

NAG Toolbox

nag_univar_robust_1var_median (g07da)

1 Purpose

nag_univar_robust_1var_median (g07da) finds the median, median absolute deviation, and a robust estimate of the standard deviation for a set of ungrouped data.

2 Syntax

```
[y, xme, xmd, xsd, ifail] = nag_univar_robust_1var_median(x, 'n', n)
[y, xme, xmd, xsd, ifail] = g07da(x, 'n', n)
```

3 Description

The data consists of a sample of size n , denoted by x_1, x_2, \dots, x_n , drawn from a random variable X . nag_univar_robust_1var_median (g07da) 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_univar_robust_1var_median (g07da) is based upon function LTMDDV within the ROBETH library, see Marazzi (1987).

4 References

Huber P J (1981) *Robust Statistics* Wiley

Marazzi A (1987) Subroutines for robust estimation of location and scale in ROBETH *Cah. Rech. Doc. IUMSP, No. 3 ROB 1* Institut Universitaire de Médecine Sociale et Préventive, Lausanne

5 Parameters

5.1 Compulsory Input Parameters

1: **x(n)** – REAL (KIND=nag_wp) array
The vector of observations, x_1, x_2, \dots, x_n .

5.2 Optional Input Parameters

1: **n** – INTEGER
Default: the dimension of the array **x**.
 n , the number of observations.
Constraint: **n** > 1.

5.3 Output Parameters

- 1: **y(n)** – REAL (KIND=nag_wp) array
The observations sorted into ascending order.
- 2: **xme** – REAL (KIND=nag_wp)
The median, θ_{med} .
- 3: **xmd** – REAL (KIND=nag_wp)
The median absolute deviation, σ_{med} .
- 4: **xsd** – REAL (KIND=nag_wp)
The robust estimate of the standard deviation, σ'_{med} .
- 5: **ifail** – INTEGER
ifail = 0 unless the function detects an error (see Section 5).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail = 1

On entry, $\mathbf{n} \leq 1$.

ifail = -99

An unexpected error has been triggered by this routine. Please contact NAG.

ifail = -399

Your licence key may have expired or may not have been installed correctly.

ifail = -999

Dynamic memory allocation failed.

7 Accuracy

The computations are believed to be stable.

8 Further Comments

None.

9 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 \mathbf{y} .

9.1 Program Text

```
function g07da_example

fprintf('g07da example results\n\n');

x = [13; 11; 16; 5; 3; 18; 9; 8; 6; 27; 7];
fprintf('Original Data\n ');
fprintf('%7.3f',x)
fprintf('\n\n');

% Sort Data abd compute estimates
[y, xme, xmd, xsd, ifail] = g07da(x);

fprintf('Sorted Data\n ');
fprintf('%7.3f',y)
fprintf('\n\n');
fprintf('Median = %6.3f\n', xme);
fprintf('Median absolute deviation = %6.3f\n', xmd);
fprintf('Robust estimate standard deviation = %6.3f\n', xsd);
```

9.2 Program Results

```
g07da example results

Original Data
 13.000 11.000 16.000  5.000  3.000 18.000  9.000  8.000  6.000 27.000  7.000

Sorted Data
 3.000  5.000  6.000  7.000  8.000  9.000 11.000 13.000 16.000 18.000 27.000

Median = 9.000
Median absolute deviation = 4.000
Robust estimate standard deviation = 5.930
```
