

# Package ‘DiscreteInverseWeibull’

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

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DiscreteInverseWeibull-package

*Discrete Inverse Weibull Distribution*

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**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)**

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**References**

- Jazi M.A., Lai C.-D., Alamatsaz M.H. (2010) A discrete inverse Weibull distribution and estimation of its parameters, *Statistical Methodology* 7: 121-132
- Khan M.S., Pasha G.R., Pasha A.H. (2008) Theoretical Analysis of Inverse Weibull Distribution, *WSEAS Transactions on Mathematics* 2(7): 30-38
- Drapella A. (1993) Complementary Weibull distribution: unknown or just forgotten, *Quality Reliability Engineering International* 9: 383-385
- Dutang, C., Goulet, V., Pigeon, M. (2008) actuar: An R package for actuarial science, *Journal of Statistical Software* 25(7): 1-37

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ahrliweibull                      *Alternative hazard rate function*

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### Description

Alternative hazard rate function for the discrete inverse Weibull distribution

### Usage

```
ahrliweibull(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  $h(x) = \log(P(X > x - 1)/P(X > x)) = \log[(1 - q^{(x-1)^{-\beta}})/(1 - q^{x^{-\beta}})]$

### Value

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

### See Also

[hrliweibull](#)

### Examples

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

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 Discrete Inverse Weibull

*The discrete inverse Weibull distribution*


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**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  $P(X = x; q, \beta) = q^{(x)^{-\beta}} - q^{(x-1)^{-\beta}}$ ,  $x = 1, 2, 3, \dots$ ,  $0 < q < 1, \beta > 0$ . 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**

Dutang, C., Goulet, V., Pigeon, M. (2008) actuar: An R package for actuarial science, Journal of Statistical Software 25(7): 1-37

**Examples**

```
# Ex.1
x<-1:10
q<-0.6
beta<-0.8
ddiweibull(x, q, beta)
t<-qdiweibull(0.99, q, beta)
t
pdiweibull(t, q, beta)
# Ex.2
q<-0.4
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)
```

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Ediweibull

*First and second order moments*


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**Description**

First and second order moments of the discrete inverse Weibull distribution

**Usage**

```
Ediweibull(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**

Khan M.S., Pasha G.R., Pasha A.H. (2008) Theoretical Analysis of Inverse Weibull Distribution, WSEAS Transactions on Mathematics 2(7): 30-38

**Examples**

```
# Ex.1
q<-0.75
beta<-1.25
Ediweibull(q, beta)
# Ex.2
q<-0.5
beta<-2.5
Ediweibull(q, beta)
# Ex.3
q<-0.4
beta<-4
Ediweibull(q, beta)
```

---

 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**

```
n<-100
q<-0.5
beta<-2.5
# generation of a sample
x<-rdiweibull(n, q, 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")
```

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heuristic

*Heuristic method of estimation*

---

**Description**

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

**Usage**

```
heuristic(x, beta1=1, z = 0.1, r = 0.1, Leps = 0.01)
```

**Arguments**

x	a vector of sample values
beta1	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 containig the two estimates of  $q$  and  $\beta$

**References**

Jazi M.A., Lai C.-D., Alamatsaz M.H. (2010) A discrete inverse Weibull distribution and estimation of its parameters, *Statistical Methodology*, 7: 121-132

Drapella A. (1993) Complementary Weibull distribution: unknown or just forgotten, *Quality Reliability Engineering International* 9: 383-385

**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, beta1=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])
```



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hrdiweibull	<i>Hazard rate function</i>
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**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 $\beta$ parameter

**Details**

The hazard rate function is defined as  $r(x) = P(X = x)/P(X \geq x) = (q^{x^{-\beta}} - q^{(x-1)^{-\beta}})/(1 - q^{(x-1)^{-\beta}})$

**Value**

the hazard rate function computed on the x values

**See Also**

[ahradiweibull](#)

**Examples**

```
q<-0.5  
beta<-2.5  
x<-1:10  
hrdiweibull(x, q, beta)
```

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loglikediw	<i>likelihood function</i>
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**Description**

Log-likelihood function of the discrete inverse Weibull

**Usage**

```
loglikediw(x, q, beta)
```

**Arguments**

x	a vector of sample values
q	the value of the $q$ parameter
beta	the value of the $\beta$ parameter

**Value**

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  $x$

**See Also**

[heuristic](#)

**Examples**

```
n<-100
q<-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...
```

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lossdiw	<i>Loss function</i>
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**Description**

Quadratic loss function for the method of moments

**Usage**

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

**Arguments**

x	a vector of sample values
par	a vector of parameters ( $q$ and $\beta$ )
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**

```
n<-100
q<-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...)
```

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