Package ‘LindleyPowerSeries’

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Type Package

Title Lindley Power Series Distribution

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Description Computes the probability density function, the cumulative distribution function, the hazard rate function, the quantile function and random generation for Lindley Power Series distributions, see Nadarajah and Si (2018) <doi:10.1007/s13171-018-0150-x>.

License GPL (>= 2)

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LazyData true

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Imports stats, lamW(>= 1.3.0)

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R topics documented:

plindleybinomial *LindleyBinomial*

Description

distribution function, density function, hazard rate function, quantile function, random number generation

Usage

```
plindleybinomial(x, lambda, theta, m, log.p = FALSE)

dlindleybinomial(x, lambda, theta, m)

hlindleybinomial(x, lambda, theta, m)

qlindleybinomial(p, lambda, theta, m)

rlindleybinomial(n, lambda, theta, m)
```

Arguments

x	vector of positive quantiles.
lambda	positive parameter
theta	positive parameter.
m	number of trails.
log.p	logical; If TRUE, probabilities p are given as $log(p)$.
p	vector of probabilities.
n	number of observations.

Details

Probability density function

$$f(x) = \frac{\theta\lambda^2}{(\lambda+1)A(\theta)}(1+x)exp(-\lambda x)A^{'}(\phi)$$

Cumulative distribution function

$$F(x) = \frac{A(\phi)}{A(\theta)}$$

Quantile function

$$F^{-1}(p) = -1 - \frac{1}{\lambda} - \frac{1}{\lambda}W_{-1}\left\{\frac{\lambda+1}{exp(\lambda+1)}\left[\frac{1}{\theta}A^{-1}\{pA(\theta)\} - 1\right]\right\}$$

Hazard rate function

$$h(x) = \frac{\theta\lambda^2}{1+\lambda}(1+x)exp(-\lambda x)\frac{A^{'}(\phi)}{A(\theta)-A(\phi)}$$

where W_{-1} denotes the negative branch of the Lambert W function. $A(\theta) = \sum_{n=1}^{\infty} a_n\theta^n$ is given by specific power series distribution. Note that $x > 0, \lambda > 0$ for all members in Lindley Power Series distribution. $0 < \theta < 1$ for Lindley-Geometric distribution, Lindley-logarithmic distribution, Lindley-Negative Binomial distribution. $\theta > 0$ for Lindley-Poisson distribution, Lindley-Binomial distribution.

Value

`plindleybinomial` gives the culmulative distribution function

`dlindleybinomial` gives the probability density function

`hlindleybinomial` gives the hazard rate function

`qlindleybinomial` gives the quantile function

`rlindleybinomial` gives the random number generatedy by distribution

Invalid arguments will return an error message.

Author(s)

Saralees Nadarajah & Yuancheng Si <yuancheng.si@manchester.ac.uk>

Peihao Wang

References

Ghitany, M. E., Atieh, B., Nadarajah, S., (2008). Lindley distribution and its application. *Mathematics and Computers in Simulation*, **78**, (4), 49-506.

Jodra, P., (2010). Computer generation of random variables with Lindley or Poisson-Lindley distribution via the Lambert W function. *Mathematics and Computers in Simulation*, **81**, (4), 851-859.

Lindley, D. V., (1958). Fiducial distributions and Bayes' theorem. *Journal of the Royal Statistical Society. Series B. Methodological*, **20**, 102-107.

Lindley, D. V., (1965). *Introduction to Probability and Statistics from a Bayesian View-point, Part II: Inference*. Cambridge University Press, New York.

Examples

```
set.seed(1)
lambda = 1
theta = 0.5
n = 10
m = 10
x <- seq(from = 0.1,to = 6,by = 0.5)
p <- seq(from = 0.1,to = 1,by = 0.1)
plindleybinomial(x, lambda, theta, m, log.p = FALSE)
dlindleybinomial(x, lambda, theta, m)
hlindleybinomial(x, lambda, theta, m)
qlindleybinomial(p, lambda, theta, m)
rlindleybinomial(n, lambda, theta, m)
```

plindleygeometric *LindleyGeometric*

Description

distribution function, density function, hazard rate function, quantile function, random number generation

Usage

```
plindleygeometric(x, lambda, theta, log.p = FALSE)

dlindleygeometric(x, lambda, theta)

hlindleygeometric(x, lambda, theta)

qlindleygeometric(p, lambda, theta)

rlindleygeometric(n, lambda, theta)
```

Arguments

x	vector of positive quantiles.
lambda	positive parameter
theta	positive parameter.
log.p	logical; If TRUE, probabilities p are given as $log(p)$.
p	vector of probabilities.
n	number of observations.

