

PNRCDF**PURPOSE**

Compute the standard power-normal cumulative distribution function.

DESCRIPTION

The standard power-normal distribution has the following probability density function:

$$f(x, \sigma, p) = \left(\frac{p}{x\sigma}\right)\phi\left(\frac{x}{\sigma}\right)\left(\Phi\left(\frac{-x}{\sigma}\right)\right)^{p-1} \quad x > 0, \sigma > 0, p > 0 \quad \text{(EQ Aux-270)}$$

where σ is the shape parameter, p is the power parameter, and Φ and ϕ are the cumulative distribution function and the probability density function for the standard normal distribution respectively.

The cumulative distribution is the area under the curve from negative infinity to x (i.e., the integral of the above function). It has the formula:

$$F(x, \sigma, p) = 1 - \left(\Phi\left(\frac{-x}{\sigma}\right)\right)^p \quad \sigma > 0, p > 0 \quad \text{(EQ Aux-271)}$$

If p is 1, this distribution reduces to the normal distribution.

SYNTAX

LET <y2> = PNRCDF(<y1>,<p>,<s>) <SUBSET/EXCEPT/FOR qualification>

where <y1> is a non-negative number, parameter, or variable;

<p> is a positive number, parameter, or variable that specifies the power parameter;

<s> is an optional positive number, parameter, or variable that specifies the shape parameter;

<y2> is a variable or a parameter (depending on what <y1> is) where the computed power-normal cdf value is stored; and where the <SUBSET/EXCEPT/FOR qualification> is optional.

If the <s> parameter is omitted, it defaults to 1.

EXAMPLES

LET A = PNRCDF(3,2,1)

LET X2 = PNRCDF(X1,POW,SD)

LET X2 = PNRCDF(X1,1,0.5)

NOTE

The general power-normal distribution has the following probability density function:

$$f(x, \mu, \sigma, p) = \left(\frac{p}{x\sigma}\right)\phi\left(\frac{(x-\mu)}{\sigma}\right)\left(\Phi\left(\frac{-(x-\mu)}{\sigma}\right)\right)^{p-1} \quad x > 0, \sigma > 0, p > 0 \quad \text{(EQ Aux-272)}$$

where μ is the location parameter, σ is the shape parameter and p is the power parameter. The cumulative distribution function has the formula:

$$F(x, \mu, \sigma, p) = 1 - \left(\Phi\left(\frac{-(x-\mu)}{\sigma}\right)\right)^p \quad \sigma > 0, p > 0 \quad \text{(EQ Aux-273)}$$

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

PNRPDF	=	Compute the power-normal probability density function.
PNRPPF	=	Compute the power-normal percent point function.
PLNCDF	=	Compute the power-lognormal cumulative distribution function.
PLNPDF	=	Compute the power-lognormal probability density function.

PLNPPF	=	Compute the power-lognormal percent point function.
NORCDF	=	Compute the normal cumulative distribution function.
NORPDF	=	Compute the normal probability density function.
NORPPF	=	Compute the normal percent point function.

REFERENCE

"A Computer Program POWNOR for Fitting the Power-Normal and -Lognormal Models to Life or Strength Data from Specimens of Various Sizes," Nelson and Doganaksoy, NIST-IR 4760, March 1992.

APPLICATIONS

Reliability

IMPLEMENTATION DATE

95/5

PROGRAM

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X1LABEL CDF's; TITLE SIZE 2
YLIMITS 0 1; MAJOR YTIC MARK NUMBER 6
TITLE SD=1, P=10000, 3000, 1000, 300, 100, 50, 20, 5, 1, 0.5, 0.2 0.1
PLOT PNRCDF(X,10000,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,3000,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,1000,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,300,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,100,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,50,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,20,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,5,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,1,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,0.5,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,0.2,1) FOR X = -5 .05 5 AND
PLOT PNRCDF(X,0.1,1) FOR X = -5 .05 5
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