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

Package: MultiOrd
Type: Package
Version: 2.1
Date: 2014-03-05
License: GPL-2

This package can be used to generate multivariate ordinal data. Two main input required are 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.

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References


BinToOrd

Description

Converts multivariate binary data to multivariate ordinal data.

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; nSim = 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),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: binObj = simBinCorr(ordPmat1, cmat1, nSim)  
## 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**

```r
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**

[phi2poly](#) 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**

```r
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

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

generate.binary

Generates multivariate binary data given marginal probabilities and correlation.

Description

Usage

generate.binary(no.rows, prop.vec.bin, corr.mat)

Arguments

no.rows 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 correla-
tion 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: ordMat1 = matrix( c(0.15,0.70,0.10, 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(ordMat1)
## Not run: finalCorr = simBinCorr(ordMat1, cmat1, nSim=100000)
## Not run: y=generate.binary( 1000, p&p, finalCorr$del.next)

---

genOrd

Generates multivariate ordinal data from binary parameters

Description

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

    genord(nobs, ordpmat, binObj)

Arguments

- **nobs**: 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 calculated 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

```r
CC not run: ordpmat1 = matrix( c(PN1U,PN7P,PNTP,
    PNUU,PN1P,PNRU,
    PN1P,PNTP,PN1U,
    PNPU,PN1P,PNRP),T,S,byrow=true)
CC end(not run)
CC not run: cmat1= matrix( c(1,PNR,PNR,
    PNR,1,PNR,
    PNR,PNR,1),S,S,byrow=true)
CC end(not run)
CC not run: binobj=simbincorr(ordpmat1, cmat1, nsim=1PPPPP, steps=PNPRU)
CC not run: mydata = genord( 1PPP, ordpmat1, binobj)
```

---

**simBinCorr**

*Calculates intermediate binary correlation matrix*

Description

Calculates intermediate binary correlation matrix via simulation.

Usage

    simBinCorr(ordPmat, CorrMat, nSim, steps = 0.025)
validation.CorrMat

Arguments

ordPmat
Input matrix of ordinal marginal probabilities

CorrMat
Correlation matrix of the multivariate ordinal data

nSim
Number of simulations to use to calculate intermediate binary correlation matrix

steps
Fraction of difference between the current and target matrix to be added in each iteration.

Value

del.next
Calculated binary correlation matrix

mlocation
Cutoff point for converting ordinal probabilities to binary ones.

pvec
Vector of binary probabilities

See Also

generate.binary, BinToOrd

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,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,byrow=true)
## End(Not run)
## Not run: simBinCorr(ordPmat1, cmat1, nSim=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

prop.vec.bin
Vector of binary (converted from ordinal) marginal probabilities

CorrMat
Correlation matrix to be validated
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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