Details

Probability density function

$$f(x) = \frac{\theta\lambda^2}{(\lambda+1)A(\theta)}(1+x)exp(-\lambda x)A^{'}(\phi)$$

Cumulative distribution function

$$F(x) = \frac{A(\phi)}{A(\theta)}$$

Quantile function

$$F^{-1}(p) = -1 - \frac{1}{\lambda} - \frac{1}{\lambda}W_{-1}\left\{\frac{\lambda+1}{exp(\lambda+1)}\left[\frac{1}{\theta}A^{-1}\{pA(\theta)\} - 1\right]\right\}$$

Hazard rate function

$$h(x) = \frac{\theta\lambda^2}{1+\lambda}(1+x)exp(-\lambda x)\frac{A^{'}(\phi)}{A(\theta) - A(\phi)}$$

where W_{-1} denotes the negative branch of the Lambert W function. $A(\theta) = \sum_{n=1}^{\infty} a_n \theta^n$ is given by specific power series distribution. Note that $x > 0, \lambda > 0$ for all members in Lindley Power Series distribution. $0 < \theta < 1$ for Lindley-Geometric distribution, Lindley-logarithmic distribution, Lindley-Negative Binomial distribution. $\theta > 0$ for Lindley-Poisson distribution, Lindley-Binomial distribution.

Value

`plindleygeometric` gives the culmulative distribution function

`dlindleygeometric` gives the probability density function

`hlindleygeometric` gives the hazard rate function

`qlindleygeometric` gives the quantile function

`rlindleygeometric` gives the random number generatedy by distribution

Invalid arguments will return an error message.

Author(s)

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Peihao Wang

References

Ghitany, M. E., Atieh, B., Nadarajah, S., (2008). Lindley distribution and its application. *Mathematics and Computers in Simulation*, **78**, (4), 49-506.

Jodra, P., (2010). Computer generation of random variables with Lindley or Poisson-Lindley distribution via the Lambert W function. *Mathematics and Computers in Simulation*, **81**, (4), 851-859.

Lindley, D. V., (1958). Fiducial distributions and Bayes' theorem. *Journal of the Royal Statistical Society. Series B. Methodological*, **20**, 102-107.

Lindley, D. V., (1965). *Introduction to Probability and Statistics from a Bayesian View-point, Part II: Inference*. Cambridge University Press, New York.

Examples

```
set.seed(1)
lambda = 1
theta = 0.5
n = 10
x <- seq(from = 0.1,to = 6,by = 0.5)
p <- seq(from = 0.1,to = 1,by = 0.1)
plindleygeometric(x, lambda, theta, log.p = FALSE)
dlindleygeometric(x, lambda, theta)
hlindleygeometric(x, lambda, theta)
qlindleygeometric(p, lambda, theta)
rlindleygeometric(n, lambda, theta)
```

`plindleylogarithmic` *LindleyLogarithmic*

Description

distribution function, density function, hazard rate function, quantile function, random number generation

Usage

```
plindleylogarithmic(x, lambda, theta, log.p = FALSE)

dlindleylogarithmic(x, lambda, theta)

hlindleylogarithmic(x, lambda, theta)

qlindleylogarithmic(p, lambda, theta)

rlindleylogarithmic(n, lambda, theta)
```

Arguments

`x`	vector of positive quantiles.
`lambda`	positive parameter
`theta`	positive parameter.
`log.p`	logical; If `TRUE`, probabilities p are given as $log(p)$.
`p`	vector of probabilities.
`n`	number of observations.

