PEXPPF

PURPOSE

Compute the exponential power percent point function with shape parameters a and b.

DESCRIPTION

The exponential power distribution has the proability density function:

$$f(x, \alpha, \beta) = \left(\frac{e\beta}{\alpha^{\beta}}\right) x^{\beta - 1} e^{\left(\frac{x}{\alpha}\right)^{\beta}} e^{-e^{\left(\frac{x}{\alpha}\right)^{\beta}}} \qquad x \geq 0, \alpha > 0, \beta > 0 \qquad \textbf{(EQ Aux-257)}$$

where a and b are the shape parameters. The corresponding percent point function is:

$$G(p, \alpha, \beta) = \alpha[\log(1 - \log(1 - p))^{1/\beta}] \qquad \textbf{(EQ Aux-258)}$$

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> = PEXPPF(<p>,<alpha>,<beta>) <SUBSET/EXCEPT/FOR qualification>

where <p> is a variable, a number, or a parameter in the range 0 to 1;

<y> is a variable or a parameter (depending on what <p> is) where the computed eponential power ppf 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 = PEXPPF(0.95,1.5,0.8)
LET X2 = PEXCDF(P,ALPHA,BETA)

NOTE 1

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

$$f(x, \alpha, \beta, \mu) = \left(\frac{e\beta}{\alpha^{\beta}}\right)(x - \mu)^{\beta - 1} e^{\left(\frac{x-\mu}{\alpha}\right)^{\beta}} e^{-e^{\left(\frac{x-\mu}{\alpha}\right)^{\beta}}} \qquad x \geq 0, \alpha > 0, \beta > 0 \qquad \textbf{(EQ Aux-259)}$$

where μ is a positive location parameter. The case β = 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.
PEXPDF	=	Compute the exponential power probability density 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 PEXPPF(P,A1,B1) FOR P = 0 0.01 0.99
END OF LOOP
END OF MULTIPLOT
```