Package ‘DiscreteInverseWeibull’

May 1, 2016

Type Package
Title Discrete Inverse Weibull Distribution
Version 1.0.2
Date 2016-04-29
Author Alessandro Barbiero, Riccardo Inchingolo, Mario Samigli
Maintainer Alessandro Barbiero <alessandro.barbiero@unimi.it>
Description Probability mass function, distribution function, quantile function, random generation and parameter estimation for the discrete inverse Weibull distribution.
License GPL
LazyLoad yes
Depends Rsolnp
Repository CRAN
Date/Publication 2016-05-01 00:44:40
NeedsCompilation no

R topics documented:

DiscreteInverseWeibull-package ........................................ 2
ahdiweibull ............................................................. 2
Discrete Inverse Weibull .............................................. 3
Ediweibull ............................................................... 5
estdiweibull ............................................................. 6
heuristic ................................................................. 7
hrdiweibull ............................................................. 8
loglikediw .............................................................. 9
lossdiw ................................................................. 10

Index 12
DiscreteInverseWeibull-package

Discrete Inverse Weibull Distribution

Description

Probability mass function, distribution function, quantile function, random generation and parameter estimation for the discrete inverse Weibull distribution

Details

Package: DiscreteInverseWeibull
Type: Package
Version: 1.0.2
Date: 2016-04-29
License: GPL
LazyLoad: yes
Depends: Rsolnp

Author(s)

Alessandro Barbiero <alessandro.barbiero@unimi.it>, Riccardo Inchingolo <dott.inchingolo_r@libero.it>, Mario Samigli <giulio.samigli@gmail.com>

References


ahrdiweibull

Alternative hazard rate function

Description

Alternative hazard rate function for the discrete inverse Weibull distribution
Discrete Inverse Weibull

Usage

ahrdiweibull(x, q, beta)

Arguments

x a vector of values
q the value of the q parameter
beta the value of the beta parameter

Details

The alternative hazard rate function is defined as
\[ h(x) = \log\left(\frac{P(X > x - 1) / P(X > x)}{1 - q(x-1)^{-\beta} / (1 - q x^{-\beta})}\right) \]

Value

the value of the alternative hazard rate function in the x values

See Also

hrdiweibull

Examples

q<-0.5
beta<-2
x<-1:10
y<-ahrdiweibull(x, q, beta)
y
plot(x,y,ylab="alt.hazard rate")

Discrete Inverse Weibull

The discrete inverse Weibull distribution

Description

Probability mass function, distribution function, quantile function and random generation for the discrete inverse Weibull distribution with parameters q and beta

Usage

ddiweibull(x, q, beta)
pdiweibull(x, q, beta)
qdiweibull(p, q, beta)
rdiweibull(n, q, beta)
Arguments

\( x \)  
- a vector of quantiles

\( p \)  
- a vector of probabilities

\( q \)  
- the value of the first parameter, \( q \)

\( \beta \)  
- the value of the second parameter, \( \beta \)

\( n \)  
- the sample size

Details

The discrete inverse Weibull distribution has probability mass function given by 

\[
P(X = x; q, \beta) = q^{(x-\beta)} - q^{(x-1-\beta)}, \ x = 1, 2, 3, \ldots, \ 0 < q < 1, \ \beta > 0.\]

Its cumulative distribution function is 

\[
F(x; q, \beta) = q^{x-\beta}.
\]

Value

ddiweibull gives the probability, pdiweibull gives the distribution function, qdiweibull gives the quantile function, and rdiweibull generates random values. See the reference below for the continuous inverse Weibull distribution.

