Package ‘PoisBinOrdNor’

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Title Data Generation with Poisson, Binary, Ordinal and Normal Components

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Description Generation of multiple count, binary, ordinal and normal variables simultaneously given the marginal characteristics and association structure. The details of the method are explained in Demirtas et al. (2012) <DOI:10.1002/sim.5362>.

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**PoisBinOrdNor-package**

*Data Generation with Count, Binary, Ordinal and Normal Components*

**Description**

Generation of multiple count, binary, ordinal and normal variables simultaneously given the marginal characteristics and association structure based on the methodologies proposed in Demirtas et al. (2012), Demirtas and Yavuz (2015), Amatya and Demirtas (2016), Demirtas and Hedeker (2016).

**Details**

- **Package:** PoisBinOrdNor
- **Type:** Package
- **Version:** 1.6.3
- **Date:** 2021-03-21
- **License:** GPL-2 | GPL-3

PoisBinOrdNor package consists of nine functions. The function `validation.specs` validates the specified quantities to avoid obvious specification errors. The functions `corr.nn4bb`, `corr.nn4bn`, `corr.nn4on`, `corr.nn4pbo`, `corr.nn4pn`, and `corr.nn4pp` each computes the intermediate correlation coefficient for binary-binary combinations, binary-normal combinations, ordinal-normal combinations, count-binary/ordinal combinations, count-normal and count-count combinations, respectively. The function `intermat` assembles the intermediate correlation matrix for the multivariate data based on input from functions `corr.nn4bb`, `corr.nn4bn`, `corr.nn4on`, `corr.nn4pbo`, `corr.nn4pn` and `corr.nn4pp`. The engine function `genPBONdata` computes the final correlation matrix and generates mixed data in accordance with the specified marginal and correlational quantities.

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**References**


corr.nn4bb


corr.nn4bb

Finds the tetrachoric correlation based on user-specified correlation between binary variables.

Description

This function computes the tetrachoric correlation given the correlation for a pair of binary variables (phi coefficient).

Usage

corr.nn4bb(p1, p2, BB.cor)

Arguments

p1 Probability parameter for the first binary variable.
p2 Probability parameter for the second binary variable.
BB.cor Pre-specified correlation for a pair of binary variables.

Value

A tetrachoric correlation coefficient.

References


Examples

```r
## Not run:
corr.nn4bb(0.43, 0.7, 0.129)
## End(Not run)
```
corr.nn4bn

Finds the biserial correlation given the correlation for a binary-normal pair.

Description

This function computes the biserial correlation given the specified correlation for a pair of binary and normal variables (point-biserial correlation).

Usage

corr.nn4bn(p, BN.cor)

Arguments

p Probability parameter for the binary variable.
BN.cor Pre-specified correlation for a pair of binary and normal variables.

Value

A biserial correlation coefficient.

Examples

## Not run:
corr.nn4bn(0.43, 0.12)
## End(Not run)

corr.nn4on

Finds polyserial correlation for given the correlation for an ordinal-normal pair.

Description

This function computes the polyserial correlation given the specified correlation for a pair of ordinal and normal variables (point-polyserial correlation).

Usage

corr.nn4on(p, ON.cor)
**corr.nn4pbo**

**Arguments**

- **p**: A vector of probabilities for an ordinal variable. The i-th element of the pvec is the cumulative probability defining the marginal distribution of the ordinal variable. If the variable has k categories, the i-th element of p will contain k-1 probabilities. The k-th element is implicitly 1.

- **ON.cor**: Pre-specified correlation for a pair of ordinal-normal variables.

**Value**

A tetrachoric correlation coefficient.

**Examples**

```r
## Not run:
corr.nn4on(c(0.33, 0.66), 0.22)
## End(Not run)
```

**corr.nn4pbo**

*Finds the underlying bivariate normal correlation given the correlation for a count-binary or count-ordinal pair.*

**Description**

This function computes the underlying bivariate normal correlation given the correlation for a pair of count and binary variables or a pair of count and ordinal variables.

**Usage**

```r
corr.nn4pbo(lam, p, PO.cor)
```

**Arguments**

- **lam**: Rate parameter for the count variable.

- **p**: A vector of probabilities for an ordinal variable. The i-th element of the pvec is the cumulative probability defining the marginal distribution of the ordinal variable. If the variable has k categories, the i-th element of p will contain k-1 probabilities. The k-th element is implicitly 1.

- **PO.cor**: Pre-specified correlation for a pair of count and binary, or count and ordinal, variables.

**Value**

A tetrachoric correlation coefficient.
References


Examples

```r
## Not run:
corr.nn4pbo(0.5, c(0.2, 0.5), 0.235)
## End(Not run)
```

---

corr.nn4pn

Finds the underlying bivariate normal correlation given the correlation for a count-normal pair.

