Package 'DiscreteLaplace'

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Type Package

Title Discrete Laplace distribution

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Description Density, distribution function, quantile function, random generation and estimation for the skew discrete Laplace distribution

License GPL

LazyLoad yes

R topics documented:

`DiscreteLaplace-package`

Discrete Laplace distribution

Description

Density, distribution function, quantile function and random generation for the skew discrete Laplace distribution

Details

Package:	DiscreteLaplace
Type:	Package
Version:	1.0
Date:	2012-01-29
License:	GPL
LazyLoad:	yes

Author(s)

Alessandro Barbiero, Riccardo Inchingolo Maintainer: Alessandro Barbiero <alessandro.barbiero@unimi.it>

References

Tomasz J. Kozubowski, Seidu Inusah (2006) A skew Laplace distribution on integers, *AISM*, 58: 555-571

`ddlaplace` *Density function of the discrete Laplace distribution*

Description

The function computes the density function of the discrete Laplace distribution

Usage

```
ddlaplace(x, p, q)
```

Arguments

`x`	a vector of integer values
`p`	the first parameter of the discrete Laplace distribution
`q`	the second parameter of the discrete Laplace distribution

Details

$P(X = x; p, q) = \frac{(1-p)(1-q)}{1-pq} p^x; x = 0, 1, 2, 3, \ldots$

$P(X = x; p, q) = \frac{(1-p)(1-q)}{1-pq} q^{|x|}; x = 0, -1, -2, -3, \ldots$

Value

The vector of probabilities corresponding to the vector of integer values `x`

Author(s)

Alessandro Barbiero, Riccardo Inchingolo

References

Tomasz J. Kozubowski, Seidu Inusah (2006) A skew Laplace distribution on integers, *AISM*, 58: 555-571

See Also

pdlaplace, qdlaplace, rdlaplace

Examples

```
p<-0.7
q<--0.45
x<--10:10
prob<-ddlaplace(x, p, q)
plot(x, prob, type="h")
# swap the parameters
prob<-ddlaplace(x, q, p)
plot(x, prob, type="h")
```

Edlaplace *Moments of the discrete Laplace distribution*

Description

The function provides the expected value and the variance of the discrete Laplace distribution, and the expectation of its absolute value

Usage

```
Edlaplace(p, q)
```

Arguments

p	the first parameter of the discrete Laplace distribution
q	the second parameter of the discrete Laplace distribution

Details

$E(X;p,q) = \frac{1}{1-p} - \frac{1}{1-q} = \frac{p}{1-p} - \frac{q}{1-q}$,

$E(|X|;p,q) = \frac{q(1-p)^2+p(1-q)^2}{(1-qp)(1-q)(1-p)}$,

$V(X;p,q) = \frac{1}{(1-p)^2(1-q)^2}[\frac{q(1-p)^3(1+q)+p(1-q)^3(1+p)}{1-pq} - (p-q)^2]$

Value

A list of three items:

E1	expected value
E1a	expectation of the absolute value
V	variance

Author(s)

Alessandro Barbiero, Riccardo Inchingolo

References

Tomasz J. Kozubowski, Seidu Inusah (2006) A skew Laplace distribution on integers, *AISM*, 58: 555-571

See Also

ddlaplace

Examples

```
# ex.1
p<-0.5
q<-0.4
Edlaplace(p, q)
# ex.2
p<-0.1
q<-0.9
Edlaplace(p, q)
```

`estdlaplace` *Sample estimation for the discrete Laplace distribution*

Description

The function provides the maximum likelihood estimates for the parameters of the discrete Laplace distribution and the estimate of the inverse of the Fisher information matrix. The method of moments estimators of p and q coincide with the maximum likelihood's.

Usage

```
estdlaplace(x)
```

Arguments

x	a vector of integer values sampled from the discrete Laplace distribution

Details

See the reference. If $\bar{x}^+ = \frac{1}{n}\sum_{i=1}^{n} x_i^+$, $\bar{x}^- = \frac{1}{n}\sum_{i=1}^{n} x_i^-$ where x^+ and x^- are the positive and the negative parts of x, respectively: $x^+ = x$ if $x \geq 0$ and zero otherwise, $x^- = (-x)^+$, then

$\hat{q} = \frac{2\bar{x}^-(1+\bar{x})}{1+2\bar{x}^-\bar{x}+\sqrt{1+4\bar{x}^-\bar{x}^+}}$, $\hat{p} = \frac{\hat{q}+\bar{x}(1-\hat{q})}{1+\bar{x}(1-\hat{q})}$

when $\bar{x} \geq 0$ and

$\hat{p} = \frac{2\bar{x}^+(1-\bar{x})}{1-2\bar{x}^+\bar{x}+\sqrt{1+4\bar{x}^-\bar{x}^+}}$, $\hat{q} = \frac{\hat{p}-\bar{x}(1-\hat{p})}{1-\bar{x}(1-\hat{p})}$

when $\bar{x} \leq 0$.

