Package ‘rWishart’

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Title Random Wishart Matrix Generation

Version 0.1.2

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Description An expansion of R's 'stats' random wishart matrix generation.
This package allows the user to generate singular, Uhlig and Harald (1994)
<doi:10.1214/aos/1176325375>, and pseudo wishart, Diaz-Garcia, et al.(1997)
<doi:10.1006/jmva.1997.1689>, matrices. In addition the user can generate
wishart matrices with fractional degrees of freedom, Adhikari (2008)
<doi:10.1061/(ASCE)0733-9399(2008)134:12(1029)>, commonly used in volatility
modeling. Users can also use this package to create random covariance matrices.

Depends R (>= 3.3)

Imports Matrix, MASS, stats, lazyeval

License GPL-2

Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Suggests covr, knitr, rmarkdown, testthat

URL https://rwishart.bearstatistics.com

NeedsCompilation no

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Repository CRAN

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R topics documented:

`rFractionalWishart` *Random Fractional Wishart Matrix*

Description

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rFractionalWishart(n, df, Sigma, covariance = FALSE,
  simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, "degrees of freedom".
`Sigma`	positive definite $(p \times p)$ "scale" matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of "rank" (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

References

Adhikari, S. (2008). Wishart random matrices in probabilistic structural mechanics. Journal of engineering mechanics, 134(12), doi: 10.1061/(ASCE)07339399(2008)134:12(1029).

Examples

```
rFractionalWishart(2, 22.5, diag(1, 20))
```

`rNonsingularWishart` *Random Nonsingular Wishart Matrix*

Description

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rNonsingularWishart(n, df, Sigma, covariance = FALSE,
  simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, “degrees of freedom”.
`Sigma`	positive definite $(p \times p)$ “scale” matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of “rank” (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

Examples

```
rNonsingularWishart(2, 20, diag(1, 5))
```

rPsuedoWishart *Random Psuedo Wishart Matrix*

Description

Generate n random matrices, distributed according to the Wishart distribution with parameters Sigma and df, W_p(Sigma, df).

Usage

```
rPsuedoWishart(n, df, Sigma, covariance = FALSE, simplify = "array")
```

Arguments

n	integer: the number of replications.
df	numeric parameter, "degrees of freedom".
Sigma	positive definite $(p \times p)$ "scale" matrix, the matrix parameter of the distribution.
covariance	logical on whether a covariance matrix should be generated
simplify	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For sapply it must be named and not abbreviated. The default value, TRUE, returns a vector or matrix if appropriate, whereas if simplify = "array" the result may be an array of "rank" (=length(dim(.))) one higher than the result of FUN(X[[i]]).

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension p * p * n, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

References

Diaz-Garcia, Jose A, Ramon Gutierrez Jaimez, and Kanti V Mardia. 1997. "Wishart and Pseudo-Wishart Distributions and Some Applications to Shape Theory." Journal of Multivariate Analysis 63 (1): 73–87. doi:10.1006/jmva.1997.1689.

Examples

```
rPsuedoWishart(2, 5, diag(1, 20))
```

`rSingularWishart` *Random Singular Wishart Matrix*

Description

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rSingularWishart(n, df, Sigma, covariance = FALSE, simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, "degrees of freedom".
`Sigma`	positive definite $(p \times p)$ "scale" matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of "rank" (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

References

Uhlig, Harald. 1994. "On Singular Wishart and Singular Multivariate Beta Distributions." The Annals of Statistics 22 (1): 395–405. doi:10.1214/aos/1176325375.

Examples

```
rSingularWishart(2, 5, diag(1, 20))
```

`rWishart` *Random Wishart Matrix Generation*

Description

An expansion of R's 'stats' random wishart matrix generation. This package allows the user to generate singular, Uhlig and Harald (1994) <doi:10.1214/aos/1176325375>, and pseudo wishart, Diaz-Garcia, et al.(1997) <doi:10.1006/jmva.1997.1689>, matrices. In addition the user can generate wishart matrices with fractional degrees of freedom, Adhikari (2008) <doi:10.1061/(ASCE)0733-9399(2008)134:12(1029)>, commonly used in volatility modeling. Users can also use this package to create random covariance matrices.

Generate `n` random matrices, distributed according to the Wishart distribution with parameters `Sigma` and `df`, W_p(Sigma, df).

Usage

```
rWishart(n, df, Sigma, covariance = FALSE, simplify = "array")
```

Arguments

`n`	integer: the number of replications.
`df`	numeric parameter, "degrees of freedom".
`Sigma`	positive definite $(p \times p)$ "scale" matrix, the matrix parameter of the distribution.
`covariance`	logical on whether a covariance matrix should be generated
`simplify`	logical or character string; should the result be simplified to a vector, matrix or higher dimensional array if possible? For `sapply` it must be named and not abbreviated. The default value, `TRUE`, returns a vector or matrix if appropriate, whereas if `simplify = "array"` the result may be an `array` of "rank" (=`length(dim(.))`) one higher than the result of `FUN(X[[i]])`.

Details

If X_1, ..., X_m is a sample of m independent multivariate Gaussians with mean vector 0, and covariance matrix Sigma, the distribution of M = X'X is W_p(Sigma, m).

Value

A numeric array of dimension `p * p * n`, where each array is a positive semidefinite matrix, a realization of the Wishart distribution W_p(Sigma, df)

Examples

```
rWishart(2, 5, diag(1, 20))
```

`wishartTest` *Test if Matrix is a Wishart Matrix*

Description

Given a random Wishart matrix, B, from W_p(Sigma, df) and independent random vector `a`, then (a' B a) / (a' Sigma a) is chi-squared with df degrees of freedom.

Usage

```
wishartTest(WishMat, Sigma, vec = NULL)
```

Arguments

`WishMat`	random Wishart Matrix from W_p(Sigma, df)
`Sigma`	Covariance matrix for W_p(Sigma, df)
`vec`	independent random vector

Value

A chi-squared random variable with df degrees of freedom.

Examples

```
wishartTest(rWishart(1, 5, diag(1, 20), simplify = FALSE)[[1]], diag(1, 20))
```

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