

nag_bessel_k1_scaled (s18cdc)**1. Purpose**

nag_bessel_k1_scaled (s18cdc) returns a value of the scaled modified Bessel function $e^x K_1(x)$.

2. Specification

```
#include <nag.h>
#include <nags.h>
```

```
double nag_bessel_k1_scaled(double x, NagError *fail)
```

3. Description

This function evaluates an approximation to $e^x K_1(x)$, where K_1 is a modified Bessel function of the second kind. The scaling factor e^x removes most of the variation in $K_1(x)$.

The function uses the same Chebyshev expansions as **nag_bessel_k1 (s18adc)**, which returns the unscaled value of $K_1(x)$.

4. Parameters

x

Input: the argument x of the function.

Constraint: $x > 0.0$. If **x** is too close to zero, there is a danger of overflow, and a failure will occur.

fail

The NAG error parameter, see the Essential Introduction to the NAG C Library.

5. Error Indications and Warnings**NE_REAL_ARG_LE**

On entry, **x** must not be less than or equal to 0.0: $x = \langle value \rangle$.

K_1 is undefined and the function returns zero.

NE_REAL_ARG_TOO_SMALL

On entry, **x** must be greater than $\langle value \rangle$: $x = \langle value \rangle$.

The function returns the value of the function at the smallest permitted value of the argument.

6. Further Comments**6.1. 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**.

6.2. References

Abramowitz M and Stegun I A (1968) *Handbook of Mathematical Functions* Dover Publications, New York ch 9 p 374.

7. See Also

nag_bessel_k1 (s18adc)
nag_bessel_k0_scaled (s18ccc)

8. 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.

8.1. Program Text

```

/* nag_bessel_k1_scaled(s18cdc) Example Program
 *
 * Copyright 1991 Numerical Algorithms Group.
 *
 * Mark 2 revised, 1992.
 */

#include <nag.h>
#include <stdio.h>
#include <nag_stdlib.h>
#include <nags.h>

main()
{
    double x, y;

    /* Skip heading in data file */
    Vscanf("%*[^\\n]");
    Vprintf("s18cdc Example Program Results\\n");
    Vprintf("      x      y\\n");
    while (scanf("%lf", &x) != EOF)
    {
        y = s18cdc(x, NAGERR_DEFAULT);
        Vprintf("%12.3e%12.3e\\n", x, y);
    }
    exit(EXIT_SUCCESS);
}

```

8.2. Program Data

```

s18cdc Example Program Data
      0.4
      0.6
      1.4
      2.5
     10.0
    1000.0

```

8.3. Program Results

```

s18cdc Example Program Results
      x      y
  4.000e-01  3.259e+00
  6.000e-01  2.374e+00
  1.400e+00  1.301e+00
  2.500e+00  9.002e-01
  1.000e+01  4.108e-01
  1.000e+03  3.965e-02

```
