NAG Fortran Library Routine Document

G01FTF

Note: before using this routine, please read the Users' Note for your implementation to check the interpretation of ***bold italicised*** terms and other implementation-dependent details.

1 Purpose

G01FTF returns the value of the inverse $\Phi^{-1}(x)$ of the Landau distribution function, via the routine name.

2 Specification

double precision `FUNCTION G01FTF (X, IFAIL)`

```
INTEGER                  IFAIL
double precision         X
```

3 Description

G01FTF evaluates an approximation to the inverse $\Phi^{-1}(x)$ of the Landau distribution function given by

$$\Psi(x) = \Phi^{-1}(x)$$

(where $\Phi(\lambda)$ is described in G01ETF and G01MTF), using either linear or quadratic interpolation or rational approximations which mimic the asymptotic behaviour. Further details can be found in Kölbig and Schorr (1984).

It can also be used to generate Landau distributed random numbers in the range $0 < x < 1$.

4 References

Kölbig K S and Schorr B (1984) A program package for the Landau distribution *Comp. Phys. Comm.* **31** 97–111

5 Parameters

1: X – ***double precision*** *Input*

On entry: the argument x of the function.

Constraint: $0.0 < \mathrm{X} < 1.0$.

2: IFAIL – INTEGER *Input/Output*

On entry: IFAIL must be set to 0, -1 or 1. Users who are unfamiliar with this parameter should refer to Chapter P01 for details.

On exit: $\mathrm{IFAIL} = 0$ unless the routine detects an error (see Section 6).

For environments where it might be inappropriate to halt program execution when an error is detected, the value -1 or 1 is recommended. If the output of error messages is undesirable, then the value 1 is recommended. Otherwise, for users not familiar with this parameter the recommended value is 0. **When the value -1 or 1 is used it is essential to test the value of IFAIL on exit.**

6 Error Indicators and Warnings

If on entry IFAIL $= 0$ or -1, explanatory error messages are output on the current error message unit (as defined by X04AAF).

Errors or warnings detected by the routine:

IFAIL $= 1$

On entry, X ≤ 0.0,
or X ≥ 1.0.

7 Accuracy

At least $5 - 6$ significant digits are correct. Such accuracy is normally considered to be adequate for applications in large scale Monte Carlo simulations.

8 Further Comments

None.

9 Example

The example program evaluates $\Phi^{-1}(x)$ at $x = 0.5$, and prints the results.

9.1 Program Text

Note: the listing of the example program presented below uses ***bold italicised*** terms to denote precision-dependent details. Please read the Users' Note for your implementation to check the interpretation of these terms. As explained in the Essential Introduction to this manual, the results produced may not be identical for all implementations.

```
*     G01FTF Example Program Text
*     Mark 21 Release. NAG Copyright 2004.
*     .. Parameters ..
      INTEGER          NIN, NOUT
      PARAMETER        (NIN=5,NOUT=6)
*     .. Local Scalars ..
      DOUBLE PRECISION X, Y
      INTEGER          IFAIL
*     .. External Functions ..
      DOUBLE PRECISION G01FTF
      EXTERNAL         G01FTF
*     .. Executable Statements ..
      WRITE (NOUT,*) 'G01FTF Example Program Results'
*     Skip heading in data file
      READ (NIN,*)
      WRITE (NOUT,*)
      WRITE (NOUT,*) '  X          Y        IFAIL'
      WRITE (NOUT,*)
   20 READ (NIN,*,END=40) X
*
*     Compute the value of the inverse of the Landau distribution function
*
      IFAIL = 0
*
      Y = G01FTF(X,IFAIL)
*
      WRITE (NOUT,99999) X, Y, IFAIL
      GO TO 20
   40 STOP
*
99999 FORMAT (1X,F4.1,3X,1P,D12.4,I6)
      END
```

9.2 Program Data

```
G01FTF Example Program Data
 0.5  : Value of X
```

9.3 Program Results

```
 G01FTF Example Program Results

   X          Y        IFAIL

  0.5     1.3558D+00     0
```