

FNRPPF**PURPOSE**

Compute the folded normal percent point 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:

$$f(x, \mu, \sigma) = \left(\frac{1}{\sigma}\right) \left(\phi\left(\frac{x-\mu}{\sigma}\right) + \phi\left(\frac{x+\mu}{\sigma}\right) \right) \quad x \geq 0 \quad \text{(EQ Aux-144)}$$

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 percent point function is the inverse of the cumulative distribution function. The cumulative distribution sums the probability from 0 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 percent point function for the folded normal distribution is computed using a bisection method.

SYNTAX

LET <y> = FNRPPF(<p>,<u>,<s>) <SUBSET/EXCEPT/FOR qualification>
 where <p> is a variable, a number, or a parameter in the range 0 to 1;
 <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 = FNRPPF(0.9,2,4)
LET X2 = FNRPPF(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

| | | |
|--------|---|---|
| FNRCDF | = | Compute the folded normal cumulative distribution function. |
| FNRPDF | = | Compute the folded normal probability density 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. |
| LGNCDF | = | Compute the lognormal cumulative distribution function. |
| LGNPDF | = | Compute the lognormal probability density function. |
| LGNPPF | = | Compute the lognormal 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

```

MULTIPLY 2 2; MULTIPLY CORNER COORDINATES 0 0 100 100
TITLE AUTOMATIC
LET U = 0.5
LET SD = 6
XILABEL U = ^U, SD= ^SD
PLOT FNRPPF(P,U,SD) FOR P = 0.01 0.01 0.99
LET U = 6
LET SD = 0.5
XILABEL U = ^U, SD= ^SD
PLOT FNRPPF(P,U,SD) FOR P = 0.01 0.01 0.99
LET U = 2
LET SD = 10
XILABEL U = ^U, SD= ^SD
PLOT FNRPPF(P,U,SD) FOR P = 0.01 0.01 0.99
LET U = 3
LET SD = 2
XILABEL U = ^U, SD= ^SD
PLOT FNRPPF(P,U,SD) FOR P = 0.0 0.01 0.99
END OF MULTIPLY

```

