Package ‘PoisBinOrd’

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Title Data Generation with Poisson, Binary and Ordinal Components
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Description Generation of multiple count, binary and ordinal variables simultaneously given the marginal characteristics and association structure. Throughout the package, the word 'Poisson' is used to imply count data under the assumption of Poisson distribution.
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Description

Provides R functions for generation of multiple count, binary and ordinal variables simultaneously given the marginal characteristics and association structure.

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PoisBinOrd package consists of ten functions. The functions validation.bin, validation.ord, and validation.corr validate the specified quantities to avoid users from obvious specification errors. correlation.limits returns the lower and upper bounds of the pairwise correlation of Poisson-Poisson, Poisson-binary, Poisson-ordinal, binary-binary, binary-ordinal, and ordinal-ordinal combinations given their marginal distributions, i.e. returns the range of feasible pairwise correlations. The function correlation.bound.check checks the validity of the values of pairwise correlations. The functions intermediate.corr.PP, intermediate.corr.BO, and intermediate.corr.P_BO computes intermediate correlation matrix for Poisson-Poisson combinations, binary/ordinal and binary/ordinal combinations, and Poisson and binary/ordinal combinations, respectively. The function overall.corr.mat assembles the final correlation matrix. The engine function gen.PoisBinOrd generates mixed data in accordance with the specified marginal and correlational quantities. Throughout the package, variables are supposed to be inputted in a certain order, namely, first count variables, next binary variables, and then ordinal variables should be placed.

Author(s)

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References

correlation.bound.check


**correlation.bound.check**

*Checks if the pairwise correlation among variables are within the feasible range*

**Description**

This function checks if there are range violations among correlation of Poisson-Poisson, Poisson-binary, Poisson-ordinal, binary-binary, binary-ordinal, and ordinal-ordinal combinations.

**Usage**

```r
```

**Arguments**

- `n.P`: Number of Poisson variables.
- `n.B`: Number of binary variables.
- `n.O`: Number of ordinal variables.
- `lambda.vec`: Rate vector for Poisson variables.
- `prop.vec`: Probability vector for binary variables.
- `prop.list`: A list of probability vectors for ordinal variables.
- `corr.vec`: Vector of elements below the diagonal of correlation matrix ordered column-wise.
- `corr.mat`: Specified correlation matrix.

**Value**

The function returns TRUE if no specification problem is encountered. Otherwise, it returns an error message.

**References**


**See Also**

`validation.corr`, `correlation.limits`
correlation.limits

Computes lower and upper correlation bounds for each pair of variables

Description
This function computes lower and upper limits for pairwise correlations of Poisson-Poisson, Poisson-binary, Poisson-ordinal, binary-binary, binary-ordinal, and ordinal-ordinal combinations.

Usage


Arguments

<table>
<thead>
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<tr>
<td>n.P</td>
<td>Number of Poisson variables.</td>
</tr>
<tr>
<td>n.B</td>
<td>Number of binary variables.</td>
</tr>
<tr>
<td>n.O</td>
<td>Number of ordinal variables.</td>
</tr>
<tr>
<td>lambda.vec</td>
<td>Rate vector for Poisson variables</td>
</tr>
<tr>
<td>prop.vec</td>
<td>Probability vector for binary variables.</td>
</tr>
<tr>
<td>prop.list</td>
<td>A list of probability vectors for ordinal variables.</td>
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correlation.limits

Details

While the function computes the exact lower and upper bounds for pairwise correlations among binary-binary variables as formulated in Demirtas et al. (2012), it computes approximate lower and upper bounds for pairwise correlations among Poisson-Poisson, Poisson-binary, Poisson-ordinal, binary-ordinal, and ordinal-ordinal variables through the method suggested by Demirtas and Hedeker (2011).

Value

The function returns a matrix of size \((n.P + n.B + n.O)*(n.P + n.B + n.O)\), where the lower triangular part of the matrix contains the lower bounds and the upper triangular part of the matrix contains the upper bounds of the feasible correlations.