References


Examples

```r
# Ex.1
x<-1:10
q<-.6
beta<-.8
ddiweibull(x, q, beta)
t<-qdiweibull(.99, q, beta)
t
pdiweibull(t, q, beta)
# Ex.2
q<-.4
beta<-1.7
n<-100
x<-rdiweibull(n, q, beta)
tabulate(x)/sum(tabulate(x))
y<-1:round(max(x))
# compare with
ddiweibull(y, q, beta)
```
Description

First and second order moments of the discrete inverse Weibull distribution

Usage

odiweibull(q, beta, eps = 1e-04, nmax = 1000)

Arguments

q        the value of the \(q\) parameter
beta     the value of the \(\beta\) parameter
eps      error threshold for the approximated computation of the moments
nmax     a first maximum value of the support considered for the approximated computation of the moments

Details

For a discrete inverse Weibull distribution we have \(E(X; q, \beta) = \sum_{x=0}^{+\infty} 1-F(x; q, \beta)\) and \(E(X^2; q, \beta) = 2 \sum_{x=1}^{+\infty} x(1-F(x; q, \beta)) + E(X; q, \beta)\). The expected values are numerically computed considering a truncated support: integer values smaller than or equal to \(\min(nmax; F^{-1}(1-eps; q, \beta))\), where \(F^{-1}\) is the inverse of the cumulative distribution function (implemented by the function qdiweibull). Increasing the value of nmax or decreasing the value of eps improves the approximation, but slows down the calculation speed.

Value

a list comprising the (approximate) first and second order moments of the discrete inverse Weibull distribution. Note that the first moment is finite iff \(\beta\) is greater than 1; the second order moment is finite iff \(\beta\) is greater than 2

References


Examples

# Ex. 1
q<-0.75
beta<-1.25
odiweibull(q, beta)

# Ex. 2
q<-0.5
estdiweibull

Estimation of parameters

Description

Sample estimation of the parameters of the discrete inverse Weibull distribution

Usage

estdiweibull(x, method="P", control=list())

Arguments

x  a vector of sample values
method  the estimation method that will be carried out: "P" method of proportion, "M" method of moments, "H" heuristic-maximum likelihood method, "PP" graphical method-probability plot
control  a list of additional parameters: eps, nmax for the method of moments; beta1, z, r, Leps for the heuristic method

Details

For a description of the methods, have a look at the reference. Note that they may be not applicable to some specific samples. For examples, the method of proportion cannot be applied if there are no 1s in the samples; it cannot be applied for estimating $\beta$ if all the sample values are $\leq 2$. The method of moments cannot be applied for estimating $\beta$ if all the sample values are $\leq 2$; besides, it may return unreliable results since the first and second moments can be computed only if $\beta > 2$. The heuristic method cannot be applied for estimating $\beta$ if all the sample values are $\leq 2$.

Value

a vector containing the two estimates of $q$ and $\beta$

See Also

heuristic, Ediweibull
Examples

```r
n<-100
def<-0.5
beta<-2.5
# generation of a sample
x<-rdiweibull(n, def, beta)
# sample estimation through each of the implemented methods
estdiweibull(x, method="P")
estdiweibull(x, method="M")
estdiweibull(x, method="H")
estdiweibull(x, method="PP")
```

---

<table>
<thead>
<tr>
<th>heuristic</th>
<th>Heuristic method of estimation</th>
</tr>
</thead>
</table>

Description

Heuristic method for the estimation of parameters of the discrete inverse Weibull

Usage

```r
heuristic(x, beta = 1, z = 0.1, r = 0.1, Leps = 0.01)
```

Arguments

- `x`: a vector of sample values
- `beta`: launch value of the \( \beta \) parameter
- `z`: initial value of width
- `r`: initial value of rate
- `Leps`: tolerance error for the likelihood function

Details

For a detailed description of the method, have a look at the reference

Value

a list containing the two estimates of \( q \) and \( \beta \)

