

# Package: poistweedie (via r-universe)

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**Title** Poisson-Tweedie Exponential Family Models

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**Description** Simulation of models Poisson-Tweedie.

**License** GPL (>= 2)

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dpoistweeie

*The individual probabilities of Y when Y follows a Poisson-Tweedie Distributions*

### Description

Let  $X$  be a non-negative random variable following  $\mathcal{T}_P(\theta, \lambda)$ . If a discrete random variable  $Y$  is such that the conditional distribution of  $Y$  given  $X$  is Poisson with mean  $X$ , then the EDM generated by the distribution of  $Y$  is of the Poisson-Tweedie class. For  $p \geq 1$  individual probabilities of  $Y \sim \mathcal{PT}_P(\theta, \lambda)$  when  $Y$  follows a Poisson-Tweedie Distributions are:  $Pr(Y = y) = \int_0^\infty \frac{e^{-x} x^y}{y!} \mathcal{T}_P(\theta, \lambda) d(x), y = 0, 1, \dots$ .

For  $p = 1$ , it is a Neyman type A distribution; for  $1 < p < 2$ , then Poisson-compound Poisson distribution is obtained; for  $p = 2$ , the Poisson-Tweedie model  $PT_2(\mu, \lambda)$  correspond to the negative binomiale law  $BN\left(\lambda, \frac{1}{1+\mu}\right)$ ; and, for  $p = 3$ , it is the Sichel or Poisson-inverse Gaussian distribution (e.g. Willmot, 1987). Also, when  $p \rightarrow \infty$ ,  $\lambda = \frac{\mu \times (1-\theta_0)}{1+\mu}$  and the  $\lambda = \mu \simeq -\theta_0$ , the Poisson-Tweedie model  $PT_p(\mu, \lambda)$  correspond to the poisson law  $P_y(\lambda^2)$ .

### Usage

```
dpoistweeie(y, p, mu, lambda, theta0, log)
densitept1(p, n, mu, lambda, theta0)
densitept2(p, n, mu, lambda, theta0)
dpt1(p, n, mu, lambda, theta0)
dpt1Log(p, n, mu, lambda, theta0)
dpt2(p, n, mu, lambda, theta0)
dpt2Log(p, n, mu, lambda, theta0)
dptp(p, n, mu, lambda, theta0)
dptpLog(p, n, mu, lambda, theta0)
gam1.1(y, lambda)
gam1.2(y, lambda)
imfx0(x0, p, mu, theta0)
moyennePT(p, omega, theta0)
omega(p, mu, theta0)
testOmegaPT(p, n)
```

### Arguments

$y$	vector of (non-negative integer) quantiles $Y = (y_1, y_2, \dots, y_n)$ where $y_{ii} = 1, 2, \dots, n$ are the integer.
$p$	is a real index related to a precise model $p \geq 1$ .
$n$	non-negative integer (length of $y$ )
$x_0$	is a real index
$\mu$	the mean $\mu \in R^+, .$

omega	is a real index. $\omega \in R$
lambda	the dispersion parameter $\lambda \in R, \lambda > 0$ .
theta0	the canonical parameter $\theta_0 \in R^-$ .
log	logical; if TRUE, probabilities y are given as log(y).

### Details

The Poisson-Tweedie distributions are the EDMs with a variance of the form  $V_p^{\mathcal{PT}}(\mu) = \mu + \mu^p \exp\{(2-p)\Phi_p(\mu)\}$ ,  $\mu > 0$ , where  $\Phi_p(\mu)$  a generally implicit, denotes the inverse of the increasing function  $\omega \rightarrow \frac{d\{\ln IE(e^{w\omega})\}}{dw}$ . `omega(p,mu,theta0)` is a function whose permit to determine the value of  $w$ .

