PEXPDF

PURPOSE

Compute the exponential power probability density function with shape parameters α and β.

DESCRIPTION

The exponential power distribution has the proability density function:

$$f(x, \alpha, \beta) = \left(\frac{e\beta}{\alpha^\beta}\right) x^{\beta-1} e^{\left(\frac{x}{\alpha}\right)^\beta} e^{-e^{\left(\frac{x}{\alpha}\right)^\beta}} \qquad x \geq 0, \alpha > 0, \beta > 0 \qquad \textbf{(EQ Aux-255)}$$

where α and β are the shape parameters. This distribution has been recommended for lifetime analysis when a U-shaped hazard function is desired. This corresponds to rapid failure once the product starts to wear out after a period of steady or even improving reliability. See the Smith and Bain paper listed in the Reference section below for details.

SYNTAX

LET <y> = PEXPDF(<x>,<alpha>,<beta>) <SUBSET/EXCEPT/FOR qualification>

where <x> is a non-negative variable, a number, or a parameter;

<y> is a variable or a parameter (depending on what <x> is) where the computed eponential power pdf value is saved;

<alpha> is a positive number or parameter that specifies the first shape parameter;

<beta> is a positive number or parameter that specifies the second shape parameter;

and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES

LET A = PEXPDF(3,1.5,0.8)

LET X2 = PEXPDF(X1,ALPHA,BETA)

NOTE 1

The general form of the exponential power probability density function is:

$$f(x, \alpha, \beta, \mu) = \left(\frac{e\beta}{\alpha^\beta}\right) (x-\mu)^{\beta-1} e^{\left(\frac{x-\mu}{\alpha}\right)^\beta} e^{-e^{\left(\frac{x-\mu}{\alpha}\right)^\beta}} \qquad x \geq 0, \alpha > 0, \beta > 0 \qquad \textbf{(EQ Aux-256)}$$

where μ is a positive location parameter. The case $\beta = 1$ is the truncated extreme value distribution.

NOTE 2

Johnson, Kotz, and Balakrishnan define this distribution with the reciprocal of the alpha parameter (i.e., simply substitute alpha with (1/alpha) in the pdf formula above). They also define a power exponential (or Subbotin) distribution. However, this distribution is distinct from the exponential power distribution defined here.

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

PEXCDF	=	Compute the exponential power cumulative distribution function.
PEXPPF	=	Compute the exponential power percent point function.
EWECDF	=	Compute the exponentiated Weibull cumulative distribution function.
EWEPDF	=	Compute the exponentiated Weibull probability density
WEICDF	=	Compute the Weibull cumulative distribution function.
WEIPDF	=	Compute the Weibull probability density function.
WEIPPF	=	Compute the Weibull percent point function.
EV1CDF	=	Compute the extreme value type 1 cumulative distribution function.
EV1PDF	=	Compute the extreme value type 1 probability density function.
EV1PPF	=	Compute the extreme value type 1 percent point function.

REFERENCE

"An Exponential-Power Life-Testing Distribution," Smith and Bain, Communications in Statistics, 1975, pp. 469-481.

"Continuous Univariate Distributions - Vol. 2," 2nd. Ed., Johnson, Kotz, and Balakrishnan, John Wiley and Sons, 1994 (pp. 63-64).

"Statistical Distributions," 2nd. Ed., Evans, Hastings, and Peacock, John Wiley and Sons, 1994 (chapter 12).

APPLICATIONS

Reliability Analysis

IMPLEMENTATION DATE

96/1

PROGRAM

```
LET A = DATA 1 1 1 0.5 0.5 0.5 2 2 2
LET B = DATA 0.5 1 2 0.5 1 2 0.5 1 2
.
MULTIPLOT 3 3; MULTIPLOT CORNER COORDINATES 0 0 100 100
TITLE AUTOMATIC
TIC LABEL SIZE 3
LABEL SIZE 3
LOOP FOR K = 1 1 9
    LET A1 = A(K)
    LET B1 = B(K)
    X1LABEL ALPHA = ^A1
    X2LABEL BETA = ^B1
    PLOT PEXPDF(X,A1,B1) FOR X = 0.01 0.01 4
END OF LOOP
END OF MULTIPLOT
```