Package ‘condMVNorm’

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Title Conditional Multivariate Normal Distribution

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Description Computes conditional multivariate normal densities, probabilities, and random deviates.

Imports stats

Depends R(>= 4.0.0), mvtnorm

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`cmvnorm` *Conditional Multivariate Normal Density and Random Deviates*

Description

These functions provide the density function and a random number generator for the conditional multivariate normal distribution, [Y given X], where Z = (X,Y) is the fully-joint multivariate normal distribution with mean equal to `mean` and covariance matrix `sigma`.

Usage

```
dcmvnorm(x, mean, sigma, dependent.ind, given.ind,
X.given, check.sigma=TRUE, log = FALSE)
rcmvnorm(n, mean, sigma, dependent.ind, given.ind,
X.given, check.sigma=TRUE,
method=c("eigen", "svd", "chol"))
```

Arguments

`x`	vector or matrix of quantiles of Y. If `x` is a matrix, each row is taken to be a quantile.
`n`	number of random deviates.
`mean`	mean vector, which must be specified.
`sigma`	a symmetric, positive-definte matrix of dimension n x n, which must be specified.
`dependent.ind`	a vector of integers denoting the indices of dependent variable Y.
`given.ind`	a vector of integers denoting the indices of conditioning variable X. If specified as integer vector of length zero or left unspecified, the unconditional distribution is used.
`X.given`	a vector of reals denoting the conditioning value of X. This should be of the same length as `given.ind`
`check.sigma`	logical; if `TRUE`, the variance-covariance matrix is checked for appropriateness (symmetry, positive-definiteness). This could be set to FALSE if the user knows it is appropriate.
`log`	logical; if `TRUE`, densities d are given as log(d).
`method`	string specifying the matrix decomposition used to determine the matrix root of `sigma`. Possible methods are eigenvalue decomposition (`"eigen"`, default), singular value decomposition (`"svd"`), and Cholesky decomposition (`"chol"`). The Cholesky is typically fastest, not by much though.

See Also

pcmvnorm, pmvnorm, dmvnorm, qmvnorm

Examples

```
# 10-dimensional multivariate normal distribution
n <- 10
A <- matrix(rnorm(n^2), n, n)
A <- A %*% t(A)

# density of Z[c(2,5)] given Z[c(1,4,7,9)]=c(1,1,0,-1)
dcmvnorm(x=c(1.2,-1), mean=rep(1,n), sigma=A,
dependent.ind=c(2,5), given.ind=c(1,4,7,9),
X.given=c(1,1,0,-1))

dcmvnorm(x=-1, mean=rep(1,n), sigma=A, dep=3, given=c(1,4,7,9,10),
```

```
  X=c(1,1,0,0,-1))

dcmvnorm(x=c(1.2,-1), mean=rep(1,n), sigma=A, dep=c(2,5),
  given=integer())

# gives an error since `x' and `dep' are incompatibe
#dcmvnorm(x=-1, mean=rep(1,n), sigma=A, dep=c(2,3),
# given=c(1,4,7,9,10), X=c(1,1,0,0,-1))

rcmvnorm(n=10, mean=rep(1,n), sigma=A, dep=c(2,5),
given=c(1,4,7,9,10), X=c(1,1,0,0,-1),
method="eigen")

rcmvnorm(n=10, mean=rep(1,n), sigma=A, dep=3,
given=c(1,4,7,9,10), X=c(1,1,0,0,-1),
method="chol")
```

---

condMVN *Conditional Mean and Variance of Multivariate Normal Distribution*

Description

These functions provide the conditional mean and variance-covariance matrix of [Y given X], where Z = (X,Y) is the fully-joint multivariate normal distribution with mean equal to `mean` and covariance matrix `sigma`.

Usage

```
condMVN(mean, sigma, dependent.ind, given.ind, X.given, check.sigma=TRUE)
```

Arguments

`mean`	mean vector, which must be specified.
`sigma`	a symmetric, positive-definte matrix of dimension n x n, which must be specified.
`dependent.ind`	a vector of integers denoting the indices of dependent variable Y.
`given.ind`	a vector of integers denoting the indices of conditioning variable X. If specified as integer vector of length zero or left unspecified, the unconditional density is returned.
`X.given`	a vector of reals denoting the conditioning value of X. This should be of the same length as `given.ind`
`check.sigma`	logical; if `TRUE`, the variance-covariance matrix is checked for appropriateness (symmetry, positive-definiteness). This could be set to FALSE if the user knows it is appropriate.

See Also

`dcmvnorm`, `pcmvnorm`, `pmvnorm`, `dmvnorm`, `qmvnorm`

Examples

```
# 10-dimensional multivariate normal distribution
n <- 10
A <- matrix(rnorm(n^2), n, n)
A <- A %*% t(A)

condMVN(mean=rep(1,n), sigma=A, dependent=c(2,3,5), given=c(1,4,7,9),
  X.given=c(1,1,0,-1))

condMVN(mean=rep(1,n), sigma=A, dep=3, given=c(1,4,7,9), X=c(1,1,0,-1))

condMVN(mean=rep(1,n), sigma=A, dep=3, given=integer())
# or simply the following

condMVN(mean=rep(1,n), sigma=A, dep=3)
```

---

pcmvnorm *Conditional Multivariate Normal Distribution*

Description

Computes the distribution function of the conditional multivariate normal, [Y given X], where Z = (X,Y) is the fully-joint multivariate normal distribution with mean equal to `mean` and covariance matrix `sigma`.

Usage

```
pcmvnorm(lower=-Inf, upper=Inf, mean, sigma,
dependent.ind, given.ind, X.given,
check.sigma=TRUE, algorithm = GenzBretz(), ...)
```

Arguments

`lower`	the vector of lower limits of length n.
`upper`	the vector of upper limits of length n.
`mean`	the mean vector of length n.
`sigma`	a symmetric, positive-definte matrix, of dimension n x n, which must be specified.
`dependent.ind`	a vector of integers denoting the indices of the dependent variable Y.
`given.ind`	a vector of integers denoting the indices of the conditioning variable X. If specified as integer vector of length zero or left unspecified, the unconditional distribution is used.
`X.given`	a vector of reals denoting the conditioning value of X. This should be of the same length as `given.ind`

`check.sigma`	logical; if `TRUE`, the variance-covariance matrix is checked for appropriateness (symmetry, positive-definiteness). This could be set to FALSE if the user knows it is appropriate.
`algorithm`	an object of class `GenzBretz`, `Miwa` or `TVPACK` specifying both the algorithm to be used as well as the associated hyper parameters.
`...`	additional parameters (currently given to `GenzBretz` for backward compatibility issues).

Details

This program involves the computation of multivariate normal probabilities with arbitrary correlation matrices.

Value

The evaluated distribution function is returned with attributes

`error`	estimated absolute error and
`msg`	status messages.

See Also

`dcmvnorm`, `rcmvnorm`, `pmvnorm`.

Examples

```
n <- 10
A <- matrix(rnorm(n^2), n, n)
A <- A %*% t(A)

pcmvnorm(lower=-Inf, upper=1, mean=rep(1,n), sigma=A,  dependent.ind=3,
  given.ind=c(1,4,7,9,10), X.given=c(1,1,0,0,-1))

pcmvnorm(lower=-Inf, upper=c(1,2), mean=rep(1,n), sigma=A,
  dep=c(2,5), given=c(1,4,7,9,10), X=c(1,1,0,0,-1))

pcmvnorm(lower=-Inf, upper=c(1,2), mean=rep(1,n), sigma=A,
dep=c(2,5))
```

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