Value

A list comprising

`hatp`	estimate of p
`hatq`	estimate of q
`hatSigma`	estimate of the inverse of the Fisher information matrix

Author(s)

Alessandro Barbiero, Riccardo Inchingolo

References

Tomasz J. Kozubowski, Seidu Inusah (2006) A skew Laplace distribution on integers, *AISM*, 58: 555-571

See Also

`ddlaplace`, `pdlaplace`, `qdlaplace`, `rdlaplace`

Examples

```
p<-0.6
q<-0.3
n<-20
x<-rdlaplace(n, p, q)
est<-estdlaplace(x)
est[1]
est[2]
est[3]
# increase n
n<-100
x<-rdlaplace(n, p, q)
est<-estdlaplace(x)
est[1]
est[2]
est[3]
# swap the parameters
x<-rdlaplace(n, q, p)
est<-estdlaplace(x)
est[1]
est[2]
est[3]
```

---

pdlaplace *Distribution function of the discrete Laplace distribution*

Description

The function provides the cumulate probabilities associated to the values of a given vector of real values

Usage

```
pdlaplace(x, p, q)
```

Arguments

x	a vector of real values
p	the first parameter of the discrete Laplace distribution
q	the second parameter of the discrete Laplace distribution

Details

$F(x;p,q) = P(X \leq x) = \frac{(1-p)q^{-[x]}}{1-pq}, x < 0$

$F(x;p,q) = P(X \leq x) = 1 - \frac{(1-q)p^{[x]+1}}{1-pq}, x \geq 0$

Value

A vector of cumulate probabilities

Author(s)

Alessandro Barbiero, Riccardo Inchingolo

References

Tomasz J. Kozubowski, Seidu Inusah (2006) A skew Laplace distribution on integers, *AISM*, 58: 555-571

See Also

ddlaplace, qdlaplace, rdlaplace

Examples

```
p<-0.2
q<-0.5
x<-c(-3, -1, pi)
pdlaplace(x, p, q)
```

---

qdlaplace *Quantile function of the discrete Laplace distribution*

Description

The function provides the values corresponding to a vector of desired cumulate probabilities

Usage

```
qdlaplace(prob, p, q)
```

Arguments

prob	a vector of cumulate probabilities
p	the first parameter of the discrete Laplace distribution
q	the second parameter of the discrete Laplace distribution

Value

A vector of integer values

Author(s)

Alessandro barbiero, Riccardo Inchingolo

References

Tomasz J. Kozubowski, Seidu Inusah (2006) A skew Laplace distribution on integers, *AISM*, 58: 555-571

See Also

ddlaplace, pdlaplace, rdlaplace

Examples

```
p<-0.8
q<-0.4
prob<-c(0.2,0.5,0.8)
x<-qdlaplace(prob, p, q)
x
# check
upper<-pdlaplace(x, p, q)
upper
lower<-pdlaplace(x-1, p, q)
lower
lower<=prob & prob<=upper
```

---

rdlaplace *Random generation for the discrete Laplace distribution*

Description

The function provides a random sample of size n from the discrete Laplace distribution

Usage

```
rdlaplace(n, p, q)
```

Arguments

n	the sample size
p	the first parameter of the discrete Laplace distribution
q	the second parameter of the discrete Laplace distribution

Value

A vector of size of integer values n

Author(s)

Alessandro Barbiero, Riccardo Inchingolo

References

Tomasz J. Kozubowski, Seidu Inusah (2006) A skew Laplace distribution on integers, *AISM*, 58: 555-571

See Also

ddlaplace, pdlaplace, qdlaplace

Examples

```
n<-100
p<-0.3
q<-0.5
x<-rdlaplace(n, p, q)
x
t<-table(x)
t
plot(t)
```

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