NAG Library Function Document

nag_bessel_i1_scaled (s18cfc)

1 Purpose

nag_bessel_i1_scaled (s18cfc) returns a value of the scaled modified Bessel function $e^{-|x|}I_1(x)$.

2 Specification

```
#include <nag.h>
#include <nags.h>
double nag_bessel_i1_scaled (double x)
```

3 Description

nag_bessel_i1_scaled (s18cfc) 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 function uses the same Chebyshev expansions as nag_bessel_i1 (s18afc), which returns the unscaled value of $I_1(x)$.

4 References

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

5 Arguments

1: **x** – double *Input*

On entry: the argument x of the function.

6 Error Indicators and Warnings

None.

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 Parallelism and Performance

Not applicable.

9 Further Comments

None.

10 Example

This example reads values of the argument x from a file, evaluates the function at each value of x and prints the results.

10.1 Program Text

```
/* nag_bessel_i1_scaled (s18cfc) Example Program.
 *
 * Copyright 1991 Numerical Algorithms Group.
 *
 * Mark 2 revised, 1992.
 */

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

int main(void)
{
  Integer exit_status = 0;
  double  x, y;

  /* Skip heading in data file */
  scanf("%*[^\n]");
  printf("nag_bessel_i1_scaled (s18cfc) Example Program Results\n");
  printf("     x           y\n");
  while (scanf("%lf", &x) != EOF)
    {
      /* nag_bessel_i1_scaled (s18cfc).
       * Scaled modified Bessel function exp(-|x|) I_1(x)
       */
      y = nag_bessel_i1_scaled(x);
      printf("%12.3e%12.3e\n", x, y);
    }

  return exit_status;
}
```

10.2 Program Data

```
nag_bessel_i1_scaled (s18cfc) Example Program Data
             0.0
             0.5
             1.0
             3.0
             6.0
             10.0
             1000.0
             -1.0
```

10.3 Program Results

```
nag_bessel_i1_scaled (s18cfc) Example Program Results
     x           y
   0.000e+00   0.000e+00
   5.000e-01   1.564e-01
   1.000e+00   2.079e-01
   3.000e+00   1.968e-01
   6.000e+00   1.521e-01
   1.000e+01   1.213e-01
   1.000e+03   1.261e-02
  -1.000e+00  -2.079e-01
```