

NAG Library Routine Document

G01ALF

Note: before using this routine, please read the Users' Note for your implementation to check the interpretation of *bold italicised* terms and other implementation-dependent details.

1 Purpose

G01ALF calculates a five-point summary for a single sample.

2 Specification

```
SUBROUTINE G01ALF (N, X, IWRK, RES, IFAIL)
```

```
INTEGER          N, IWRK(N), IFAIL
```

```
REAL (KIND=nag_wp) X(N), RES(5)
```

3 Description

G01ALF calculates the minimum, lower hinge, median, upper hinge and the maximum of a sample of n observations.

The data consist of a single sample of n observations denoted by x_i and let z_i , for $i = 1, 2, \dots, n$, represent the sample observations sorted into ascending order.

Let $m = \frac{n}{2}$ if n is even and $\frac{(n+1)}{2}$ if n is odd,

and $k = \frac{m}{2}$ if m is even and $\frac{(m+1)}{2}$ if m is odd.

Then we have

Minimum	= z_1 ,	
Maximum	= z_n ,	
Median	= z_m	if n is odd,
	= $\frac{z_m + z_{m+1}}{2}$	if n is even,
Lower hinge	= z_k	if m is odd,
	= $\frac{z_k + z_{k+1}}{2}$	if m is even,
Upper hinge	= z_{n-k+1}	if m is odd,
	= $\frac{z_{n-k} + z_{n-k+1}}{2}$	if m is even.

4 References

Erickson B H and Nosanchuk T A (1985) *Understanding Data* Open University Press, Milton Keynes

Tukey J W (1977) *Exploratory Data Analysis* Addison–Wesley

5 Parameters

1: N – INTEGER

Input

On entry: n , number of observations in the sample.

Constraint: $N \geq 5$.

- 2: X(N) – REAL (KIND=nag_wp) array *Input*
On entry: the sample observations, x_1, x_2, \dots, x_n .
- 3: IWRK(N) – INTEGER array *Workspace*
- 4: RES(5) – REAL (KIND=nag_wp) array *Output*
On exit: RES contains the five-point summary.
 RES(1)
 The minimum.
 RES(2)
 The lower hinge.
 RES(3)
 The median.
 RES(4)
 The upper hinge.
 RES(5)
 The maximum.
- 5: IFAIL – INTEGER *Input/Output*
On entry: IFAIL must be set to 0, -1 or 1. If you are unfamiliar with this parameter you should refer to Section 3.3 in the Essential Introduction for details.
 For environments where it might be inappropriate to halt program execution when an error is detected, the value -1 or 1 is recommended. If the output of error messages is undesirable, then the value 1 is recommended. Otherwise, if you are not familiar with this parameter, the recommended value is 0. **When the value -1 or 1 is used it is essential to test the value of IFAIL on exit.**
On exit: IFAIL = 0 unless the routine detects an error or a warning has been flagged (see Section 6).

6 Error Indicators and Warnings

If on entry IFAIL = 0 or -1, explanatory error messages are output on the current error message unit (as defined by X04AAF).

Errors or warnings detected by the routine:

IFAIL = 1

 On entry, $N < 5$.

7 Accuracy

The computations are stable.

8 Further Comments

The time taken by G01ALF is proportional to n .

9 Example

This example calculates a five-point summary for a sample of 12 observations.

9.1 Program Text

```

Program g01alfe

!      G01ALF Example Program Text

!      Mark 24 Release. NAG Copyright 2012.

!      .. Use Statements ..
Use nag_library, Only: g01alf, nag_wp
!      .. Implicit None Statement ..
Implicit None
!      .. Parameters ..
Integer, Parameter          :: nin = 5, nout = 6
!      .. Local Scalars ..
Integer                    :: ifail, n
!      .. Local Arrays ..
Real (Kind=nag_wp)        :: res(5)
Real (Kind=nag_wp), Allocatable :: x(:)
Integer, Allocatable      :: iwrk(:)
!      .. Executable Statements ..
Write (nout,*) 'G01ALF Example Program Results'
Write (nout,*)

!      Skip heading in data file
Read (nin,*)

!      Read in the problem size
Read (nin,*) n

Allocate (x(n),iwrk(n))

!      Read in data
Read (nin,*) x(1:n)

!      Calculate summary statistics
ifail = 0
Call g01alf(n,x,iwrk,res,ifail)

!      Display results
Write (nout,99999) 'Maximum', res(5)
Write (nout,99999) 'Upper Hinge (75% quantile)', res(4)
Write (nout,99999) 'Median (50% quantile)', res(3)
Write (nout,99999) 'Lower Hinge (25% quantile)', res(2)
Write (nout,99999) 'Minimum', res(1)

99999 Format (1X,A,F16.4)
End Program g01alfe

```

9.2 Program Data

```

G01ALF Example Program Data
12
12.0  9.0  2.0  5.0  6.0  8.0  2.0  7.0  3.0  1.0  11.0  10.0

```

9.3 Program Results

```

G01ALF Example Program Results

Maximum                12.0000
Upper Hinge (75% quantile)  9.5000
Median (50% quantile)     6.5000
Lower Hinge (25% quantile)  2.5000
Minimum                 1.0000

```
