VONCDF

PURPOSE

Compute the Von Mises cumulative distribution function with shape parameter κ.

DESCRIPTION

The standard form of the Von Mises cumulative distribution function is:

$$F(x) = \frac{xI_0(\kappa) + 2\sum_{j=0}^{\infty} \frac{I_j(\kappa)\sin(j(x-\mu))}{j}}{2\pi I_0(\kappa)} \qquad -\pi \le x \le \pi \qquad \textbf{(EQ 8-348)}$$

where κ is the shape parameter and I_j is the modified Bessel function of order j. The Von Mises distribution is a circular function with a period of 2π. If the input argument is outside the interval (-π,π), DATAPLOT converts it to the equivalent argument in that interval.

A shape parameter of 0 reduces to a rectangular distribution on the (-π,π) interval. The Von Mises distribution approaches a normal distribution as κ gets large.

SYNTAX

LET <y2> = VONCDF(<y1>,<b>) <SUBSET/EXCEPT/FOR qualification>
where <y1> is a variable, number, or parameter containing values in the interval (-PI,PI);
<b> is a non-negative number, parameter, or variable;
<y2> is a variable or a parameter (depending on what <x> and <b> are) where the computed cdf value is stored;
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES

LET A = VONCDF(0.5,0)
LET Y = VONCDF(X1,4)

NOTE 1

DATAPLOT uses the ACM algorithm 518 (see the REFERENCE section below) to calculate the Von Mises cdf function. For values of κ less than 50, a series expansion in terms of modified Bessel functions is used. For larger values, a normal approximation is used.

NOTE 2

The general form of the Von Mises cumulative distribution function is:

$$F(x) = \frac{xI_0(\kappa) + 2\sum_{j=0}^{\infty} \frac{I_j(\kappa)\sin(j(x-\mu))}{j}}{2\pi I_0(\kappa)} \qquad -\pi \le x \le \pi \qquad \textbf{(EQ 8-349)}$$

where μ is a location parameter. See topic (3) under the General considerations section at the beginning of this chapter for a discussion of generating cdf values for the general form of the distribution. As κ approaches infinity, the density concentrates to a single point (the location parameter μ).

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

VONPDF	=	Compute the Von Mises probability density function.
VONPPF	=	Compute the Von Mises percent point function.
SEMCDF	=	Compute the semi-circular cumulative distribution function.
SEMPDF	=	Compute the semi-circular probability density function.
SEMPPF	=	Compute the semi-circular 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

"Algorithm 518, Incomplete Bessel Function I0: The Von Mises Distribution," Hill, ACM Transactions on Mathematical Software, Vol. 3, No. 3, September 1977, Pages 279-284.

"Algorithm AS 86: The Von Mises Distribution Function," Mardia, Applied Statistics, 24, 1975 (pp. 268-272).

"Statistical Distributions," 2nd. Edition, Evans, Hastings, and Peacock, John Wiley and Sons, 1993, (chapter 39).

APPLICATIONS

Analysis of circular data

IMPLEMENTATION DATE

94/10

PROGRAM

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TITLE VON MISES DISTRIBUTIONS
X1LABEL X
Y1LABEL PROBABILITY
PLOT VONCDF(X,0) FOR X = -3.14 0.01 3.14 AND
PLOT VONCDF(X,0.5) FOR X = -3.14 0.01 3.14 AND
PLOT VONCDF(X,1) FOR X = -3.14 0.01 3.14 AND
PLOT VONCDF(X,2) FOR X = -3.14 0.01 3.14 AND
PLOT VONCDF(X,4) FOR X = -3.14 0.01 3.14 AND
PLOT VONCDF(X,500) FOR X = -0.5 0.01 0.5
```