Description

This function computes the underlying bivariate normal correlation given the specified correlation for a pair of count and normal variables.

Usage

```r
corr.nn4pn(lam, PN.cor)
```

Arguments

- `lam`  
  Rate parameter for the count variable.
- `PN.cor`  
  Pre-specified correlation for a pair of count and normal variables.

Value

Correlation of underlying bivariate normal data.

Examples

```r
## Not run:
corr.nn4pn(0.5, 0.32)
## End(Not run)
```
### corr.nn4pp

*Finds the underlying bivariate normal correlation given the correlation for a pair of count variables.*

**Description**

This function computes the underlying bivariate normal correlation given the specified correlation for a pair of count variables.

**Usage**

```r
corr.nn4pp(lambda1, lambda2, PP.cor)
```

**Arguments**

- **lambda1**: Rate parameter for the first count variable.
- **lambda2**: Rate parameter for the second count variable.
- **PP.cor**: Pre-specified correlation for a pair of count variables.

**Value**

Correlation of underlying bivariate normal data.

**References**


**Examples**

```r
## Not run:
corr.nn4pp(0.5, 2, 0.4)
## End(Not run)
```

---

### genPBONdata

*Generates correlated data with multiple count, binary, ordinal and normal variables*

**Description**

This function simulates a multivariate data set that is composed of count, binary, ordinal and normal variables with specified marginals and a correlation matrix.
Usage

`genPBONdata(n, no_pois, no_bin, no_ord, no_norm, inter.mat, lamvec, prop_vec_bin, prop_vec_ord, nor.mean, nor.var)`

Arguments

- **n**: Number of rows
- **no_pois**: Number of count variables
- **no_bin**: Number of binary variables
- **no_ord**: Number of ordinal variables
- **no_norm**: Number of normal variables
- **inter.mat**: The intermediate correlation matrix obtained from function `intermat`
- **lamvec**: A vector of marginal rates for the count variables
- **prop_vec_bin**: A vector of probabilities for the binary variables
- **prop_vec_ord**: A vector of probabilities for the ordinal variables. For each of the variable, the i-th element of the pvec is the cumulative probability defining the marginal distribution of the ordinal variable. If the variable has k categories, the i-th element of p will contain k-1 probabilities. The k-th element is implicitly 1.
- **nor.mean**: A vector of means for the normal variables
- **nor.var**: A vector of variances for the normal variables

Value

- **data**: A simulated data matrix of size nx(no_pois + no_bin + no_ord + no_norm), of which the first no_pois are count variables, followed by no_bin binary variables, no_ord ordinal variables, and lastly no_norm normal variables.
- **n.rows**: Number of rows in the simulated data
- **prob.bin**: A vector of probabilities for the binary variables
- **prob.ord**: A vector of probabilities for the ordinal variables
- **nor.mean**: A vector of means for the normal variables
- **nor.var**: A vector of variances for the normal variables
- **lamvec**: A vector of rate parameters for the count variables
- **n.pois**: Number of count variables
- **n.bin**: Number of binary variables
- **n.ord**: Number of ordinal variables
- **n.norm**: Number of normal variables
- **final.corr**: The final correlation matrix for the simulated data
Examples

```r
## Not run:

ss=10000
num_pois<-2
num_bin<-1
num_ord<-2
num_norm<-1

lamvec=sample(10,2)
pbin=runif(1)
pord=list(c(0.1, 0.9), c(0.2, 0.3, 0.5))
nor.mean=3.1
nor.var=0.85
M=c(-0.05, 0.26, 0.14, 0.09, 0.14, 0.12, 0.13, -0.02, 0.17, 0.29,
    -0.04, 0.19, 0.10, 0.35, 0.39)
N=diag(6)
N[lower.tri(N)]=M
TV=N+t(N)
diag(TV)<-1
intmat<-intermat(num_pois,num_bin,num_ord,num_norm,corr_mat=TV,pbin,pord,lamvec,
nor.mean,nor.var)
genPBONdata(ss,num_pois,num_bin,num_ord,num_norm,intmat,lamvec,pbin,pord,nor.mean,nor.var)
## End(Not run)
```

**intermat**

Calculates and assembles the intermediate correlation matrix entries for the multivariate normal data.

**Description**

This function computes and assembles the correlation entries for the intermediate multivariate normal data.

**Usage**

```r
intermat(no_pois, no_bin, no_ord, no_norm, corr_mat, prop_vec_bin, prop_vec_ord,
    lam_vec, nor_mean, nor_var)
```

**Arguments**

- `no_pois`: Number of the count variables.
- `no_bin`: Number of the binary variables.
- `no_ord`: Number of the ordinal variables.
- `no_norm`: Number of the normal variables.
- `corr_mat`: Pre-specified correlation matrix for the multivariate data.
prop_vec_bin  Vector of probabilities for the binary variables.
prop_vec_ord  Vector of probabilities for the ordinal variables.
lam_vec      Vector of rate parameters for the count variables.
nor_mean     Vector of means for the normal variables.
nor_var      Vector of variances for the normal variables.

