

Package ‘rWishart’

July 23, 2025

Title Random Wishart Matrix Generation

Version 0.1.2

Maintainer Ben Barnard <benbarnard87@gmail.com>

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

Author Ben Barnard [aut, cre],
Dean Young [aut]

Repository CRAN

Date/Publication 2019-11-19 23:10:02 UTC

Contents

rFractionalWishart	2
rNonsingularWishart	3
rPsuedoWishart	4
rSingularWishart	5
rWishart	6
wishartTest	7

Index**8**

rFractionalWishart	<i>Random Fractional Wishart Matrix</i>
--------------------	---

Description

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

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” ($=\text{length}(\text{dim}(.))$) one higher than the result of $\text{FUN}(X[[i]])$.

Details

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

Value

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

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\(1029\)](https://doi.org/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, $W_p(\text{Sigma}, \text{df})$.

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 simplify 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” ($=\text{length}(\text{dim}(.))$) one higher than the result of $\text{FUN}(X[[i]])$.

Details

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

Value

A numeric array of dimension $p \times p \times n$, where each array is a positive semidefinite matrix, a realization of the Wishart distribution $W_p(\text{Sigma}, \text{df})$

Examples

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

rPsuedoWishart	<i>Random Psuedo Wishart Matrix</i>
----------------	-------------------------------------

Description

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

Usage

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

Arguments

<code>n</code>	integer: the number of replications.
<code>df</code>	numeric parameter, “degrees of freedom”.
<code>Sigma</code>	positive definite ($p \times p$) “scale” matrix, the matrix parameter of the distribution.
<code>covariance</code>	logical on whether a covariance matrix should be generated
<code>simplify</code>	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 <code>simplify = "array"</code> the result may be an array of “rank” (<code>=length(dim(.))</code>) one higher than the result of <code>FUN(X[[i]])</code> .

Details

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

Value

A numeric array of dimension $p \times p \times n$, 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	<i>Random Singular Wishart Matrix</i>
------------------	---------------------------------------

Description

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

Usage

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

Arguments

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

Details

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

Value

A numeric array of dimension $p \times p \times n$, 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))
```

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, $W_p(\text{Sigma}, \text{df})$.

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 simplify 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" ($=\text{length}(\text{dim}(.))$) one higher than the result of $\text{FUN}(X[[i]])$.

Details

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

Value

A numeric array of dimension $p \times p \times n$, where each array is a positive semidefinite matrix, a realization of the Wishart distribution $W_p(\text{Sigma}, \text{df})$

Examples

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

wishartTest	<i>Test if Matrix is a Wishart Matrix</i>
-------------	---

Description

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

Usage

wishartTest(WishMat, Sigma, vec = NULL)

Arguments

- WishMat random Wishart Matrix from $W_p(\text{Sigma}, \text{df})$
- Sigma Covariance matrix for $W_p(\text{Sigma}, \text{df})$
- 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))

Index

array, [2–6](#)

rFractionalWishart, [2](#)

rNonsingularWishart, [3](#)

rPsuedoWishart, [4](#)

rSingularWishart, [5](#)

rWishart, [6](#)

rWishart-package (rWishart), [6](#)

wishartTest, [7](#)