### Value

density (`dpoistweedie`), for the given Poisson-Tweedie distribution with parameters

### Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

### References

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- Dunn, Peter K and Smyth, Gordon K (2001). Tweedie family densities: methods of evaluation. *Proceedings of the 16th International Workshop on Statistical Modelling*, Odense, Denmark, 2–6 July
- Hougaard, P., Lee, M-L.T. and Whitmore, G.A. (1997). Analysis of overdispersed count data by mixtures of Poisson variables and Poisson processes, *Biometrics* **53**, 1225–1238
- Jorgensen, B. (1987). Exponential dispersion models. *Journal of the Royal Statistical Society, B*, **49**, 127–162.
- Kokonendji, C.C., Demeetrio, C.G.B. and Dossou-Gbete, S. (2004). Some discrete exponential dispersion models: Poisson-Tweedie and Hinde-Demetrio classes. *SORT: Statistics and Operations Research Transactions* **28** (2), 201–214.

### See Also

[ppoistweedie](#)

### Examples

```
## dpoistweedie(y, power, mu, lambda, theta0, log = FALSE)
## Plot dpois() and dpoistweedie() with log=FALSE
layout(matrix(1 :1, 1, 1))
layout.show(2)
power <- exp(10)
mu <- 10
```

```

lambda <- 10
theta0<--10
lambda1<-100
y <- 0:200
## plot dpoistweedie function with log = FALSE
d1<-dpoistweedie(y,power,mu,lambda,theta0,log = FALSE)
d2<-dpois(y,lambda1,log=FALSE)
erreure<-d1-d2
plot (y,d1,col='blue', type='h',xlab="y
      avec y=0:200, power=exp(30),mu=10, lambda=10,
      theta0=-10, lambda1=100", ylab="densite P(100)",
      main = "dpoistweedie(*,col='blue' log=FALSE)
      et dpois(*,col='red' log=FALSE)")
lines(y,d2,type ="p",col='red',lwd=2)
sum(abs(erreure))

```

```

## Plot dnbinom() and dpoistweedie()
layout(matrix(1 :1, 1, 1))
layout.show(2)
power<-2
mu<-10
lambda <- 1
theta0<-0
prob<-1-(mu/(1+mu))
y <- seq(0,50, by =3)
## plot a dpoistweedie function with log=FALSE
d1<-dpoistweedie(y,power,mu,lambda,theta0,log=FALSE)
d2<-dnbinom(y,lambda,prob, log=FALSE)
erreure<-d1-d2
plot (y,d1,col='blue', type='h',xlab="y
      avec y=seq(0,50,by=3), power=2,mu=10,
      lambda=1, theta0=0", ylab="densite NB(1,1/11)"
      ,main = "dnpoistweedie(*,col='blue' log=FALSE)
      et dnbinom(*,col='red' log=FALSE)")
lines(y,d2,type ="p",col='red',lwd=2)
abs(erreure)

```

---

poistweedie

*Poisson-Tweedie (Some discrete exponential dispersion models)*

---

## Description

Density, Log of density, variance for the Poisson-Tweedie family of distributions

## Usage

```
poistweedie(x, n, p, mu, lambda, theta0, lower.tail = TRUE, log.p = FALSE,
```

```

fonction = "PROBABILITE")
poisson(x, n, p, lambda1, lower.tail = TRUE, log.p = FALSE,
fonction = "PROBABILITE")
nbinomiale(x, n, p, lambda1, p1, lower.tail = TRUE, log.p = FALSE,
fonction = "PROBABILITE")

```

### Arguments

<code>x</code>	vector of (non-negative integer) quantiles.
<code>p</code>	is a real index related to a precise model.
<code>p1</code>	is a real index related to a precise model.
<code>n</code>	non-negative integer
<code>mu</code>	the mean.
<code>lambda</code>	the dispersion parameter.
<code>lambda1</code>	the dispersion parameter.
<code>theta0</code>	the canonical parameter.
<code>log, log.p</code>	logical; if TRUE, probabilities <code>p</code> are given as $\log(p)$ .
<code>lower.tail</code>	logical; if TRUE (default), probabilities are $P[X \leq x]$ , otherwise, $P[X > x]$ .
<code>fonction</code>	is a string

### Details

Density, Log of density, variance for the Poisson-Tweedie family of distributions

### Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

### See Also

[dpoistwee\*die\*](#), [ppoistwee\*die\*](#)

