Package 'hermite'

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Title Generalized Hermite Distribution

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Description Probability functions and other utilities for the generalized Hermite distribution.

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License GPL (>= 2)

NeedsCompilation no

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Contents

`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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Version:	1.1.2
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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)

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References

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

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Bekelis, D. Convolutions of the Poisson laws in number theory. In Analytic & Probabilistic Methods in Number Theory: Proceedings of the 2nd International Conference in Honour of J. Kubilius, Lithuania 1996;**4**:283–296.

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Kotz S. Univariate discrete distributions. Norman L. Johnson 2005.

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

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`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 varible with parameters `a`, `b` and `m` of taking `x` counts.

Author(s)

David Moriña, Manuel Higueras, 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.

Kemp A W, Kemp C D. An alternative derivation of the Hermite distribution. Biometrika 1966;**53** (3-4):627–628.

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Gupta R P, Jain G C. A Generalized Hermite distribution and Its Properties. SIAM Journal on Applied Mathematics 1974;**27**:359–363.

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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`

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 response ~ 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).
- hessHessian 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 Higueras, David Moriña and Pere Puig

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.

Kemp A W, Kemp C D. An alternative derivation of the Hermite distribution. Biometrika 1966;**53** (3-4):627–628.

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Gupta R P, Jain G C. A Generalized Hermite distribution and Its Properties. SIAM Journal on Applied Mathematics 1974;**27**:359–363.

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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 dicentrics 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., Vallerga 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

q	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.
lower.tail	logical; if TRUE (default), probabilities are $P[X \leq x]$, otherwise, $P[X > x]$.

Value

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

Author(s)

David Moriña, Manuel Higueras, 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 Moriña, Manuel Higueras, 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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Zhang J, Huang H. On Nonnegative Integer-Valued Lévy Processes and Applications in Probabilistic Number Theory and Inventory Policies. American Journal of Theoretical and Applied Statistics 2013;**2**:110–121.

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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, 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 Moriña, Manuel Higueras, 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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Patel Y C. Even Point Estimation and Moment Estimation in Hermite Distribution. Biometrics 1976;**32** (4):865–873.

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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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