Details

Probability density function

$$f(x) = \frac{\theta\lambda^2}{(\lambda+1)A(\theta)}(1+x)exp(-\lambda x)A^{'}(\phi)$$

Cumulative distribution function

$$F(x) = \frac{A(\phi)}{A(\theta)}$$

Quantile function

$$F^{-1}(p) = -1 - \frac{1}{\lambda} - \frac{1}{\lambda}W_{-1}\left\{\frac{\lambda+1}{exp(\lambda+1)}\left[\frac{1}{\theta}A^{-1}\{pA(\theta)\} - 1\right]\right\}$$

Hazard rate function

$$h(x) = \frac{\theta\lambda^2}{1+\lambda}(1+x)exp(-\lambda x)\frac{A^{'}(\phi)}{A(\theta) - A(\phi)}$$

where W_{-1} denotes the negative branch of the Lambert W function. $A(\theta) = \sum_{n=1}^{\infty} a_n \theta^n$ is given by specific power series distribution. Note that $x > 0, \lambda > 0$ for all members in Lindley Power Series distribution. $0 < \theta < 1$ for Lindley-Geometric distribution,Lindley-logarithmic distribution,Lindley-Negative Binomial distribution. $\theta > 0$ for Lindley-Poisson distribution,Lindley-Binomial distribution.

Value

`plindleylogarithmic` gives the culmulative distribution function

`dlindleylogarithmic` gives the probability density function

`hlindleylogarithmic` gives the hazard rate function

`qlindleylogarithmic` gives the quantile function

`rlindleylogarithmic` gives the random number generatedy by distribution

Invalid arguments will return an error message.

Author(s)

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Peihao Wang

References

Ghitany, M. E., Atieh, B., Nadarajah, S., (2008). Lindley distribution and its application. *Mathematics and Computers in Simulation*, **78**, (4), 49-506.

Jodra, P., (2010). Computer generation of random variables with Lindley or Poisson-Lindley distribution via the Lambert W function. *Mathematics and Computers in Simulation*, **81**, (4), 851-859.

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Lindley, D. V., (1965). *Introduction to Probability and Statistics from a Bayesian View-point, Part II: Inference*. Cambridge University Press, New York.

Examples

```
set.seed(1)
lambda = 1
theta = 0.5
n = 10
x <- seq(from = 0.1,to = 6,by = 0.5)
p <- seq(from = 0.1,to = 1,by = 0.1)
plindleylogarithmic(x, lambda, theta, log.p = FALSE)
dlindleylogarithmic(x, lambda, theta)
hlindleylogarithmic(x, lambda, theta)
qlindleylogarithmic(p, lambda, theta)
rlindleylogarithmic(n, lambda, theta)
```

`plindleynb` *LindleyNegativeBinomial*

Description

distribution function, density function, hazard rate function, quantile function, random number generation

Usage

```
plindleynb(x, lambda, theta, m, log.p = FALSE)

dlindleynb(x, lambda, theta, m)

qlindleynb(p, lambda, theta, m)

rlindleynb(n, lambda, theta, m)
```

Arguments

`x`	vector of positive quantiles.
`lambda`	positive parameter
`theta`	positive parameter.
`m`	target for number of successful trials. Must be strictly positive, need not be integer.
`log.p`	logical; If `TRUE`, probabilities p are given as $log(p)$.
`p`	vector of probabilities.
`n`	number of observations.

Details

Probability density function

$$f(x) = \frac{\theta\lambda^2}{(\lambda+1)A(\theta)}(1+x)exp(-\lambda x)A^{'}(\phi)$$

Cumulative distribution function

$$F(x) = \frac{A(\phi)}{A(\theta)}$$

Quantile function

$$F^{-1}(p) = -1 - \frac{1}{\lambda} - \frac{1}{\lambda}W_{-1}\left\{\frac{\lambda+1}{exp(\lambda+1)}\left[\frac{1}{\theta}A^{-1}\{pA(\theta)\} - 1\right]\right\}$$

Hazard rate function

$$h(x) = \frac{\theta\lambda^2}{1+\lambda}(1+x)exp(-\lambda x)\frac{A^{'}(\phi)}{A(\theta)-A(\phi)}$$

where W_{-1} denotes the negative branch of the Lambert W function. $A(\theta) = \sum_{n=1}^{\infty} a_n\theta^n$ is given by specific power series distribution. Note that $x > 0, \lambda > 0$ for all members in Lindley Power Series distribution. $0 < \theta < 1$ for Lindley-Geometric distribution,Lindley-logarithmic distribution,Lindley-Negative Binomial distribution. $\theta > 0$ for Lindley-Poisson distribution,Lindley-Binomial distribution.

Value

`plindleynb` gives the culmulative distribution function

`dlindleynb` gives the probability density function

`hlindleynb` gives the hazard rate function

`qlindleynb` gives the quantile function

`rlindleynb` gives the random number generatedy by distribution

Invalid arguments will return an error message.

