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Submitter :
Language : Fortran

Library: MATHLIB
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Upper Tail Probability of Chi-Squared Distribution

Function subprogram `PROB` computes the probability that a random variable having a χ^2-distribution with $N \geq 1$ degrees of freedom assumes a value which is larger than a given value $X \geq 0$, i.e.

$$Q(X|N) \;=\; \frac{1}{\sqrt{2^N}\,\Gamma(\frac{1}{2}N)} \int_X^\infty e^{-\frac{1}{2}t}\, t^{\frac{1}{2}N-1}\, dt.$$

Structure:

`FUNCTION` subprogram
User Entry Names: `PROB`
External References: `ERFC` (C300), `DERFC` (C300), `MTLMTR` (N002), `ABEND` (Z035)

Usage:

In any arithmetic expression,

`PROB(X,N)` has the value $Q(\mathtt{X},\mathtt{N})$.

`PROB` and `X` are of type `REAL` and `N` is of type `INTEGER`.

Method:

See Ref. 1, formulae Nr. 26.4.4, 26.4.5 and, for $N > 300$, No. 26.4.14.

Accuracy:

For $\mathtt{N} \leq 300$, `PROB` has an accuracy of about six digits. For $\mathtt{N} > 300$, the accuracy decreases for $\mathtt{X} > \mathtt{N}$ with increasing `X`.

Error handling:

Error `G100.1`: $\mathtt{N} < 1$.
Error `G100.2`: $\mathtt{X} < 0$.
In both cases, the function value is set equal to zero, and a message is written on `Unit 6`, unless subroutine `MTLSET` (N002) has been called.

References:

1. M. Abramowitz and I.A. Stegun (eds.), Handbook of mathematical functions with formulas, graphs, and mathematcal tables, 9th printing with corrections, (Dover, New York 1972).

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