

## nag\_bessel\_i0\_scaled (s18cec)

### 1. Purpose

`nag_bessel_i0_scaled (s18cec)` returns a value of the scaled modified Bessel function  $e^{-|x|}I_0(x)$ .

### 2. Specification

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

```
double nag_bessel_i0_scaled(double x)
```

### 3. Description

This function evaluates an approximation to  $e^{-|x|}I_0(x)$ , where  $I_0$  is a modified Bessel function of the first kind. The scaling factor  $e^{-|x|}$  removes most of the variation in  $I_0(x)$ .

The function uses the same Chebyshev expansions as `nag_bessel_i0 (s18aec)`, which returns the unscaled value of  $I_0(x)$ .

### 4. Parameters

**x**

Input: the argument  $x$  of the function.

### 5. Error Indications and Warnings

None.

### 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_i0 (s18aec)
nag_bessel_i1_scaled (s18cfc)
```

### 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_i0_scaled(s18cec) 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("s18cec Example Program Results\n");
    Vprintf("      x      y\n");
    while (scanf("%lf", &x) != EOF)
    {
        y = s18cec(x);
        Vprintf("%12.3e%12.3e\n", x, y);
    }
    exit(EXIT_SUCCESS);
}

```

### 8.2. Program Data

```

s18cec Example Program Data
      0.0
      0.5
      1.0
      3.0
      6.0
     10.0
    1000.0
     -1.0

```

### 8.3. Program Results

```

s18cec Example Program Results
      x      y
  0.000e+00  1.000e+00
  5.000e-01  6.450e-01
  1.000e+00  4.658e-01
  3.000e+00  2.430e-01
  6.000e+00  1.667e-01
  1.000e+01  1.278e-01
  1.000e+03  1.262e-02
 -1.000e+00  4.658e-01

```

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