References


See Also

validation.corr.correlation.bound.check

Examples

```r
## Not run:
n.P<3
n.B<2
n.O<3
lambda.vec<-c(1,2,3)
prop.vec<-c(0.3,0.5)
prop.list<-list(c(0.3,0.6),c(0.25,0.5,0.75),c(0.1,0.2,0.8,0.9))

#Correlation limits among Poisson variables
correlation.limits(n.P,n.B=0,n.O=0, lambda.vec,prop.vec=NULL, prop.list=NULL)

#See also Cor.PP.Limit in R package PoisNor

#Correlation limits among binary variables
correlation.limits(n.P=0,n.B=0,n.O=0,lambda.vec=NULL, prop.vec, prop.list=NULL)

#See also correlation.limits in R package BinNonNor

#Correlation limits among ordinal variables
correlation.limits(n.P=0,n.B=0,n.O=0,lambda.vec=NULL, prop.vec=NULL, prop.list)

#See also Limit_forOO in R package OrdNor

#Correlation limits among Poisson and binary variables and within themselves.
correlation.limits(n.P,n.B,n.O=0,lambda.vec, prop.vec, prop.list=NULL)
```
**Description**

This function simulates a sample of size \( n \) from a set of multivariate Poisson, binary, and ordinal data with pre-specified marginals and a correlation matrix.

**Usage**

\[
\text{gen.PoisBinOrd}(n, n.P, n.B, n.O, \text{lambda.vec} = \text{NULL}, \text{prop.vec} = \text{NULL}, \text{prop.list} = \text{NULL}, \text{final.corr.mat})
\]

**Arguments**

- \( n \): Number of variates.
- \( n.P \): Number of Poisson variables.
- \( n.B \): Number of binary variables.
- \( n.O \): Number of ordinal variables.
- \( \text{lambda.vec} \): Rate vector for Poisson variables.
- \( \text{prop.vec} \): Probability vector for binary variables.
- \( \text{prop.list} \): A list of probability vectors for ordinal variables.
- \( \text{final.corr.mat} \): Final correlation matrix produced from \( \text{overall.corr.mat} \).

**Value**

A matrix of size \( n \times (n.P + n.B + n.O) \), of which the first \( n.P \) columns are Poisson variables, the next \( n.B \) columns are binary variables, and the last \( n.O \) columns are ordinal variables.
Examples

```r
## Not run:
n=100
n.P<-2
n.B<-2
n.0<-2
lambda.vec<-sample(10,2)
prop.vec<-runif(2)
prop.list<-list(c(0.3,0.6,0.7),c(0.2,0.3,0.5))
corr.mat=matrix(0.4,6,6)
diag(corr.mat)=1
final.corr.mat=overall.corr.mat(n.P, n.B, n.0, lambda.vec, prop.vec, prop.list,
corr.vec = NULL, corr.mat)
mymixdata=gen.PoisBinOrd(n, n.P, n.B, n.0, lambda.vec, prop.vec, prop.list,
final.corr.mat)
```

## End(Not run)

intermediate.corr.BO

Computes an intermediate normal correlation matrix for any combination of binary and ordinal variables given the specified correlation matrix.

**Description**

Computes an intermediate normal correlation matrix for any combination of binary and ordinal variables before dichotomization/ordinalization given the specified correlation matrix as formulated in Ferrari and Barberio (2012).

**Usage**

```r
intermediate.corr.BO(n.B, n.O, prop.vec = NULL, prop.list = NULL, corr.vec = NULL, corr.mat = NULL)
```

**Arguments**

- `n.B`: Number of binary variables.
- `n.O`: Number of ordinal variables.
- `prop.vec`: Probability vector for binary variables.
- `prop.list`: A list of probability vectors for ordinal variables.
- `corr.vec`: Vector of elements below the diagonal of correlation matrix ordered column-wise.
- `corr.mat`: Specified correlation matrix.

