

Package ‘hermite’

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hermite-package

*Generalized Hermite distribution***Description**

Probability mass, distribution and quantile functions; random generation; and regression models for the generalized Hermite distribution.

Details

Package: hermite
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The package implements probability mass function [dhermite](#), distribution function [phermite](#), quantile function [qhermite](#) and random generation [rhermite](#) for the generalized Hermite distribution. The probability mass function is usually parametrized in terms of the mean μ and the index of dispersion $d = \frac{\sigma^2}{\mu}$:

$$P(X = x) = P(X = 0) \frac{\mu^x (m-d)^x}{(m-1)^x} \sum_{j=0}^{[x/m]} \frac{(d-1)^j (m-1)^{(m-1)j}}{m^j \mu^{(m-1)j} (m-d)^{mj} (x-mj)! j!}$$

where $P(X = 0) = \exp(\mu(-1 + \frac{d-1}{m}))$, m is the degree of the generalized Poisson distribution and $[x/m]$ is the integer part of x/m .

The package is able to fit Hermite regression models as well, by means of the function [glm.hermite](#), also in the presence of covariates.

Author(s)

David Moriña, Manuel Higuera, Pedro Puig and María Oliveira

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References

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Puig P. (2003). Characterizing Additively Closed Discrete Models by a Property of Their Maximum Likelihood Estimators, with an Application to Generalized Hermite Distributions. Journal of the American Statistical Association 2003; **98**:687–692.

See Also

[Distributions](#) for some other distributions, [qhermite](#), [phermite](#), [rhermite](#), [hermite-package](#), [glm.hermite](#)

dhermite

Probability mass function for the generalized Hermite distribution

Description

Probability mass function for the generalized Hermite distribution with parameters a, b and m.

Usage

```
dhermite(x, a, b, m=2)
```

Arguments

| | |
|---|---|
| x | vector of non-negative integer quantiles. |
| a | first parameter for the Hermite distribution. |
| b | second parameter for the Hermite distribution. |
| m | degree of the generalized Hermite distribution. Its default value is 2, corresponding to the standard Hermite distribution. |

Value

Probability for a generalized Hermite random variable with parameters a, b and m of taking x counts.

Author(s)

David Moriña, Manuel Higuera, Pedro Puig and María Oliveira

References

- Kemp C D, Kemp A W. Some Properties of the Hermite Distribution. *Biometrika* 1965;**52** (3-4):381–394.
- McKendrick A G Applications of Mathematics to Medical Problems. *Proceedings of the Edinburgh Mathematical Society* 1926;**44**:98–130.
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See Also

[Distributions](#) for some other distributions, [qhermite](#), [phermite](#), [rhermite](#), [hermite-package](#), [glm.hermite](#)

Examples

```
d <- dhermite(3, 0.8, 0.3)
```

glm.hermite

Maximum likelihood estimation and Hermite regression

Description

glm.hermite is used to fit generalized linear models with count responses following a Hermite distribution, specified by giving a symbolic description of the linear predictor. A summary method providing the most meaningful information on the fitted model is available for objects of class glm.hermite.

Usage

```
glm.hermite(formula, data, link="log", start=NULL, m = NULL)
```

Arguments

| | |
|---------|---|
| formula | symbolic description of the model. A typical predictor has the form $\text{response} \sim \text{terms}$ where response is the (numeric) response vector and terms is a series of terms which specifies a linear predictor for response. |
| data | an optional data frame containing the variables in the model. |
| link | character specification of link function: "log" or "identity". By default link="log". |
| start | a vector containing the starting values for the parameters of the specified model. Its default value is NULL. |
| m | value for parameter m. Its default value is NULL, and in that case it will be estimated inside the function. |

Value

glm.hermite returns an object of class `glm.hermite`, which is a list including the following components:

- `coefs` the vector of coefficients.
- `data` an optional data frame containing the variables in the model.
- `loglik` log-likelihood of the fitted model.
- `vcov` covariance matrix of all coefficients in the model (derived from the Hessian of the `maxLik` output).
- `hess` Hessian matrix, returned by the `maxLik` output.
- `fitted.values` the fitted mean values, obtained by transforming the linear predictors by the inverse of the link function.
- `wLikelihood` ratio test statistic.
- `pvalLikelihood` ratio test p-value.

Author(s)

María Oliveira, Manuel Higuera, David Morriña and Pere Puig

References

- Kemp C D, Kemp A W. Some Properties of the Hermite Distribution. *Biometrika* 1965;**52** (3-4):381–394.
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Puig P. (2003). Characterizing Additively Closed Discrete Models by a Property of Their Maximum Likelihood Estimators, with an Application to Generalized Hermite Distributions. *Journal of the American Statistical Association* 2003; **98**:687–692.

See Also

[Distributions](#) for some other distributions, [qhermite](#), [phermite](#), [rhermite](#), [hermite-package](#)

Examples

```
data <- c(rep(0,122), rep(1,40), rep(2,14), rep(3,16), rep(4,6), rep(5,2))
mle1 <- glm.hermite(data~1, link="log", start=NULL, m=3)
mle1
```

hi_let

High-LET Radiation Exposure

Description

This data corresponds to an experimental simulation of in vitro whole body irradiation for high-LET radiation exposure, where peripheral blood samples were exposed to 10 different doses of 1480MeV oxygen ions. For each dose, the number of dicentric chromosomes per blood cell were scored.

Usage

```
hi_let
```

Format

A data frame with 7413 rows and 3 columns.