### Examples

```

## poistweedie(x, n, p, mu, lambda, theta0, lower.tail = TRUE,
##           log.p = FALSE, fonction = "PROBABILITE")
x <- 0:200
p <- 1.5
mu <- 10
lambda <- 10
theta0 <- -10
d1 <- poistweedie(x, n, p, mu, lambda, theta0, lower.tail = TRUE,
log.p = FALSE, fonction = "PROBABILITE")

```

---

ppoistweedie                      *Distribution function for the Poisson-Tweedie family*

---

### Description

Distribution function, for the Poisson-Tweedie family of distributions

### Usage

```
ppoistweedie(q, p, mu, lambda, theta0, lower.tail, log.p)
```

### Arguments

q	vector of quantiles.
p	is a real index related to a precise model.
mu	the mean.
lambda	the dispersion parameter.
theta0	the canonical parameter.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X \leq x]$ , otherwise, $P[X > x]$ .

### Details

The Poisson-Tweedie family of distributions belong to the class of exponential dispersion models (EDMs), famous for their role in generalized linear models.

### Value

probability (ppoistweedie), for the given Poisson-Tweedie distribution with parameters

### Author(s)

Cactha David Pechel, Laure Pauline Fotso and Celestin C Kokonendji Maintainer: Cactha David Pechel (<davidpechel@yahoo.fr>)

### See Also

[qpoistweedie](#)

**Examples**

```
## function ppoistweedie(q, power, mu, lambda, theta0,
## lower.tail = TRUE, log.p = FALSE)
## Plot ppois() et ppoistweedie() avec log.p=FALSE
layout(matrix(1 :1, 1, 1))
layout.show(1)
power<-exp(30)
mu<-5
lambda <- 5
theta0<--5
prob<-1-(mu/(1+mu))
lambda1<-lambda^2
q <- 0:100
## function ppoistweedie function with log=FALSE
d1<-ppoistweedie(q,power,mu,lambda,theta0,lower.tail=TRUE,log.p=FALSE)
d2<-ppois(q,lambda1,lower.tail=TRUE,log.p=FALSE)
erreure<- d1-d2
plot (q,d1,col='blue', type='h',xlab="q
avec q=0:100, power=exp(30),mu=5, lambda=5,
theta0=-5, lambda1=25", ylab="fonction de
repartition P(25)",main = "ppoistweedie(*,col='blue' log=FALSE)
et ppois(*,col='red' log=FALSE)")
lines(q,d2,type ="p",col='red',lwd=2)
sum(abs(erreure))
```

---

qpoistweedie

*Quantile function for the Poisson-Tweedie family of distributions*


---

**Description**

Quantile function for the Poisson-Tweedie family of distributions

**Usage**

```
qpoistweedie(p1, p, mu, lambda, theta0, lower.tail, log.p)
```

**Arguments**

p1	vector of probabilities.
p	is a real index related to a precise model.
mu	the mean.
lambda	the dispersion parameter.
theta0	the canonical parameter.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are $P[X \leq x]$ , otherwise, $P[X > x]$ .

**Details**

The Poisson-Tweedie family of distributions belong to the class of exponential dispersion models (EDMs), famous for their role in generalized linear models. T

**Value**

quantile (qpoistweedie) for the given Poisson-Tweedie distribution with parameters

**Author(s)**

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**See Also**

[poistweedie](#)

**Examples**

```
## function qpoistweedie(p, power, mu,lambda,theta0,
## lower.tail = TRUE, log.p = FALSE)
## Plot qpois() and qpoistweedie() with log.p=FALSE
layout(matrix(1 :1, 1, 1))
layout.show(1)
power<-exp(30)
mu<-10
lambda <- 10
theta0<--10
prob<-1-(mu/(1+mu))
lambda1<-100
p <- runif(50)
p
## plot of qpoistweedie function with log=FALSE
d1<-ppoistweedie(p,power,mu,lambda,theta0,lower.tail=TRUE,log.p=FALSE)
d2<-ppois(p,lambda1,lower.tail=TRUE,log.p=FALSE)
erreure<- d1-d2
plot (p,d1,col='blue', type='h',xlab="p
avec p=runif(50), power=exp(30),mu=10, lambda=10,
theta0=-10, lambda1=100, lower.tail=TRUE",
ylab="quantile function P(100)",main =
"qpoistweedie(*,col='blue' log.p=FALSE)
et qpois(*,col='red' log.p=FALSE)")
lines(p,d2,type ="p",col='red',lwd=2)
sum(abs(erreure))
```