References


See Also

estdiweibull

Examples

n<-50
q<-0.25
beta<-1.5
x<-rdiweibull(n, q, beta)
# estimates using the heuristic algorithm
par0<-heuristic(x)
par0
# change the default values of some working parameters...
par1<-heuristic(x, beta=2)
par1
par2<-heuristic(x, z=0.5)
par2
par3<-heuristic(x, r=0.2)
par3
par4<-heuristic(x, Leps=0.1)
par4
# ...there should be just light differences among the estimates...
# ... and among the corresponding values of the loglikelihood functions
loglikediw(x, par0[1], par0[2])
loglikediw(x, par1[1], par1[2])
loglikediw(x, par2[1], par2[2])
loglikediw(x, par3[1], par3[2])
loglikediw(x, par4[1], par4[2])

hrdiweibull  Hazard rate function

Description

Hazard rate function for the discrete inverse Weibull distribution

Usage

hrdiweibull(x, q, beta)

Arguments

x a vector of values
q the value of the q parameter
beta the value of the β parameter
The hazard rate function is defined as \( r(x) = \frac{P(X = x)}{P(X \geq x)} = \frac{q^x - q^{(x-1)}}{1 - q^{(x-1) - \beta}} \) for the discrete inverse Weibull distribution.

The value of the log-likelihood function (changed in sign) of the discrete inverse Weibull distribution with parameters \( q \) and \( \beta \) computed on a sample \( x \) is given by:

\[
\text{loglikediw}(x, q, \beta) = \frac{q^x - q^{(x-1)}}{1 - q^{(x-1) - \beta}}
\]

where \( x \) is a vector of sample values, \( q \) is the value of the \( q \) parameter, and \( \beta \) is the value of the \( \beta \) parameter.

See Also
- \text{ahrdiweibull}
- \text{hrdiweibull}
Examples

```r
n<-100
gamma<-0.4
beta<-2
x<-rdiweibull(n, q, beta)
# loglikelihood function (changed in sign) computed on the true values
loglikediw(x, q, beta)
par<-estdiweibull(x, method="H")
par
# loglikelihood function (changed in sign) computed on the ML estimates
loglikediw(x, par[1], par[2])
# it should be smaller than before...
```

---

lossdiw | Loss function

Description

Quadratic loss function for the method of moments

Usage

```r
lossdiw(x, par, eps = 1e-04, nmax=1000)
```

Arguments

- `x`: a vector of sample values
- `par`: a vector of parameters (q and 
- `eps`: a tolerance error for the computation of first order moments
- `nmax`: a first maximum value for the computation of first order moments

Value

the value of the quadratic loss function $L(x; q, \beta) = (E(X; q, \beta) - m_1)^2 + (E(X^2; q, \beta) - m_2)^2$

where $m_1$ and $m_2$ are the first and second order sample moments.

See Also

`Ediweibull`

Examples

```r
n<-100
gamma<-0.5
beta<-2.5
x<-rdiweibull(n, q, beta)
# loss function computed on the true values
lossdiw(x, c(q, beta))
```
par<-estdiweibull(x, method="M")
# estimates of the parameters through the method of moments
par
# loss function computed on the estimates derived through
# the method of moments
lossdiw(x, par)
# it should be zero (however, smaller than before...)
Index

*Topic distribution, htest
   estdiweibull, 6
   heuristic, 7
   loglikediw, 9
*Topic distribution
   ahrdiweibull, 2
   Discrete Inverse Weibull, 3
   Ediweibull, 5
   hrdiweibull, 8
   losssdiw, 10
*Topic package
   DiscreteInverseWeibull-package, 2

ahrdiweibull, 2, 9

ddiweibull (Discrete Inverse Weibull), 3
Discrete Inverse Weibull, 3
DiscreteInverseWeibull
   (DiscreteInverseWeibull-package),
      2
DiscreteInverseWeibull-package, 2

Ediweibull, 5, 6, 10
estdiweibull, 6, 8

heuristic, 6, 7, 9
hrdiweibull, 3, 8

loglikediw, 9
lossdiw, 10

pdiweibull (Discrete Inverse Weibull), 3
qdiweibull, 5
qdiweibull (Discrete Inverse Weibull), 3
rdiweibull (Discrete Inverse Weibull), 3