

Package ‘rBeta2009’

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Type Package

Title The Beta Random Number and Dirichlet Random Vector Generating Functions

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Author Ching-Wei Cheng, Ying-Chao Hung, Narayanaswamy Balakrishnan

Maintainer Ching-Wei Cheng <aks43725@gmail.com>

Description The package contains functions to generate random numbers from the beta distribution and random vectors from the Dirichlet distribution.

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| rbeta | <i>The Beta Random Number Generating Function</i> |
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Description

Random generation for the beta distribution with parameters shape1 and shape2.

Usage

```
rbeta(n, shape1, shape2)
```

Arguments

n Number of beta random numbers to generate. If `length(n) > 1`, the length is taken to be the number required.

shape1, shape2 Positive shape parameters.

Details

The beta distribution with parameters $\text{shape1} = a$ and $\text{shape2} = b$ has density

$$\frac{\Gamma(a+b)}{\Gamma(a)\Gamma(b)} x^{a-1}(1-x)^{b-1}$$

for $a > 0, b > 0$ and $0 \leq x \leq 1$.

The mean is $\frac{a}{a+b}$ and the variance is $\frac{ab}{(a+b)^2(a+b+1)}$.

rbeta basically utilizes the following guideline primarily proposed by Hung *et al.* (2009) for generating beta random numbers.

- When $\max(\text{shape1}, \text{shape2}) < 1$, the B00 algorithm (Sakasegawa, 1983) is used;
- When $\text{shape1} < 1 < \text{shape2}$ or $\text{shape1} > 1 > \text{shape2}$, the B01 algorithm (Sakasegawa, 1983) is used;
- When $\min(\text{shape1}, \text{shape2}) > 1$, the B4PE algorithm (Schmeiser and Babu, 1980) is used if one parameter is close to 1 and the other is large (say > 4); otherwise, the BPRS algorithm (Zechner and Stadlober, 1993) is used.

Value

rbeta generates beta random numbers.

Author(s)

Ching-Wei Cheng <aks43725@gmail.com>,
 Ying-Chao Hung <hungy@nccu.edu.tw>,
 Narayanaswamy Balakrishnan <bala@univmail.cis.mcmaster.ca>

Source

rbeta uses a C translation of

Y. C. Hung and N. Balakrishnan and Y. T. Lin (2009), Evaluation of beta generation algorithms, *Communications in Statistics - Simulation and Computation*, **38**:750–770.

References

- Y. C. Hung and N. Balakrishnan and Y. T. Lin (2009), Evaluation of beta generation algorithms, *Communications in Statistics - Simulation and Computation*, **38**, 750–770.
- H. Sakasegawa (1983), Stratified rejection and squeeze method for generating beta random numbers, *Annals of the Institute Statistical Mathematics*, **35**, 291–302.
- B.W. Schmeiser and A.J.G. Babu (1980), Beta variate generation via exponential majorizing functions, *Operations Research*, **28**, 917–926.
- H. Zechner and E. Stadlober (1993), Generating beta variates via patchwork rejection, *Computing*, **50**, 1–18.

See Also

[rbeta](#) in package `stats`.

Examples

```
library(rBeta2009)
rbeta(10, 0.7, 1.5)
```

rdirichlet

The Dirichlet Random Vector Generating Function

Description

The function to generate random vectors from the Dirichlet distribution.

Usage

```
rdirichlet(n, shape)
```

Arguments

- | | |
|-------|--|
| n | Number of Dirichlet random vectors to generate. If <code>length(n) > 1</code> , the length is taken to be the number required. |
| shape | Vector with <code>length(shape) >= 2</code> containing positive shape parameters of the Dirichlet distribution. If <code>length(shape) = 2</code> , it reduces to the beta generating function. |

Details

The Dirichlet distribution is the multidimensional generalization of the beta distribution.

A k -variate Dirichlet random vector (x_1, \dots, x_k) has the joint probability density function

$$\frac{\Gamma(\alpha_1 + \dots + \alpha_{k+1})}{\Gamma(\alpha_1) \dots \Gamma(\alpha_{k+1})} x_1^{\alpha_1 - 1} \dots x_k^{\alpha_k - 1} \left(1 - \sum_{i=1}^k x_i\right)^{\alpha_{k+1} - 1},$$

where $x_i \geq 0$ for all $i = 1, \dots, k$, $\sum_{i=1}^k x_i \leq 1$, and $\alpha_1, \dots, \alpha_{k+1}$ are positive shape parameters. `rdirichlet` generates the Dirichlet random vector by utilizing the transformation method based on beta variates and three guidelines introduced by Hung *et al.* (2011). The three guidelines include: how to choose the fastest beta generation algorithm, how to best re-order the shape parameters, and how to reduce the amount of arithmetic operations.

Value

`rdirichlet()` returns a matrix with `n` rows, each containing a single Dirichlet random vector.

Author(s)

Ching-Wei Cheng <aks43725@gmail.com>,
Ying-Chao Hung <hungy@nccu.edu.tw>,
Narayanaswamy Balakrishnan <bala@univmail.cis.mcmaster.ca>

Source

`rdirichlet` uses a C translation of

Y. C. Hung and N. Balakrishnan and C. W. Cheng (2011), Evaluation of algorithms for generating Dirichlet random vectors, *Journal of Statistical Computation and Simulation*, **81**, 445–459.

References

Y. C. Hung and N. Balakrishnan and C. W. Cheng (2011), Evaluation of algorithms for generating Dirichlet random vectors, *Journal of Statistical Computation and Simulation*, **81**, 445–459.

See Also

[rdirichlet](#) in package **MCMCpack**.
[rdirichlet](#) in package **gtools**.

Examples

```
library(rBeta2009)
rdirichlet(10, c(1.5, 0.7, 5.2, 3.4))
```

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