vector of locations where dichotomization is done. It is usually a second component of the list returned by `find.binary.prob`
- **bin.data**: Matrix of binary data generated using `generate.binary`

**Details**

As a part of the multivariate ordinal data generation, intermediate multivariate binary data are generated. This function converts multivariate binary data generated by `generate.binary` to the multivariate ordinal data.

**Value**

- **y**: Matrix of multivariate ordinal data
- **Corr**: Correlation matrix of y

**Examples**

```r
## Not run: nObs = 1000; no.rows = 100000
## Not run: ordPmat1 = matrix( c(0.15,0.70,0.40,
0.55,0.10,0.25,
0.25,0.10,0.15,
0.05,0.10,0.20),3,3,byrow=TRUE)
## End(Not run)

## Not run: \ cmat1= matrix( c(1,0.2,0.2,
0.2,1,0.2,
0.2,0.2,1),3,3,byrow=TRUE)
## End(Not run)

## Not run: binObj = simBinCorr(ordPmat1, cmat1, no.rows)
## Not run: ep0 = generate.binary( nObs, binObj$pvec, binObj$del.next)
## Not run: Mydata= BinToOrd(binObj$pvec, ordPmat1, binObj$Mlocation, ep0)
```
compute.sigma.star

Computes the tetrachoric correlation matrix. If it is non-positive definite, a nearest positive definite matrix is used.

Description

It computes the tetrachoric correlation matrix using the algorithm described in Emrich and Piedmonte (1991). If the resulting matrix is non-positive definite, a nearest positive definite matrix is returned and the warning message will be printed.

Usage

compute.sigma.star(prop.vec.bin, corr.mat)

Arguments

- prop.vec.bin: Vector of marginal probabilities
- corr.mat: Correlation matrix of the binary data

Value

Tetrachoric correlation matrix

See Also

phi2tetra and nearPD

conformity.Check

Checks whether the dimension of marginal probability matrix matches the dimension of correlation matrix.

Description

Checks whether the dimension of marginal probability matrix matches the dimension of correlation matrix.

Usage

conformity.Check(ordPmat, CorrMat)

Arguments

- ordPmat: Input matrix of ordinal marginal probabilities
- CorrMat: Correlation matrix of the multivariate ordinal data.
find.binary.prob  

Collapses the ordinal categories to binary ones

Description

Collapses the ordinal categories to binary ones and counts the number of categories in each variable.

Usage

```r
find.binary.prob(ordpmat)
```

Arguments

- `ordpmat`  
  Input matrix of ordinal marginal probabilities.

Value

- `p`  
  Vector of binary probabilities
- `mlocation`  
  Vector of points where ordinal variables will be dichotomized

See Also

- `validation.ordpmat`

Examples

```r
## Not run:
ordpmat1 = matrix( c(0.15,0.70,0.40,  
                      0.55,0.10,0.25,  
                      0.25,0.10,0.15,  
                      0.05,0.10,0.20),4,3,byrow=TRUE)
find.binary.prob(ordpmat1)

## End(Not run)
```

generate.binary  

Generates multivariate binary data given marginal probabilities and correlation.

Description

Usage

generate.binary(nObs, prop.vec.bin, corr.mat)

Arguments

nObs Number of observations
prop.vec.bin Vector of binary marginal probabilities
corr.mat correlation matrix of the binary data

Details

It generates multivariate binary data from the marginal probabilities and correlation matrix. It uses the algorithm described in Emrich and Piedmonte (1991). In the process, if the tetrachoric correlation matrix is non-positive definite, a nearest positive definite matrix is used.

Value

data Matrix of multivariate binary data

See Also

nearPD, compute.sigma.star

Examples

## Not run: ordPmat1 = matrix( c(0.15,0.70,0.40,
0.55,0.10,0.25,
0.25,0.10,0.15,
0.05,0.10,0.20),4,3,byrow=TRUE)
## End(Not run)
## Not run: cmat1= matrix( c(1,0.2,0.2,
0.2,1,0.2,
0.2,0.2,1),3,3,byrow=TRUE)
## End(Not run)
## Not run: p=find.binary.prob(ordPmat1)
## Not run: finalCorr = simBinCorr(ordPmat1, cmat1, no.rows=100000)
## Not run: y=generate.binary( 1000, p&p, finalCorr$del.next)

---

Description

Generates multivariate ordinal data from the ordinal marginal probabilities and a list returned by the simBinCorr function.
Usage

    genOrd(no.rows, ordPmat, binObj)

Arguments

    no.rows           Number of rows
    ordPmat           Input matrix of ordinal marginal probabilities
    binObj            A list returned by the simBinCorr

Details

    It generates multivariate ordinal data. The argument binObj must be obtained using simBinCorr before executing this function.

