nag_sin_integral (s13adc)

1. Purpose

nag_sin_integral (s13adc) returns the value of the sine integral $\mathrm{Si}(x)$.

2. Specification

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

double nag_sin_integral(double x)
```

3. Description

The function evaluates

$$\mathrm{Si}(x) = \int_0^x \frac{\sin u}{u}\, du.$$

The approximation is based on several Chebyshev expansions.

4. Parameters

x
Input: the argument x of the function.

5. Error Indications and Warnings

None.

6. Further Comments

6.1. Accuracy

If δ and ϵ are the relative errors in the argument and result, respectively, then in principle $|\epsilon| \simeq |(\delta \sin x)/\mathrm{Si}(x)|$. The equality may hold if δ is greater than the ***machine precision*** (δ due to data errors etc.), but if δ is simply due to round-off in the machine representation, then since the factor relating δ to ϵ is always less than one, the accuracy will be limited by ***machine precision***.

For $|x| \geq x_{\mathrm{hi}}$, where x_{hi} is a machine-dependent value, $\mathrm{Si}(x) = \frac{1}{2}\pi \mathrm{sign}\, x$ to within ***machine precision***.

6.2. References

Abramowitz M and Stegun I A (1968) *Handbook of Mathematical Functions* Dover Publications, New York ch 5.2 p 231.

7. See Also

nag_cos_integral (s13acc)

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_sin_integral(s13adc) Example Program
 *
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 *
 * Mark 1, 1990.
 */

#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("s13adc Example Program Results\n");
  Vprintf("     x           y\n");
  while (scanf("%lf", &x) != EOF)
    {
      y = s13adc(x);
      Vprintf("%12.3e%12.3e\n", x, y);
    }
  exit(EXIT_SUCCESS);
}
```

8.2. Program Data

```
s13adc Example Program Data
             0.0
             0.2
             0.4
             0.6
             0.8
             1.0
```

8.3. Program Results

```
s13adc Example Program Results
     x           y
   0.000e+00   0.000e+00
   2.000e-01   1.996e-01
   4.000e-01   3.965e-01
   6.000e-01   5.881e-01
   8.000e-01   7.721e-01
   1.000e+00   9.461e-01
```