nag_median_1var (g07dac)

1. Purpose

nag_median_1var (g07dac) finds the median, median absolute deviation, and a robust estimate of the standard deviation for a set of ungrouped data.

2. Specification

```
#include <nag.h>
#include <nagg07.h>

void nag_median_1var(Integer n, double x[], double y[], double *xme,
     double *xmd, double *xsd, NagError *fail)
```

3. Description

The data consists of a sample of size n, denoted by $x_1, x_2, \ldots, x_n$, drawn from a random variable X. nag_median_1var first computes the median

$$\theta_{\text{med}} = \text{med}_i\{x_i\}$$

and from this the median absolute deviation can be computed,

$$\sigma_{\text{med}} = \text{med}_i\{|x_i - \theta_{\text{med}}|\}.$$

Finally, a robust estimate of the standard deviation is computed,

$$\sigma'_{\text{med}} = \sigma_{\text{med}}/\Phi^{-1}(0.75)$$

where $\Phi^{-1}(0.75)$ is the value of the inverse standard Normal function at the point 0.75. nag_median_1var is based upon the algorithm used in the function LTMDDV in the ROBETH library, see Marazzi (1987).

4. Parameters

n
Input: the number of observations, n.
Constraint: $\mathbf{n} > 1$.

x[n]
Input: the vector of observations, $x_1, x_2, \ldots, x_n$.

y[n]
Output: the observations sorted into ascending order.

xme
Output: the median, θ_{med}.

xmd
Output: the median absolute deviation, σ_{med}.

xsd
Output: the robust estimate of the standard deviation, σ'_{med}.

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

5. Error Indications and Warnings

NE_INT_ARG_GT
On entry, **n** must not be greater than ⟨*value*⟩: **n** = ⟨*value*⟩.

NE_INT_ARG_LE
On entry, **n** must not be less than or equal to 1: **n** = ⟨*value*⟩.

6. Further Comments

The function may be called with the same actual array supplied for parameters **x** and **y**, in which case the sorted data values will overwrite the original contents of **x**.

6.1. Accuracy

The computations are believed to be stable.

6.2. References

Huber P J (1981) *Robust Statistics* Wiley. Marazzi A (1987) *Subroutines for Robust Estimation of Location and Scale in ROBETH* Institut Universitaire de Médecine Sociale et Préventive, Lausanne (Cah Rech Doc IUMSP, No 3 ROB 1).

7. See Also

None.

8. Example

The following program reads in a set of data consisting of eleven observations of a variable **x**. The median, median absolute deviation and a robust estimate of the standard deviation are calculated and printed along with the sorted data in output array **y**.

8.1. Program Text

```
/* nag_median_1var(g07dac) Example Program
 *
 * Copyright 1990 Numerical Algorithms Group.
 *
 * Mark 1, 1990.
 *
 * Mark 3 revised, 1994.
 */

#include <nag.h>
#include <stdio.h>
#include <nag_stdlib.h>
#include <nagg07.h>
#define NMAX 25

main()
{
  Integer  i, n;
  double   x[NMAX], y[NMAX], xmd, xme, xsd;

  Vprintf("g07dac Example Program Results\n");
  /* Skip heading in data file */
  Vscanf("%*[^\n]");
  Vscanf("%ld",&n);
  if (n<=NMAX)
    {
      for (i=0; i<n; ++i)
        Vscanf("%lf",&x[i]);
      g07dac(n, x, y, &xme, &xmd, &xsd, NAGERR_DEFAULT);
      Vprintf("Output y:\n");
      for (i=0; i<n; ++i)
        Vprintf("%6.3f%s", y[i], (i%11==10 || i==n-1) ? "\n": " ");
      Vprintf("\nxme = %6.3f, xmd = %6.3f, xsd = %6.3f\n", xme, xmd, xsd);
      exit(EXIT_SUCCESS);
    }
  else
```

```
    {
      Vfprintf(stderr, "n is out of range. n = %5ld\n",n);
      exit(EXIT_FAILURE);
    }
}
```

8.2. Program Data

```
g07dac Example Program Data
11
13.0 11.0 16.0 5.0 3.0 18.0 9.0 8.0 6.0 27.0 7.0
```

8.3. Program Results

```
g07dac Example Program Results
Output y:
 3.000  5.000  6.000  7.000  8.000  9.000 11.000 13.000 16.000 18.000 27.000

xme =  9.000, xmd =  4.000, xsd =  5.930
```