Package 'kdist'

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Title K-Distribution and Weibull Paper

Version 0.2

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Description Density, distribution function, quantile function and random generation for the K-distribution. A plotting function that plots data on Weibull paper and another function to draw additional lines. See results from package in T Lamont-Smith (2018), submitted J. R. Stat. Soc.

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R topics documented:

k *The K-distribution.*

Description

Density, distribution function, quantile function and random generation for the K-distribution with parameters shape and scale.

Usage

```
dk(x, shape = 1, scale = 1, intensity = FALSE, log = FALSE)

pk(q, shape = 1, scale = 1, intensity = FALSE, log.p = FALSE,
  lower.tail = TRUE)

qk(p, shape = 1, scale = 1, intensity = FALSE, log.p = FALSE)

rk(n, shape = 1, scale = 1, intensity = FALSE)
```

Arguments

x, q	vector of quantiles
shape, scale	shape and scale parameters both defaulting to 1.
intensity	logical; if TRUE, quantiles are intensities not amplitudes.
log, log.p	logical; if TRUE, probabilities p are given as log(p).
lower.tail	logical; if TRUE (default), probabilities are P[X = x], otherwise, P[X > x].
p	vector of probabilities
n	number of observations

Details

The K-distribution with shape parameter ν and scale parameter b has amplitude density given by $f(x) = [4x^{\nu}/\Gamma(\nu)][(\nu/b)^(1+\nu/2)]K(2x\sqrt{(}\nu/b), \nu - 1)$. Where K is a modified Bessel function of the second kind. For $\nu -> Inf$, the K-distrubution tends to a Rayleigh distribution, and for $\nu = 1$ it is the Exponential distribution. The function base::besselK is used in the calculation, and care should be taken with large input arguements to this function, e.g. b very small or x, ν very large. The cumulative distribution function for the amplitude, x is given by $F(x) = 1-2x^{\nu}(\nu/b)^(\nu/2)K(2x\sqrt{(}\nu/b), \nu)$. The K-Distribution is a compound distribution, with Rayleigh distributed amplitudes (exponential intensities) modulated by another underlying process whose amplitude is chi-distributed and whose intensity is Gamma distributed. An Exponential distributed number multiplied by a Gamma distributed random number is used to generate the random variates. The mth moments are given by $\mu_m = (b/\nu)^(m/2)\Gamma(0.5m+1)\Gamma(0.5m+\nu)/\Gamma(\nu)$, so that the root mean square value of x is the scale factor, $< x^2 >= b$.

Value

The function dk gives the density, pk gives the distribution function, qk gives the quantile function, and rk generates random variates.

References

E Jakeman and R J A Tough, "Non-Gaussian models for the statistics of scattered waves", Adv. Phys., 1988, vol. 37, No. 5, pp471-529

See Also

Distributions for other standard distributions, including dweibull for the Weibull distribution and dexp for the exponential distribution.

Examples

```
#=====
r <- rk(10000, shape = 3, scale = 5, intensity = FALSE)
fn <- stats::ecdf(r)
x <- seq(0, 10, length = 100)
plot(x, fn(x))
lines(x, pk(x, shape = 3, scale = 5, intensity = FALSE))
#======
r <- rk(10000, shape = 3, scale = 5, intensity = FALSE)
d <- density(r)
x <- seq(0, 10, length = 100)
plot(d, xlim=c(0,10))
lines(x, dk(x, shape = 3, scale = 5, intensity = FALSE))
```

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kdist *kdist: A package for calculating and plotting non-Gaussian distributions*

Description

The kdist package provides two categories of important functions: dk etc, and weiplot.

dk functions

The kdist functions dk, pk, qk and rk, calculates the K-distribution

weiplot functions

weiplot takes data and plots it on Weibull paper. Weilines adds lines to a Weibull plot.

`weilines` *Add Lines onto a Weibull Plot*

Description

Weibull distributed data plots as a straight line on log-log plot using `wlines()`. It is best used after function `wplot()` has been called.

Usage

```
weilines(x, y, lty = NULL, lwd = NULL, col = "black", type = "l",
  pch = 0)
```

Arguments

`x`	vector of values
`y`	vector of values the same length as x
`lty`	line type
`lwd`	line width
`col`	line color
`type`	type of plotting
`pch`	symbol type for type = "b"

Details

A Weibull plot uses log paper and has log(1/(1-F(x)) versus x, where the data values x have an empirical cdf of F(x). The plot margins may need to be adjusted so that the right hand axis is visible.

See Also

`wplot()` creates the Weibull plot

Examples

```
dummy <- c(0,0)
weiplot(dummy, xlim = c(1e-3, 10), type = "n")
x <- 10^seq(-3, 2, length = 100)
weilines(x, pexp(x), col = "red")
weilines(x, pweibull(x, 2), col = "blue")
weilines(x, pweibull(x, 3), col = "green")
```

`weiplot` *Create Weibull Plot.*

Description

A special type of plot where Weibull distributed data plots as a straight line. This was also originally called Rayleigh paper. Both Rayleigh and exponential distributions also plot as straight lines.

Usage

```
weiplot(data, n = 70, type = "p", xlim = NULL, ylim = c(0.01, 10),
  main = "Weibull Plot", sub = NULL, ylab = "log(1/1-F(x))",
  ylab2 = "F(x)", xlab = "x", percent = "False")
```

Arguments

`data`	data values from which a cumulative density function will be estimated using `ecdf(data)`
`n`	number of points required in plot (default n = 70).
`type`	plot type
`xlim`	the minimum and maximum to be used for the x-axis
`ylim`	the minimum and maximum to be used for the y-axis
`main`	the title of the plot
`sub`	the sub-title of the plot
`ylab`	the title of the left y-axis
`ylab2`	the title of the right y-axis
`xlab`	the title of the x-axis
`percent`	logical; display right hand axis as percentages

Details

A Weibull plot uses log paper and has log(1/(1-F(x)) versus x, where the data values x have an empirical cdf of F(x). The plot margins may need to be adjusted so that the right hand axis is visible.

See Also

`weilines()` adds lines to a Weibull plot

Examples

```
graphics::par(mar = c(5, 5, 5, 5))
r <- rexp(100000)
weiplot(r, xlim = c(1e-3, 10))
x <- 10^seq(-3, 2, length = 100)
weilines(x, pexp(x))
```

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