FNRCDF

PURPOSE

Compute the folded normal cumulative distribution function.

DESCRIPTION

If X is normally distributed, then ABS(X) has a folded normal distribution whose probability density function can be expressed in terms of the standard normal distribution as:)

$$f(x, \mu, \sigma) = \left(\frac{1}{\sigma}\right)\left(\phi\left(\frac{x-\mu}{\sigma}\right) + \phi\left(\frac{x+\mu}{\sigma}\right)\right) \qquad x \geq 0 \qquad \textbf{(EQ Aux-141)}$$

where ϕ is the probability density function of a standard normal distribution and μ and σ are the mean and standard deviation of the parent normal distribution. The μ and σ parameters are location and scale parameters for the parent normal distribution. However, they are shape parameters for the foleded normal distribution. If μ is zero, the folded normal distribution reduces to a half-normal distribution. The folded normal distribution also corresponds to a non-central chi distribution with 1 degree of freedom. This is discussed in Johnson, Kotz, and Balakrishnan (see the Reference section below).

The formula for the cumulative distribution function of the folded normal distribution can be expressed in terms of the cumulative distribution of the standard normal distribution as follows:

$$F(x, \mu, \sigma) = \Phi\left(\frac{x-\mu}{\sigma}\right) - \Phi\left(\frac{-x-\mu}{\sigma}\right) \qquad x \geq 0 \qquad \textbf{(EQ Aux-142)}$$

where Φ is the standard normal cumulative distribution function.

SYNTAX

LET <y> = FNRCDF(<x>,<u>,<s>)   <SUBSET/EXCEPT/FOR qualification>

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

    <u> is a number, parameter, or variable that defines the mean of the parent normal distribution;

    <s> is a number, parameter, or variable that defines the standard deviation of the parent normal distribution;

    <y> is a variable or a parameter (depending on what <x> is) where the computed folded normal pdf value is stored;

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

EXAMPLES

LET A = FNRCDF(3,2,0.7)
LET X2 = FNRCDF(X1,U,SD)

NOTE

Folded distributions are typically used when measurements are taken without regard to sign and the underlying distribution is assumed to be normal.

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

FNRPDF	=	Compute the folded normal probability density function.
FNRPPF	=	Compute the folded normal percent point function.
HFNCDF	=	Compute the half-normal cumulative distribution function.
HFNPDF	=	Compute the half-normal probability density function.
HFNPPF	=	Compute the half-normal 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

"The Folded Normal Distribution," Leone, Nelson, Nottingham, Technometrics, 3, 1961 (pp. 543-550).

"Continuous Univariate Distributions - 1," 2nd Ed., Johnson, Kotz, and Balakrishnan, Wiley and Sons, 1994 (page 170).

APPLICATIONS
Data Analysis

IMPLEMENTATION DATE
95/9

PROGRAM
```
MULTIPLOT 2 2; MULTIPLOT CORNER COORDINATES 0 0 100 100
TITLE AUTOMATIC
LET U = 0.5
LET SD = 6
X1LABEL U = ^U, SD= ^SD
PLOT FNRCDF(X,U,SD) FOR X = 0 0.1 20
LET U = 6
LET SD = 0.5
X1LABEL U = ^U, SD= ^SD
PLOT FNRCDF(X,U,SD) FOR X = 0 0.01 8.0
LET U = 2
LET SD = 10
X1LABEL U = ^U, SD= ^SD
PLOT FNRCDF(X,U,SD) FOR X = 0 0.1 50
LET U = 3
LET SD = 2
X1LABEL U = ^U, SD= ^SD
PLOT FNRCDF(X,U,SD) FOR X = 0 0.01 10
END OF MULTIPLOT
```