Package ‘PoisBinOrd’

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Author Gul Inan, Hakan Demirtas, Ran Gao
Maintainer Ran Gao <rgao8@uic.edu>
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 distribu-
tion. The details of the method are explained in Amatya, A. and Demir-
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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.

Details

Package: PoisBinOrd
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PoisBinOrd package consists of ten functions. The functions validation.bin, validation.ord, and validation.corr validate the specified quantities to prevent users from committing 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.PBO 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)

Gul Inan, Hakan Demirtas, Ran Gao
Maintainer: Ran Gao <rgao8@uic.edu>

References


**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

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.

Examples

## 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)
n.P<2
n.B<2
n.O<2
lambda.vec<-c(1,2)
prop.vec<-c(0.3,0.5)
prop.list<-list(c(0.3,0.6),c(0.5,0.6))
corr.mat=matrix(c(0.8,6,6)
diag(corr.mat)=1

## End(Not run)
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 \((n.P + n.B + n.O) \times (n.P + n.B + n.O)\), 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,lamb.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,n.O=0,lamb.vec=PROP,prop.vec=NULL,prop.list=NULL)

#See also correlation.bound.check in R package BinNonNor

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

#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,lamb.vec,prop.vec,prop.list=NULL)
```
# Correlation limits among Poisson and ordinal variables and within themselves.

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

# Correlation limits among Poisson, binary, and ordinal variables and within themselves.

n.P <- 2
lambda.vec <- c(-1, 1)
correlation.limits(n.P, n.B=0, n.O=0, lambda.vec, prop.vec=NULL, prop.list=NULL)

## End(Not run)

geno.PoisBinOrd

Simulates a sample of size n from a set of multivariate Poisson, binary, and ordinal variables

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


Arguments

- **n**: Number of variates.
- **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.
- **final.corr.mat**: Final correlation matrix produced from `overall.corr.mat`

Value

A matrix of size n*(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=10000
n.P<-2
n.B<-2
n.O<-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))
M<-c(-0.05, 0.26, 0.14, 0.09, 0.14, 0.12, 0.13, -0.02, 0.17, 0.11,
-0.04, 0.19, 0.10, 0.35, 0.39)
N=diag(6)
N[lower.tri(N)]=M
corr.mat=N+t(N)
diag(corr.mat)<-1
prop.list,corr.vec=NULL,corr.mat)
mymixdata=gen.PoisBinOrd(n,P,n.B,n.O,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 Barbiero (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**


**References**


**See Also**

intermediate.corr.PBO

**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)
```

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

```r
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)
```

```r
#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)
```

```r
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)
```
intermediate.corr.PBO

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


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

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)
```

---

### 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**

```r
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**

overall.corr.mat

See Also

intermediate.corr.PBO

Examples

n.P<-3
lambda.vec<-c(1,2,3)
corr.mat<-matrix(c(1,0.352,0.265,0.352,1,0.121,0.265,0.121,1),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,lmv=lamvec)

## 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


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

validation.bin

See Also

intermediate.corr.PP, intermediate.corr.BO, intermediate.corr.PBO

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=NULL
corr.mat=matrix(c(1,0.2,0.1,0.2,1,0.5,0.1,0.5,1),3,3)
finalmat=overall.corr.mat(n.P,n.B,n.O,lambda.vec,prop.vec,prop.list,corr.vec=NULL,
corr.mat)

## 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 are supplied, it checks whether the matrix and vector are conformable.

Usage


Arguments

- **n.P**  
  Number of Poisson variables.
- **n.B**  
  Number of binary variables.
- **n.O**  
  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
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.O, prop.list = NULL)

Arguments
- **n.O**: 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)
```r
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(0.1,0.2,0.8,0.9))
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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