

NAG Toolbox

nag_nonpar_gofstat_anddar_normal (g08ck)

1 Purpose

nag_nonpar_gofstat_anddar_normal (g08ck) calculates the Anderson–Darling goodness-of-fit test statistic and its probability for the case of a fully-unspecified Normal distribution.

2 Syntax

```
[ybar, yvar, a2, aa2, p, ifail] = nag_nonpar_gofstat_anddar_normal(issort, y, 'n', n)
[ybar, yvar, a2, aa2, p, ifail] = g08ck(issort, y, 'n', n)
```

3 Description

Calculates the Anderson–Darling test statistic A^2 (see nag_nonpar_gofstat_anddar (g08ch)) and its upper tail probability for the small sample correction:

$$\text{Adjusted } A^2 = A^2(1 + 0.75/n + 2.25/n^2),$$

for n observations.

4 References

Anderson T W and Darling D A (1952) Asymptotic theory of certain ‘goodness-of-fit’ criteria based on stochastic processes *Annals of Mathematical Statistics* **23** 193–212

Stephens M A and D’Agostino R B (1986) *Goodness-of-Fit Techniques* Marcel Dekker, New York

5 Parameters

5.1 Compulsory Input Parameters

1: **issort** – LOGICAL

Set **issort** = *true* if the observations are sorted in ascending order; otherwise the function will sort the observations.

2: **y(n)** – REAL (KIND=nag_wp) array

y_i , for $i = 1, 2, \dots, n$, the n observations.

Constraint: if **issort** = *true*, the values must be sorted in ascending order.

5.2 Optional Input Parameters

1: **n** – INTEGER

Default: the dimension of the array **y**.

n , the number of observations.

Constraint: **n** > 1.

5.3 Output Parameters

- 1: **ybar** – REAL (KIND=nag_wp)
The maximum likelihood estimate of mean.
- 2: **yvar** – REAL (KIND=nag_wp)
The maximum likelihood estimate of variance.
- 3: **a2** – REAL (KIND=nag_wp)
 A^2 , the Anderson–Darling test statistic.
- 4: **aa2** – REAL (KIND=nag_wp)
The adjusted A^2 .
- 5: **p** – REAL (KIND=nag_wp)
 p , the upper tail probability for the adjusted A^2 .
- 6: **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

Constraint: $n > 1$.

ifail = 3

issort = *true* and the data in **y** is not sorted in ascending order.

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

Probabilities are calculated using piecewise polynomial approximations to values estimated by simulation.

8 Further Comments

None.

9 Example

This example calculates the A^2 statistics for data assumed to arise from a fully-unspecified Normal distribution and the p -value.

9.1 Program Text

```
function g08ck_example

fprintf('g08ck example results\n\n');

y = [0.3131132, 0.2520412, 1.5788841, 1.4416712,-0.8246043,-1.6466685, ...
     0.7943184, 1.2874915,-0.8347250, 0.3352505, 0.9434467, 2.1099520, ...
     -0.2801654,-0.7843009, 0.6218187, 2.0963809, 1.7170403,-0.1350142, ...
     0.7982763,-0.2980977, 1.2283043, 1.5576090,-0.4828757, 2.6070754, ...
     0.1213996, 0.1431621];
% Let g08ck sort the data
issort = false;

% Calculate a-squared and probability
[ybar, yvar, a2, aa2, p, ifail] = ...
  g08ck(issort, y);

% Results
fprintf('H0: data from normal distribution\n');
fprintf('          with mean  %8.4f\n', ybar);
fprintf('          and variance %8.4f\n', yvar);
fprintf('Test statistic, A-squared: %8.4f\n', a2);
fprintf('Adjusted A-squared:      %8.4f\n', aa2);
fprintf('Upper tail probability:   %8.4f\n', p);
```

9.2 Program Results

```
g08ck example results

H0: data from normal distribution
          with mean  0.5639
          and variance  1.1386
Test statistic, A-squared:  0.1660
Adjusted A-squared:      0.1713
Upper tail probability:   0.9312
```