Source

DiGiorgio M. et al. (2004) Chromosome aberrations induced in human lymphocytes by heavy-charged particles in track segment mode. *Radiation Protection Dosimetry*, 108, 47-53.

References

DiGiorgio M., Edwards A. A., Moquet J. E., Finnon P., Hone P. A., Lloyd D. C., Kreiner A. J., Schuff J. A., Taja M. R., Vallergera M. B., López F. O. and Burlón A., Debray M. E., Valda A. (2004) Chromosome aberrations induced in human lymphocytes by heavycharged particles in track segment mode. *Radiation Protection Dosimetry*, 108, 47-53.

hot100

Hot 100 hits

Description

This data corresponds to the 965 "number 1" hits on the Hot 100 chart over the period January 1955 to December 2003. For a recording that reaches the number one spot, *Weeks* measures the number of weeks that it stays at number one. The covariates are: *Elvis* = 1 if the recording was by Elvis Presley, = 0 otherwise; *Beatles* = 1 if the recording was by the Beatles, = 0 otherwise; *Group* = 1 if the recording was by a band, = 0 otherwise; *Female* = 1 if the artist was a solo female, = 0 otherwise; *Male* = 1 if the artist was a solo male, = 0 otherwise; *Inst* = 1 if the recording was purely instrumental, = 0 otherwise; and *NonCon* = 1 if the recording topped the charts in nonconsecutive weeks, = 0 otherwise.

Usage

hot100

Format

A data frame with 965 rows and 9 columns.

Source

<http://web.uvic.ca/~dgiles/downloads/data/hot100.xls>

References

Giles, D. E. (2006) Superstardom in the US popular music industry revisited. *Economics Letters*, 92(1):68–74. Giles, D. E. (2007) Modeling inflated count data. In Y. Berbers and W. Zwaenepoel, editors, *Proceedings of the MODSIM 2007 International Congress on Modelling and Simulation*, pages 919–925. L. Oxley and D. Kulasiri, Eds., Modelling and Simulation Society of Australia and New Zealand

phermite

*Distribution function for the generalized Hermite distribution***Description**

Distribution function for the generalized Hermite distribution with parameters a , b and m .

Usage

```
phermite(q, a, b, m=2, lower.tail=TRUE)
```

Arguments

| | |
|-------------------------|---|
| <code>q</code> | vector of non-negative integer quantiles. |
| <code>a</code> | first parameter for the Hermite distribution. |
| <code>b</code> | second parameter for the Hermite distribution. |
| <code>m</code> | degree of the generalized Hermite distribution. Its default value is 2, corresponding to the standard Hermite distribution. |
| <code>lower.tail</code> | logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X > x]$. |

Value

Probability for a generalized Hermite random variable with parameters a , b and m to be lower (or greater) than q .

Author(s)

David Morriña, Manuel Higuera, Pedro Puig and María Oliveira

References

- Kemp C D, Kemp A W. Some Properties of the Hermite Distribution. *Biometrika* 1965;**52** (3-4):381–394.
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See Also

[Distributions](#) for some other distributions, [dhermite](#), [qhermite](#), [rhermite](#), [hermite-package](#), [glm.hermite](#)

Examples

```
d <- phermite(4, 0.8, 0.3, m=3)
```

qhermite

Quantile function for the generalized Hermite distribution

Description

Quantile function for the generalized Hermite distribution with parameters a, b and m.

Usage

```
qhermite(p, a, b, m=2, lower.tail=TRUE)
```

Arguments

| | |
|------------|---|
| p | vector of probabilities. |
| a | first parameter for the Hermite distribution. |
| b | second parameter for the Hermite distribution. |
| m | degree of the generalized Hermite distribution. Its default value is 2, corresponding to the standard Hermite distribution. |
| lower.tail | logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X > x]$. |

Value

The smallest integer x such that $P(X \leq x) \geq p$ (or such that $P(X \leq x) \geq 1 - p$ if `lower.tail` is set to FALSE), where X is a generalized Hermite random variable with parameters a, b and m.

Author(s)

David Morriña, Manuel Higuera, Pedro Puig and María Oliveira

References

- Kemp C D, Kemp A W. Some Properties of the Hermite Distribution. *Biometrika* 1965;**52** (3-4):381–394.
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See Also

[Distributions](#) for some other distributions, [dhermite](#), [phermite](#), [rhermite](#), [hermite-package](#), [glm.hermite](#)

Examples

```
d <- qhermite(0.9999987, 0.8, 0.3, m=3)
```

rhermite

Random generation for the generalized Hermite distribution

Description

Random generation for the generalized Hermite distribution with parameters a, b and m.

Usage

```
rhermite(n, a, b, m=2)
```

Arguments

| | |
|---|---|
| n | number of observations. |
| a | first parameter for the Hermite distribution. |
| b | second parameter for the Hermite distribution. |
| m | degree of the generalized Hermite distribution. Its default value is 2, corresponding to the standard Hermite distribution. |

Value

A vector containing n random deviates from a generalized Hermite distribution.

Author(s)

David Morriña, Manuel Higuera, Pedro Puig and María Oliveira

References

- Kemp C D, Kemp A W. Some Properties of the Hermite Distribution. *Biometrika* 1965;**52** (3-4):381–394.
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See Also

[Distributions](#) for some other distributions, [dhermite](#), [phermite](#), [qhermite](#), [hermite-package](#), [glm.hermite](#)

Examples

```
rnd <- rhermite(1000, 0.8, 0.3)
```

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