

NAG Library Routine Document

G01MTF

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

G01MTF returns the value of the Landau density function $\phi(\lambda)$, via the routine name.

2 Specification

```
FUNCTION G01MTF (X)
REAL (KIND=nag_wp) G01MTF
REAL (KIND=nag_wp) X
```

3 Description

G01MTF evaluates an approximation to the Landau density function $\phi(\lambda)$ given by

$$\phi(\lambda) = \frac{1}{2\pi i} \int_{c-i\infty}^{c+i\infty} \exp(\lambda s + s \ln s) ds,$$

where c is an arbitrary real constant, using piecewise approximation by rational functions. Further details can be found in Kölbig and Schorr (1984).

To obtain the value of $\phi'(\lambda)$, G01RTF can be used.

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 – REAL (KIND=nag_wp) *Input*
On entry: the argument λ of the function.

6 Error Indicators and Warnings

There are no failure exits from this routine.

7 Accuracy

At least 7 significant digits are usually correct, but occasionally only 6. Such accuracy is normally considered to be adequate for applications in experimental physics.

Because of the asymptotic behaviour of $\phi(\lambda)$, which is of the order of $\exp[-\exp(-\lambda)]$, underflow may occur on some machines when λ is moderately large and negative.

8 Further Comments

None.

9 Example

This example evaluates $\phi(\lambda)$ at $\lambda = 0.5$, and prints the results.

9.1 Program Text

```

Program g01mtfe

!      G01MTF Example Program Text

!      Mark 24 Release. NAG Copyright 2012.

!      .. Use Statements ..
      Use nag_library, Only: a00acf, g01mtf, nag_wp
!      .. Implicit None Statement ..
      Implicit None
!      .. Parameters ..
      Integer, Parameter          :: nin = 5, nout = 6
!      .. Local Scalars ..
      Real (Kind=nag_wp)         :: x, y
      Integer                    :: ifail
!      .. Executable Statements ..
      Write (nout,*) 'G01MTF Example Program Results'
      Write (nout,*)

!      Check for valid licence prior to calling G01MTF
      If (.Not. a00acf()) Then
         Write (nout,*) ' ** A valid licence key was not found'

      Else
!         Skip heading in data file
         Read (nin,*)

!         Display titles
         Write (nout,*) ' X          Y'
         Write (nout,*)

d_lp:   Do
         Read (nin,*,Iostat=ifail) x
         If (ifail/=0) Then
            Exit d_lp
         End If

!         Compute the value of the Landau density function
         y = g01mtf(x)

!         Display results
         Write (nout,99999) x, y
      End Do d_lp
      End If

99999 Format (1X,F4.1,3X,1P,E12.4)
End Program g01mtfe

```

9.2 Program Data

G01MTF Example Program Data
 0.5 : Value of X

9.3 Program Results

```

G01MTF Example Program Results

X          Y
0.5       1.6523E-01

```