Value

The intermediate correlation matrix that will be used later for multivariate normal data simulation.

References


See Also

Examples

```r
## Not run:
num_pois<-2
num_bin<-1
num_ord<-2
num_norm<-1
lamvec=sample(10,2)
pbin=runif(1)
pord=list(c(0.3, 0.7), c(0.2, 0.3, 0.5))
nor.mean=3.1
nor.var=0.85
M=
c(-0.05, 0.26, 0.14, 0.09, 0.14, 0.12, 0.13, -0.02, 0.17, 0.29, -0.04, 0.19, 0.10, 0.35, 0.39)
N=diag(6)
N[lower.tri(N)]=M
TV=N+t(N)
diag(TV)<-1
intmat<-intmat(num_pois,num_bin,num_ord,num_norm,corr_mat=TV,pbin,pord,lamvec,nor.mean,nor.var)

## End(Not run)
```
validation.specs

Validates user-specified parameters

Description

This function checks the validity of user-specified parameters including rate parameters for count variables, proportion parameters for binary and ordinal variables, mean and variance parameters for normal data, as well as the validity of entries in the correlation matrix. This function also computes the lower and upper limits for each pairwise correlation based on the marginal probabilities for range violation checks.

Usage

validation.specs(no.pois, no.bin, no.ord, no.norm, corr.mat, prop.vec.bin, prop.vec.ord, lamvec, nor.mean, nor.var)

validation.specs(no.pois, no.bin, no.ord, no.norm, corr.mat, prop.vec.bin, prop.vec.ord, lamvec, nor.mean, nor.var) #deprecated

Arguments

- no.pois: Number of count variables.
- no.bin: Number of binary variables.
- no.ord: Number of ordinal variables.
- no.norm: Number of normal variables.
- corr.mat: User specified correlation matrix for the multivariate data.
- prop.vec.bin: Vector of probabilities corresponding to each of the binary variables.
- prop.vec.ord: Vector of probabilities corresponding to each of the ordinal variables. For each of the ordinal variable, the i-th element of the probability vector is the cumulative probability defining the marginal distribution of the ordinal variable. If the variable has k categories, the i-th element of p will contain k-1 probabilities. The k-th element is implicitly 1.
- lamvec: Vector of rate parameters for the count variables.
- nor.mean: Vector of means for the normal variables.
- nor.var: Vector of variances for the normal variables.

Details

This function computes the lower and upper bounds for all possible pairs that involve count, binary, ordinal and normal variables.

Value

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


Examples

```r
## Not run:
num_pois<-1
num_bin<-1
num_ord<-1
num_norm<-1
lambda<-c(1)
pbin<-c(0.3)
pord<-list(c(0.3,0.6))
normean<-15
norvar<-7
corr.mat=matrix(c(1,0.2,0.1,0.3, 0.2,1,0.5,0.4, 0.1,0.5,1, 0.7, 0.3, 0.4, 0.7, 1),4,4)
validation.specs(num_pois, num_bin, num_ord, num_norm,
corr.mat, pbin, pord, lambda, normean, norvar)

num_pois<-2
num_bin<-2
num_ord<-2
num_norm<-0
lambda<-c(1,2)
pbin<-c(0.3,0.5)
pord<-list(c(0.3,0.6),c(0.5,0.6))
corr.mat=matrix(0.64,6,6)
 diag(corr.mat)=1
validation.specs(num_pois, num_bin, num_ord, num_norm,
corr.mat, pbin, pord, lambda, normean=NA, nor.var=NA)

# An example with an invalid target correlation matrix (bound violation).
num_pois<-1
num_bin<-2
num_ord<-2
num_norm<-1
lamvec=c(1)
pbin=c(0.3, 0.7)
pord=list(c(0.2, 0.5), c(0.4, 0.7, 0.8))
normean=2.1
nor.var=0.75
M=c(-0.35, 0.26, 0.34, 0.09, 0.14, 0.12, 0.30, -0.02, 0.17, 0.29, -0.04, 0.19,
0.10, 0.35, 0.39)
N=diag(6)
N[lower.tri(N)]=M
TV=N+t(N)
```

diag(TV)<-1
validation.specs(num_pois, num_bin, num_ord, num_norm, corr.mat=TV, pbin, pord, lamvec, normean, norvar)

# An example with a non-positive definite correlation matrix.
pbin=c(0.3, 0.7)
TV1=TV
TV1[3,2]=TV[2,3]=5
validation.specs(num_pois, num_bin, num_ord, num_norm, corr.mat=TV1, pbin, pord, lamvec, normean, norvar)

## End(Not run)
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