**Value**

A correlation matrix of size \((n.B+n.O) \times (n.B+n.O)\).
References


See Also

intermediate.corr.P_BO

Examples

```r
## Not run:
n.B<-1
n.O<-2
prop.vec=0.7
prop.list = list(cumsum(c(0.30, 0.40)), cumsum(c(0.4, 0.2, 0.3)))
corr.mat = matrix (c(
  1.0000000, 0.1767231, 0.3006186,
  0.1767231, 1.0000000, -0.139923,
  0.3006186, -0.1399230, 1.0000000),3,3)
intmatBO=intermediate.corr.BO(n.B, n.O, prop.vec, prop.list, corr.vec = NULL, corr.mat)

n.B<-1
n.O<-1
prop.vec<-c(0.3)
prop.list<-list(c(0.3,0.6))
corr.mat=matrix(c(1,0.2,0.1,0.2,1,0.5,0.1,0.5,1),3,3)
intmatBO=intermediate.corr.BO(n.B, n.O, prop.vec, prop.list, corr.vec = NULL, corr.mat)

n.B<-2
prop.vec=c(0.4,0.7)
corr.mat = matrix(c(1,-0.3,-0.3,1,2,2)
intmatBB=intermediate.corr.BO(n.B, n.O=0, prop.vec, prop.list= NULL, corr.vec = NULL, corr.mat)

#See Tetra.Corr.BB in R package BinNonNor
#Tetra.Corr.BB(n.BB=2, prop.vec=c(0.4,0.7), corr.vec = NULL, corr.mat = corr.mat)

n.B<-0
n.O<-2
prop.list = list(cumsum(c(0.30, 0.40)), cumsum(c(0.4, 0.2, 0.3)))
corr.mat = matrix(c(1.0000000, -0.139923,-0.139923,1.0000000),2,2)
intmatOO=intermediate.corr.BO(n.B, n.O, prop.vec=NULL, prop.list, corr.vec = NULL, corr.mat)

#See IntermediateOO(plist, OOCorrMat) in R package OrdNor
#IntermediateOO(plist=list(cumsum(c(0.30, 0.40)), cumsum(c(0.4, 0.2, 0.3))), OOCorrMat=corr.mat)
```
intermediate.corr.PP

Computes an intermediate normal correlation matrix for Poisson variables given the specified correlation matrix

Description

This function computes the intermediate normal correlation matrix for Poisson-Poisson combinations before inverse cdf matching as formulated in Amatya and Demirtas (2015).

Usage

intermediate.corr.PP(n.P, lambda.vec, corr.vec = NULL, corr.mat = NULL)

Arguments

n.P Number of Poisson variables
lambda.vec Rate vector for Poisson variables
corr.vec Vector of elements below the diagonal of correlation matrix ordered column-wise.
corr.mat Specified correlation matrix.

Value

A correlation matrix of size n.P*n.P

References


See Also

intermediate.corr.P_80

Examples

n.P<3
lambda.vec<-c(1,2,3)
corr.mat<-matrix(c(1,0.35,0.265,0.35,1,0.121,0.265,0.121,1),n.P,n.P)
intmatPP=intermediate.corr.PP(n.P, lambda.vec, corr.vec=NULL, corr.mat)

## Not run:
#See also cmat.star in R package PoisNor
#cmat.star(no.pois=3, no.norm=0, corMat=corr.mat, lamvec=lambda.vec)

## End(Not run)
intermediate.corr.P_BO

*Computes the pairwise entries of the intermediate normal correlation matrix for all Poisson-binary and Poisson-ordinal variable combinations given the specified correlation matrix.*

**Description**

This function computes the pairwise entries of the intermediate normal correlation matrix for all Poisson-binary and Poisson-ordinal variable combinations given the specified correlation matrix as formulated in Amatya and Demirtas (2015).

**Usage**

```r
```

**Arguments**

- `n.P`: Number of Poisson variables.
- `n.B`: Number of binary variables.
- `n.O`: Number of ordinal variables.
- `lambda.vec`: Rate vector for Poisson variables.
- `prop.vec`: Probability vector for binary variables.
- `prop.list`: A list of probability vectors for ordinal variables.
- `corr.vec`: Vector of elements below the diagonal of correlation matrix ordered column-wise.
- `corr.mat`: Specified correlation matrix.

**Value**


**References**


**See Also**

`intermediate.corr.PP`, `intermediate.corr.BO`
overall.corr.mat

Examples

```r
## Not run:
n.P<1
n.B<1
n.O<1
lambda.vec<-c(1)
prop.vec<-c(0.3)
prop.list<-list(c(0.3,0.6))
corr.mat=matrix(c(1,0.2,0.1,0.2,1,0.5,0.1,0.5,1),3,3)

corr.vec = NULL, corr.mat)

## End(Not run)
```

---

**overall.corr.mat**  
Computes the final intermediate correlation matrix

**Description**

This function computes the final correlation matrix by combining pairwise intermediate correlation matrix entries for Poisson-Poisson, Poisson-binary, Poisson-ordinal, binary-binary, binary-ordinal, and ordinal-ordinal combinations. If the resulting correlation matrix is not positive definite, a nearest positive matrix will be used.

