Package 'cdfinv'

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Type Package

Title Confidence Interval Estimation via CDF Inversion

Version 0.1.0

Description Estimation of one- and two-sided confidence intervals via the numerical inversion of the cumulative distribution function of a statistic's sampling distribution. For more details, see section 9.2.3 of Casella and Berger (2002) <ISBN:0534243126>.

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VignetteBuilder knitr, extraDistr

Suggests knitr, rmarkdown, extraDistr

NeedsCompilation no

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Contents

cdfinv *Computation of confidence intervals via CDF inversion*

Description

cdfinv() returns one- or two-sided confidence interval estimates.

Usage

```
cdfinv(
  DISTR,
  PARAM,
  STAT,
  lpb = -10000,
  upb = 10000,
  bound = "two-sided",
  alpha = 0.05,
  tolb = 1e-06,
  tol = 1e-06,
  ...
)
```

Arguments

DISTR	name of sampling distribution in R
PARAM	name of distribution parameter for which we are computing an interval estimate
STAT	observed value of the chosen statistic
lpb	lower bound of search interval
upb	upper bound of search interval
bound	one of "two-sided", "lower", or "upper"
alpha	the confidence coefficient is 1 - alpha
tolb	search interval bound offset value
tol	convergence tolerance for uniroot function
...	additional arguments for DISTR's cdf function

Value

A list with interval bounds and associated cdf values.

- DISTR - The distribution name (as given in R)
- PARAM - The parameter name (as given in R)
- STAT - The observed statistic value
- bound - The interval bound(s)
- q - The cdf quantile(s) associated with the interval bound(s)

Author(s)

Peter E. Freeman, <pfreeman@cmu.edu>

Examples

```
cdfinv("norm","mean",3.45,sd=2) ## returns -0.4699279 and 7.3699277
cdfinv("gamma","rate",12.25,lpb=0,bound="upper",shape=10) ## returns 1.282058
cdfinv("nbinom","prob",22,lpb=0,upb=1,bound="lower",size=10) ## returns 0.1803843
```

`cdfinv.sim` *Computation of confidence intervals via simulations and CDF inversion*

Description

cdfinv.sim() returns one- or two-sided confidence interval estimates.

Usage

```
cdfinv.sim(
  DISTR,
  PARAM,
  STAT,
  lpb = -10000,
  upb = 10000,
  bound = "two-sided",
  alpha = 0.05,
  tolb = 1e-06,
  tol = 1e-06,
  seed = 1,
  numsim = 1e+05,
  nsamp = 1,
  stat.func = mean,
  ...
)
```

Arguments

DISTR	name of distribution (in R) from which each datum is sampled
PARAM	name of distribution parameter for which we are computing an interval estimate
STAT	observed value of the chosen statistic
lpb	lower bound of search interval
upb	upper bound of search interval
bound	one of "two-sided", "lower", or "upper"
alpha	the confidence coefficient is 1 - alpha

tolb	search interval bound offset value
tol	convergence tolerance for uniroot function
seed	random number generator seed
numsim	number of simulated datasets
nsamp	sample size for each simulated dataset
stat.func	pointer to function computing the statistic for each dataset
...	additional arguments for DISTR's cdf function

Value

A list with interval bounds and associated cdf values.

- DISTR - The distribution name (as given in R)
- PARAM - The parameter name (as given in R)
- STAT - The observed statistic value
- bound - The interval bound(s)
- q - The cdf quantile(s) associated with the interval bound(s)

Author(s)

Peter E. Freeman, <pfreeman@cmu.edu>

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ci_plot *Plotting of confidence intervals derived via CDF inversion*

Description

ci_plot() creates a plot showing the cumulative distribution function(s) for the sampling distribution(s) of the chosen statistic, evaluated at the interval bound(s). The horizontal dashed line(s) show(s) the assumed quantile(s) (e.g., 0.95 for a 95% lower-bound), while the vertical dashed line shows the statistic value.

