S18CFF – NAG Fortran Library Routine Document

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

S18CFF returns a value of the scaled modified Bessel function $e^{-|x|}I_1(x)$via the routine name.

2 Specification

```
real FUNCTION S18CFF(X, IFAIL)
INTEGER              IFAIL
real                 X
```

3 Description

This routine evaluates an approximation to $e^{-|x|}I_1(x)$, where I_1 is a modified Bessel function of the first kind. The scaling factor $e^{-|x|}$ removes most of the variation in $I_1(x)$.

The routine uses the same Chebyshev expansions as S18AFF, which returns the unscaled value of $I_1(x)$.

4 References

[1] Abramowitz M and Stegun I A (1972) *Handbook of Mathematical Functions* Dover Publications (3rd Edition)

5 Parameters

1: X — ***real*** *Input*

On entry: the argument x of the function.

2: IFAIL — INTEGER *Input/Output*

On entry: IFAIL must be set to 0, −1 or 1. For users not familiar with this parameter (described in Chapter P01) the recommended value is 0.

On exit: IFAIL = 0 unless the routine detects an error (see Section 6).

6 Error Indicators and Warnings

Errors detected by the routine:

There are no actual failure exits from this routine. IFAIL is always set to zero. This parameter is included for compatibility with other routines in this chapter.

7 Accuracy

Relative errors in the argument are attenuated when propagated into the function value. When the accuracy of the argument is essentially limited by the ***machine precision***, the accuracy of the function value will be similarly limited by at most a small multiple of the ***machine precision***.

8 Further Comments

None.

9 Example

The following program reads values of the argument x from a file, evaluates the function at each value of x 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.

```
*     S18CFF Example Program Text
*     Mark 14 Revised.  NAG Copyright 1989.
*     .. Parameters ..
      INTEGER          NIN, NOUT
      PARAMETER        (NIN=5,NOUT=6)
*     .. Local Scalars ..
      real             X, Y
      INTEGER          IFAIL
*     .. External Functions ..
      real             S18CFF
      EXTERNAL         S18CFF
*     .. Executable Statements ..
      WRITE (NOUT,*) 'S18CFF 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
      IFAIL = 1
*
      Y = S18CFF(X,IFAIL)
*
      WRITE (NOUT,99999) X, Y, IFAIL
      GO TO 20
   40 STOP
*
99999 FORMAT (1X,1P,2e12.3,I7)
      END
```

9.2 Program Data

```
S18CFF Example Program Data
             0.0
             0.5
             1.0
             3.0
             6.0
             10.0
             1000.0
             -1.0
```

9.3 Program Results

```
S18CFF Example Program Results

     X           Y        IFAIL

  0.000E+00   0.000E+00      0
  5.000E-01   1.564E-01      0
  1.000E+00   2.079E-01      0
  3.000E+00   1.968E-01      0
  6.000E+00   1.521E-01      0
  1.000E+01   1.213E-01      0
  1.000E+03   1.261E-02      0
 -1.000E+00  -2.079E-01      0
```