**Usage**

```r
overall.corr.mat(n.P, n.B, n.O, lambda.vec = NULL, prop.vec = NULL, prop.list = NULL, 
corr.vec = NULL, corr.mat = NULL)
```

**Arguments**

- `n.P` Number of Poisson variables.
- `n.B` Number of binary variables.
- `n.O` Number of ordinal variables.
- `lambda.vec` Rate vector for Poisson variables.
- `prop.vec` Probability vector for binary variables.
- `prop.list` A list of probability vectors for ordinal variables.
- `corr.vec` Vector of elements below the diagonal of correlation matrix ordered column-wise.
- `corr.mat` Specified correlation matrix.

**Value**

See Also

intermediate.corr.PP, intermediate.corr.BO, intermediate.corr.P_BO

Examples

```r
## Not run:
n.P<-1
n.B<-1
n.O<-1
lambda.vec<-c(1)
prop.vec<-c(0.3)
prop.list<-list(c(0.3,0.6))
corr.vec=numeric(0)
corr.mat=matrix(c(1,0.2,0.1,0.2,1,0.5,0.1,0.5,1),3,3)

## End(Not run)
```

validation.bin 
Validates the marginal specification of the binary variables

Description

Checks whether the marginal specification of the binary part is valid and consistent.

Usage

validation.bin(n.B, prop.vec = NULL)

Arguments

n.B Number of binary variables.
prop.vec Probability vector for binary variables.

Value

The function returns TRUE if no specification problem is encountered. Otherwise, it returns an error message.

Examples

```r
n.B<-3
prop.vec<-c(0.25,0.5,0.75)
validation.bin(n.B, prop.vec)

## Not run:
n.B<-3
validation.bin(n.B)
```
validation.corr

Validates the specified correlation matrix

Description

This function validates the specified correlation vector and/or matrix for appropriate dimension, symmetry, range, and positive definiteness. If both correlation matrix and correlation vector were supplied, it checks whether the matrix and vector are conformable.

Usage

validation.corr(nP, nB, nO, corr.vec = NULL, corr.mat = NULL)

Arguments

nP          Number of Poisson variables.

nB          Number of binary variables.

nO          Number of ordinal variables.

corr.vec    Vector of elements below the diagonal of correlation matrix ordered column-wise.

corr.mat    Specified correlation matrix.

Value

The function returns TRUE if no specification problem is encountered. Otherwise, it returns an error message.
See Also

correlation.limits, correlation.bound.check

Examples

n.P<-1
n.B<-1
n.O<-1
corr.vec=c(0.2, 0.1, 0.5)

n.P<-2
n.B<-2
n.O<-2
corr.mat=matrix(c(0.5, 0.6, 0.6)
diag(corr.mat)=1

validation.ord

Validates the marginal specification of the ordinal variables

Description

Checks whether the marginal specification of the ordinal part is valid and consistent.

Usage

validation.ord(n.0, prop.list = NULL)

Arguments

n.0 Number of ordinal variables.

prop.list A list of probability vectors corresponding to each ordinal variable. The i-th element of prop.list is a vector of the cumulative probabilities defining the marginal distribution of the i-th ordinal component of the multivariate variables. If the i-th ordinal variable has k categories, the i-th vector of the prop.list will contain k-1 probability values. The k-th element is implicitly 1.

Value

The function returns TRUE if no specification problem is encountered. Otherwise, it returns an error message.
Examples

```
n.O<-3
prop.list<-list(c(0.3,0.6),c(0.25,0.5,0.75),c(0.1,0.2,0.8,0.9))
validation.ord(n.O, prop.list)

## Not run:
n.O<-3
validation.ord(n.O)

n.O<--NULL
prop.list<-list(c(0.3,0.6),c(0.25,0.5,0.75),c(0.1,0.2,0.8,0.9))
validation.ord(prop.list=prop.list)

n.O<--3
prop.list<-list(c(0.3,0.6),c(0.25,0.5,0.75),c(0.1,0.2,0.8,0.9))
validation.ord(-3, prop.list)

n.O<--0
prop.list<-list(c(0.3,0.6),c(0.25,0.5,0.75),c(0.1,0.2,0.8,0.9))
validation.ord(n.O, prop.list)

n.O<-5
prop.list<-list(c(0.3,0.6),c(0.25,0.5,0.75),c(0.1,0.2,0.8,0.9))
validation.ord(n.O, prop.list)

n.O<-3
prop.list<-list(c(0.3,0.6),c(0.25,0.5,-0.75),c(0.1,0.2,0.8,1.5))
validation.ord(n.O, prop.list)

n.O<-3
prop.list<-list(0.3,c(0.3,0.4),c(0.4,0.2,0.3))
validation.ord(n.O, prop.list)

## End(Not run)
```
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