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(>= 3.0), mvtnorm

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R topics documented:

`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")
```

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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)
```

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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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