

**PNRPPF****PURPOSE**

Compute the power-normal percent point function.

**DESCRIPTION**

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

$$f(x, \sigma, p) = \left(\frac{p}{x\sigma}\right)\phi\left(\frac{x}{\sigma}\right)\left(\Phi\left(\frac{-x}{\sigma}\right)\right)^{p-1} \quad x > 0, \sigma > 0, p > 0 \quad \text{(EQ Aux-276)}$$

where  $\sigma$  is the shape parameter,  $p$  is the power parameter, and  $\Phi$  and  $\phi$  are the cumulative distribution function and the probability density function for the standard normal distribution respectively.

The percent point function is the inverse of the cumulative distribution function. The cumulative distribution sums the probability from negative infinity to the given  $x$  value (i.e., the integral of the above function). The percent point function takes a cumulative probability value and computes the corresponding  $x$  value. The formula for the power-normal percent point function is:

$$G(x, \mu, \sigma, p) = Z_f \sigma \quad x > 0, \sigma > 0, p > 0 \quad \text{(EQ Aux-277)}$$

where  $Z_f = \text{NORPPF}(1-(1-x)^{1/p})$ . NORPPF is the percent point function of the standard normal distribution. The input value is a real number between 0 and 1 (since it corresponds to a probability).

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

**SYNTAX**

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

where <y1> is a number, parameter, or variable in the range 0 to 1;

<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 pdf 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 = PNRPPF(0.9,2,1)

LET X2 = PNRPPF(X1,P,SD)

LET X2 = PNRPPF(X1,0.5,0.5)

**NOTE**

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

$$f(x, \mu, \sigma, p) = \left(\frac{p}{x\sigma}\right)\phi\left(\frac{(x-\mu)}{\sigma}\right)\left(\Phi\left(\frac{-(x-\mu)}{\sigma}\right)\right)^{p-1} \quad x > 0, \sigma > 0, p > 0 \quad \text{(EQ Aux-278)}$$

where  $\mu$  is the location parameter,  $\sigma$  is the shape parameter and  $p$  is the power parameter. The formula for the percent point function is:

$$G(x, \mu, \sigma, p) = \mu + Z_f \sigma \quad x > 0, \sigma > 0, p > 0 \quad \text{(EQ Aux-279)}$$

where  $Z_f$  is defined as above and  $\mu$  is a location parameter.

**DEFAULT**

None

**SYNONYMS**

None

**RELATED COMMANDS**

PNRCDF = Compute the power-normal cumulative density function.  
 PNRPDF = Compute the power-normal probability density 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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TITLE SIZE 2; X1LABEL PPF's
PLOT PNRPPF(P,10000,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,3000,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,1000,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,300,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,100,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,50,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,20,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,5,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,1,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,0.5,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,0.2,1) FOR P = .01 .01 .99 AND
PLOT PNRPPF(P,0.1,1) FOR P = .01 .01 .97
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