

NAG Toolbox for MATLAB

g10ca

1 Purpose

g10ca computes a smoothed data sequence using running median smoothers.

2 Syntax

```
[smooth, rough, ifail] = g10ca(itype, y, 'n', n)
```

3 Description

Given a sequence of n observations recorded at equally spaced intervals, g10ca fits a smooth curve through the data using one of two smoothers. The two smoothers are based on the use of running medians and averages to summarize overlapping segments. The fit and the residuals are called the smooth and the rough respectively. They obey the following:

$$\text{Data} = \text{Smooth} + \text{Rough}.$$

The two smoothers are:

1. 4253H,twice consisting of a running median of 4, then 2, then 5, then 3 followed by hanning. Hanning is a running weighted average, the weights being $1/4$, $1/2$ and $1/4$. The result of this smoothing is then reroughed by computing residuals, applying the same smoother to them and adding the result to the smooth of the first pass.
2. 3RSSH,twice consisting of a running median of 3, two splitting operations named S to improve the smooth sequence, each of which is followed by a running median of 3, and finally hanning. The end points are dealt with using the method described by Velleman and Hoaglin 1981. The full smoother 3RSSH,twice is produced by reroughing as described above.

The compound smoother 4253H,twice is recommended. The smoother 3RSSH,twice is popular when calculating by hand as it requires simpler computations and is included for comparison purposes.

4 References

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

Velleman P F and Hoaglin D C 1981 *Applications, Basics, and Computing of Exploratory Data Analysis* Duxbury Press, Boston, MA

5 Parameters

5.1 Compulsory Input Parameters

- 1: **itype** – int32 scalar

Specifies the method to be used.

If **itype** = 0, 4253H,twice is used.

If **itype** = 1, 3RSSH,twice is used.

Constraint: **itype** = 0 or 1.

- 2: **y(n)** – double array

The sample observations.

5.2 Optional Input Parameters

1: **n – int32 scalar**

Default: The dimension of the arrays **y**, **smooth**, **rough**. (An error is raised if these dimensions are not equal.)

n, the number of observations.

Constraint: **n** > 6.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

1: **smooth(n) – double array**

Contains the smooth.

2: **rough(n) – double array**

Contains the rough.

3: **ifail – int32 scalar**

0 unless the function detects an error (see Section 6).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail = 1

On entry, **itype** < 0,
or **itype** > 1.

ifail = 2

On entry, **n** ≤ 6.

7 Accuracy

Not applicable.

8 Further Comments

Alternative methods of smoothing include the use of splines; see g10ab and g10ac.

9 Example

```
itype = int32(1);  
y = [569;  
     416;  
     422;  
     565;  
     484;  
     520;  
     573;  
     518;
```

```
501;  
505;  
468;  
382;  
310;  
334;  
359;  
372;  
439;  
446;  
349;  
395;  
461;  
511;  
583;  
590;  
620;  
578;  
534;  
631;  
600;  
438;  
516;  
534;  
467;  
457;  
392;  
467;  
500;  
493;  
410;  
412;  
416;  
403;  
422;  
459;  
467;  
512;  
534;  
552;  
545];  
[smooth, rough, ifail] = g10ca(itype, y)
```

```
smooth =  
416.0000  
416.0000  
431.5000  
473.0000  
509.5000  
520.6875  
521.5625  
518.0000  
510.0000  
496.5000  
455.2500  
387.5000  
339.7500  
334.9375  
353.9375  
376.1250  
392.2500  
396.2500  
403.0000  
427.2500  
461.3750  
513.3125  
567.5625  
590.0000  
593.5000  
595.2500
```

```
590.9375
566.8125
531.5000
516.0000
516.0000
501.8750
473.6250
457.0000
452.0000
440.1250
421.3750
412.0000
412.0000
412.0000
411.0625
410.6875
422.0000
446.6250
476.3750
509.0000
534.0000
545.0000
547.7500
rough =
153.0000
0
-9.5000
92.0000
-25.5000
-0.6875
51.4375
0
-9.0000
8.5000
12.7500
-5.5000
-29.7500
-0.9375
5.0625
-4.1250
46.7500
49.7500
-54.0000
-32.2500
-0.3750
-2.3125
15.4375
0
26.5000
-17.2500
-56.9375
64.1875
68.5000
-78.0000
0
32.1250
-6.6250
0
-60.0000
26.8750
78.6250
81.0000
-2.0000
0
4.9375
-7.6875
0
12.3750
-9.3750
3.0000
```

```
      0
    7.0000
   -2.7500
ifail =
      0
```