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rpoistwee <sup>die</sup>	<i>Random generation for the Poisson-Tweedie family of distributions</i>
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---

## Description

Random generation for the Poisson-Tweedie family of distributions

## Usage

```
rpoistweedie(n, p, mu, lambda, theta0)
```

## Arguments

n	number of random values to return.
p	vector of probabilities.
mu	the mean.
lambda	the dispersion parameter.
theta0	the canonical parameter.

## Details

The Poisson-Tweedie family of distributions belong to the class of exponential dispersion models (EDMs), famous for their role in generalized linear models.

## Value

random sample (rpoistwee<sup>die</sup>) for the given Poisson-Tweedie distribution with parameters

## Author(s)

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## See Also

[varpt](#)

## Examples

```
## ----- function rpoistweedie()----- ##  
layout(matrix(2 :1, 2,1))  
layout.show(2)  
power<-exp(30)  
mu<-10  
lambda <- 10  
theta0<--10  
prob<-1-(mu/(1+mu))
```

```

lambda1<-100
n<-10
set.seed(123)
x1<-rpoistweedie(n,power,mu,lambda,theta0)
set.seed(123)
x2<-rpois(n,lambda1)
hist(x1, xlim = c(min(x1),max(x1)), probability = FALSE,
     col = 'blue',xlab="modalit\{e}s: x1",ylab="effectifs ",
     nclass = max(x1) - min(x1),main="Histogramme de x1
(lambda=100, n=10)")
hist(x2, xlim = c(min(x2),max(x2)), probability = FALSE,
     col = 'blue',xlab="modalit\{e}s: x2 ",ylab="effectifs ",
     nclass = max(x2) - min(x2),main="Histogramme de x2
(lambda1=100, n=10)")
sum(x2-x1)

```

---

varpt

*variance for the Poisson-Tweedie family of distributions*


---

### Description

Variance for the Poisson-Tweedie family of distributions

### Usage

```
varpt(mu, p, theta0)
```

### Arguments

p	is a real index related to a precise model.
mu	the mean.
theta0	the canonical parameter.

### Details

variance for the Poisson-Tweedie family of distributions

**Author(s)**

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**See Also**

[dpoistweedie](#), [ppoistweedie](#)

**Examples**

```
## plot of variance
layout(matrix(1:1,1,1))
layout.show(1)
mu <- seq(0.001,6,l=100)
var <-varpt(mu,p=5000,theta0=-150)
plot(mu, var, type = "l", col = "green", lwd=1,main="variance(p,mu,theta0=-150)")
grid(nx=1,ny=1, lty=1,lwd=2)
lines(mu,varpt(mu,p=1,theta0=-150), type = "l", col = "blue", lwd=1)
lines(mu,varpt(mu,p=2,theta0=-150), type = "l", col = "black", lwd=1)
lines(mu,varpt(mu,p=1.5,theta0=-150), type = "l", col = "yellow", lwd=1)
lines(mu,varpt(mu,p=2.5,theta0=-150), type = "l", col = "cyan", lwd=1)
lines(mu,varpt(mu,p=3,theta0=-150), type = "l", col = "magenta", lwd=1)
segments(4,2.5,4.5,2.5,col="blue" )
  text(5,2.5,"p=1",cex=0.8)
segments(4,2,4.5,2,col="yellow" )
  text(5,2,"1.5",cex=0.8)
segments(4,1.5,4.5,1.5,col= "black")
  text(5, 1.5,"p=2",cex=0.8)
segments(4,1,4.5,1,col="cyan" )
  text(5, 1,"p=2.5" ,cex=0.8)
segments(4,0.5,4.5,0.5,col="magenta" )
  text(5, 0.5,"p=3" ,cex=0.8)
segments(4,0,4.5,0,col= "green" )
  text(5, 0,"p=5000",cex=0.8)
```

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