NCTPDF

PURPOSE

Compute the non-central t probability density function with degrees of freedom parameters υ and with non-centrality parameter δ.

DESCRIPTION

Given the random variable:

Y = Z/SQRT(X/υ)

where Z is a normal distribution with mean δ and a standard deviation of 1 and X is a central chi-square distribution with υ degrees of freedom, then Y has a non-central t distribution. The probability density function is rather complicated, so it is not given here. See the Evans, Hastings, and Peacock book for the formula (see the REFERENCE section below).

DATAPLOT actually uses the following formula to compute the non-central t density function (thanks to Mark Vangel of the NIST Statistical Engineering Division for pointing this formula out to us):

$$T_\upsilon'(x, \upsilon, \delta) = \frac{\upsilon}{x}\left(T_{\upsilon+2}\left(\sqrt{\frac{\upsilon+2}{\upsilon}}x, \delta\right) - T_\upsilon(x, \delta)\right) \qquad \textbf{(EQ Aux-241)}$$

where T is the non-central t cumulative distribution function. The case where x is zero is handled separately.

SYNTAX

LET <y2> = NCTPDF(<y1>,<v>,<delta>) <SUBSET/EXCEPT/FOR qualification>

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

<y2> is a variable or a parameter (depending on what <y1> is) where the computed pdf value is stored;

<v> is a non-negative number, parameter or variable that specifies the degrees of freedom parameter;

<delta> is a non-negative number, parameter or variable that specifies the non-centrality parameter;

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

EXAMPLES

LET A = NCTPDF(0.7,1,1)
LET A = NCTPDF(3,10,10)
LET X2 = NCTPDF(5,10,10)

NOTE 1

DATAPLOT uses algorithm AS 243 (see the REFERENCE section below) obtained from the statlib archive to compute the non-central t cdf. It uses the DBETAI and DLNGAM routines from the SLATEC library rather than the corresponding algorithms from the Applied Statistics series to compute the log gamma and incomplete beta functions. It uses the DATAPLOT normal cdf function rather than AS 66.

NOTE 2

DATAPLOT also supports the central t and the doubly non-central t distributions (see the documentation for TPDF and DNTCDF).

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

NCTCDF	=	Compute the singly non-central t cumulative distribution function.
NCTPPF	=	Compute the singly non-central t percent point function.
DNTCDF	=	Compute the doubly non-central t cumulative distribution function.
TCDF	=	Compute the t cumulative distribution function.
TPDF	=	Compute the t probability density function.
TPPF	=	Compute the t percent point function.
NCFCDF	=	Compute the non-central F cumulative distribution function.
NCFPPF	=	Compute the non-central F percent point function.
NCBCDF	=	Compute the non-central beta cumulative distribution function.

NCBPPF	=	Compute the non-central beta percent point function.
NCCCDF	=	Compute the non-central chi-square cumulative distribution function.
NCCPPF	=	Compute the non-central chi-square 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

"Tables of Normal Tolerance Limits, Sampling Plans and Screening", Odeh and Owen, Marcel Dekker, 1980 (page 272).

"Statistical Distributions", 2nd Edition, Evans, Hastings, and Peacock, 1994 (chapter 38).

APPLICATIONS

Statistical Testing

IMPLEMENTATION DATE

95/5

PROGRAM

```
TITLE NON-CENTRAL T DISTRIBUTIONS (V = 5)
X1LABEL X
Y1LABEL PROBABILITY
LINE SOLID DASH DOT
PLOT NCTPDF(X,5,0) FOR X = -3 0.01 7 AND
PLOT NCTPDF(X,5,2) FOR X = -3 0.01 7 AND
PLOT NCTPDF(X,5,0.5) FOR X = -3 0.01 7
```