Author(s)

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Peihao Wang

References

Ghitany, M. E., Atieh, B., Nadarajah, S., (2008). Lindley distribution and its application. *Mathematics and Computers in Simulation*, **78**, (4), 49-506.

Jodra, P., (2010). Computer generation of random variables with Lindley or Poisson-Lindley distribution via the Lambert W function. *Mathematics and Computers in Simulation*, **81**, (4), 851-859.

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Examples

```
set.seed(1)
lambda = 1
theta = 0.5
n = 10
m = 10
x <- seq(from = 0.1,to = 6,by = 0.5)
p <- seq(from = 0.1,to = 1,by = 0.1)
plindleynb(x, lambda, theta, m, log.p = FALSE)
dlindleynb(x, lambda, theta, m)
hlindleynb(x, lambda, theta, m)
qlindleynb(p, lambda, theta, m)
rlindleynb(n, lambda, theta, m)
```

`plindleypoisson` *LindleyPoisson*

Description

distribution function, density function, hazard rate function, quantile function, random number generation

Usage

```
plindleypoisson(x, lambda, theta, log.p = FALSE)

dlindleypoisson(x, lambda, theta)

hlindleypoisson(x, lambda, theta)

qlindleypoisson(p, lambda, theta)

rlindleypoisson(n, lambda, theta)
```

Arguments

`x`	vector of positive quantiles.
`lambda`	positive parameter
`theta`	positive parameter.
`log.p`	logical; If `TRUE`, probabilities p are given as $log(p)$.
`p`	vector of probabilities.
`n`	number of observations.

Details

Probability density function

$$f(x) = \frac{\theta\lambda^2}{(\lambda+1)A(\theta)}(1+x)exp(-\lambda x)A^{'}(\phi)$$

Cumulative distribution function

$$F(x) = \frac{A(\phi)}{A(\theta)}$$

Quantile function

$$F^{-1}(p) = -1 - \frac{1}{\lambda} - \frac{1}{\lambda}W_{-1}\left\{\frac{\lambda+1}{exp(\lambda+1)}\left[\frac{1}{\theta}A^{-1}\{pA(\theta)\} - 1\right]\right\}$$

Hazard rate function

$$h(x) = \frac{\theta\lambda^2}{1+\lambda}(1+x)exp(-\lambda x)\frac{A^{'}(\phi)}{A(\theta) - A(\phi)}$$

where W_{-1} denotes the negative branch of the Lambert W function. $A(\theta) = \sum_{n=1}^{\infty} a_n \theta^n$ is given by specific power series distribution. Note that $x > 0, \lambda > 0$ for all members in Lindley Power Series distribution. $0 < \theta < 1$ for Lindley-Geometric distribution, Lindley-logarithmic distribution, Lindley-Negative Binomial distribution. $\theta > 0$ for Lindley-Poisson distribution, Lindley-Binomial distribution.

Value

`plindleypoisson` gives the culmulative distribution function

`dlindleypoisson` gives the probability density function

`hlindleypoisson` gives the hazard rate function

`qlindleypoisson` gives the quantile function

`rlindleypoisson` gives the random number generatedy by distribution

Invalid arguments will return an error message.

Author(s)

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References

Ghitany, M. E., Atieh, B., Nadarajah, S., (2008). Lindley distribution and its application. *Mathematics and Computers in Simulation*, **78**, (4), 49-506.

Jodra, P., (2010). Computer generation of random variables with Lindley or Poisson-Lindley distribution via the Lambert W function. *Mathematics and Computers in Simulation*, **81**, (4), 851-859.

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Lindley, D. V., (1965). *Introduction to Probability and Statistics from a Bayesian View-point, Part II: Inference*. Cambridge University Press, New York.

Examples

```
set.seed(1)
lambda = 1
theta = 0.5
n = 10
x <- seq(from = 0.1,to = 6,by = 0.5)
p <- seq(from = 0.1,to = 1,by = 0.1)
plindleypoisson(x, lambda, theta, log.p = FALSE)
dlindleypoisson(x, lambda, theta)
hlindleypoisson(x, lambda, theta)
qlindleypoisson(p, lambda, theta)
rlindleypoisson(n, lambda, theta)
```

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