Usage

```
ci_plot(cdfinv.out, ...)
```

Arguments

cdfinv.out	output list from cdfinv()
...	those additional arguments that were passed to cdfinv()

Value

None

Author(s)

Peter E. Freeman, <pfreeman@cmu.edu>

Examples

```
ci_plot(cdfinv("norm","mean",2.5,sd=3),sd=3)
```

---

pnormvar *Cumulative distribution function for t distribution*

Description

Computes the quantile of the chi-square distribution for n-1 degrees of freedom corresponding to the input value of the sample variance.

Usage

```
pnormvar(q, sigma2, n)
```

Arguments

q	coordinate at which the cdf is to be evaluated (named in accordance with R standards)
sigma2	the assumed normal variance
n	the sample size (pass this as an extra argument to cdfinv())

Details

Do not call pnormvar() directly. Pass DISTR="normvar" to cdfinv() when computing intervals for the normal variance. The parameter name to be passed to cdfinv() is sigma2. The additional argument n (sample size) is to be passed to cdfinv().

Value

The quantile of the chi-square distribution for n-1 degrees of freedom corresponding to the input value of the sample variance.

Author(s)

Peter E. Freeman, <pfreeman@cmu.edu>

Examples

```
cdfinv("normvar","sigma2",14.35,lpb=0,n=22) ## returns 8.493787 29.305942
```

ptmean *Cumulative distribution function for t distribution*

Description

Computes the quantile of the t distribution for n-1 degrees of freedom corresponding to the input value of the sample mean.

Usage

```
ptmean(q, mean, s2, n)
```

Arguments

q	coordinate at which the cdf is to be evaluated (named in accordance with R standards)
mean	the assumed normal mean
s2	the observed sample variance (pass this as an extra argument to cdfinv())
n	the sample size (pass this as an extra argument to cdfinv())

Details

Do not call ptmean() directly. Pass DISTR="tmean" to cdfinv() when computing intervals for the normal mean when the variance is unknown. The parameter name to be passed to cdfinv() is mean. The additional arguments s2 (sample variance) and n (sample size) are to be passed to cdfinv().

Value

The quantile of the t distribution for n-1 degrees of freedom corresponding to the input value of the sample mean.

Author(s)

Peter E. Freeman, <pfreeman@cmu.edu>

Examples

```
cdfinv("tmean","mean",14.35,s2=4.5,n=22) ## returns 13.40946 15.29054
```

qnormvar *Inverse cumulative distribution function for chi-square distribution*

Description

Computes the value of sample variance corresponding to the input quantile p of the chi-square distribution for n-1 degrees of freedom

Usage

```
qnormvar(p, sigma2, n)
```

Arguments

p	the cdf value (named in accordance with R standards)
sigma2	the assumed normal variance
n	the sample size (pass this as an extra argument to cdfinv())

Details

Do not call qnormvar() directly. Pass DISTR="normvar" to cdfinv() when computing intervals for the normal variance. The parameter name to be passed to cdfinv() is sigma2. The additional argument n (sample size) is to be passed to cdfinv().

Value

The value of sample variance corresponding to the input quantile p of the chi-square distribution for n-1 degrees of freedom

Author(s)

Peter E. Freeman, <pfreeman@cmu.edu>

qtmean *Inverse cumulative distribution function for t distribution*

Description

Computes the value of sample mean corresponding to the input quantile p of the t distribution for n-1 degrees of freedom

Usage

```
qtmean(p, mean, s2, n)
```

Arguments

p	value of cdf (named in accordance with R standards)
mean	the assumed normal mean
s2	the observed sample variance (pass this as an extra argument to cdfinv())
n	the sample size (pass this as an extra argument to cdfinv())

Details

Do not call qtmean() directly. Pass DISTR="tmean" to cdfinv() when computing intervals for the normal mean when the variance is unknown. The parameter name to be passed to cdfinv() is mean. The additional arguments s2 (sample variance) and n (sample size) are to be passed to cdfinv().

Value

The value of sample mean corresponding to the input quantile p of the t distribution for n-1 degrees of freedom

Author(s)

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Index