Value

    mydata             A list with two components. Two components are a matrix of multivariate ordinal data (y) and its correlation matrix (Corr)

See Also

    simBinCorr, BinToOrd, generate.binary

Examples

    ## Not run: ordPmat1 = matrix( c(PN1U,PN7P,PNTP,  
    0.55,0.10,0.25,     
    0.25,0.10,0.15,     
    0.05,0.10,0.20),4,3,byrow=TRUE)  
    ## End(Not run)  
    ## Not run: cmat1= matrix( c(1,PNR,PNR,  
    0.2,1,0.2,     
    0.2,0.2,1),3,3,byrow=TRUE)  
    ## End(Not run)  
    ## Not run: binObj=simbincorr(ordPmat1, cmat1, noNrows=100000, steps=PNPRU)  
    ## Not run: myData = genOrd( 1000, ordPmat1, binObj)

---

simBinCorr

Calculates intermediate binary correlation matrix

Description

    Calculates intermediate binary correlation matrix via simulation.

Usage

    simBinCorr(ordPmat, CorrMat, no.rows, steps = 0.025)
validation.CorrMat

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ordpmat</td>
<td>Input matrix of ordinal marginal probabilities</td>
</tr>
<tr>
<td>CorrMat</td>
<td>Correlation matrix of the multivariate ordinal data</td>
</tr>
<tr>
<td>noNrows</td>
<td>Number of rows to use to calculate intermediate binary correlation matrix</td>
</tr>
<tr>
<td>steps</td>
<td>Fraction of difference between the current and target matrix to be added in each iteration.</td>
</tr>
</tbody>
</table>

Value

<table>
<thead>
<tr>
<th>Value</th>
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</tr>
</thead>
<tbody>
<tr>
<td>del.next</td>
<td>Calculated binary correlation matrix</td>
</tr>
<tr>
<td>Mlocation</td>
<td>Cutoff point for converting ordinal probabilities to binary ones.</td>
</tr>
<tr>
<td>pvec</td>
<td>Vector of binary probabilities</td>
</tr>
</tbody>
</table>

See Also

generate.binary, BinToOrd

Examples

```r
## Not run: ordpmat1 = matrix( c(PN1U,PN7P,PNTP,
0.55,0.10,0.25,
0.25,0.10,0.15,
0.05,0.10,0.20),4,3,byrow=TRUE)
## End(Not run)
## Not run: cmat1= matrix( c(1,0.2,0.2,
0.2,1,0.2,
0.2,0.2,1),3,3,byrow=TRUE)
## End(Not run)
## Not run: simBinCorr(ordpmat1, cmat1, no.rows=100000, steps = 0.025)
```

validation.CorrMat  Validates input correlation matrix

Description

Checks symmetry, positive definiteness, conformity and range of the correlation matrix.

Usage

validation.CorrMat(prop.vec.bin, CorrMat)

Arguments

<table>
<thead>
<tr>
<th>Argument</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>prop.vec.bin</td>
<td>Vector of binary (converted from ordinal) marginal probabilities</td>
</tr>
<tr>
<td>CorrMat</td>
<td>Correlation matrix to be validated</td>
</tr>
</tbody>
</table>
validation.ordPmat

Details

This function checks the correlation matrix for basic properties of correlation matrix, such as symmetry and positive definiteness. In addition it verifies that all the correlations are in valid range for the calculated binary marginal probabilities. Range violation error message indicates that ordinal data with the specified correlations cannot be generated due to distributional constraints.

See Also

find.binary.prob

validation.ordPmat Validates matrix of ordinal probabilities

Description

Validates the range of input matrix of marginal probabilities. It also counts the ordinal categories for each variable.

Usage

validation.ordPmat(ordPmat)

Arguments

ordPmat Matrix of marginal probabilities.

Details

Number of columns of input matrix is the number of variables and each column contains probability of each category within each variable. Any probability with 0 value must be entered at the end of corresponding column. For example if a column contains c(0.3,0.5,0.2,0), then it is assumed that particular variable has only 3 (1, 2 and 3) categories.

Value

J Number of ordinal variables
K Vector of number of categories for each variable

Examples

## Not run:
# 3 outcomes with 3, 4 and 4 categories.
ordPmat1 = matrix( c(0.15,0.70,0.40,
0.55,0.10,0.25,
0.30,0.10,0.15,
0,0.10,0.20),4,3,byrow=TRUE)
validation.ordPmat(ordPmat1)
## End (Not run)
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