# NAG Fortran Library Routine Document

# G01AGF

**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

G01AGF performs a scatter plot of two variables on a character printing device, with a chosen number of character positions in each direction.

## 2 Specification

```
SUBROUTINE G01AGF(X, Y, NOBS, ISORT, NSTEPX, NSTEPY, IFAIL)
INTEGER           NOBS, ISORT(NOBS), NSTEPX, NSTEPY, IFAIL
real              X(NOBS), Y(NOBS)
```

## 3 Description

The routine finds the range of the data in each dimension and calculates a step size for each division on the axes; these step sizes are selected from the list

(0.1, 0.15, 0.2, 0.25, 0.4, 0.5, 0.6, 0.75, 0.8) $\times$ power of 10.

The axes are drawn and annotated and data points are plotted on the nearest character position. The character plotted is either a digit 1 to 9 for the equivalent number of occurrences of a point at a particular character position, an alphabetic A to Z for 10 to 35 occurrences, or * if there are more than 35 coincident occurrences. Axes are drawn on all sides of the plot with the left-hand and bottom ones annotated; zero axes are also marked if included in the plotting area.

The Fortran logical unit number used for the output is the current advisory message unit number defined for each implementation. This number may be changed by an appropriate call to X04ABF before calling G01AGF.

## 4 References

None.

## 5 Parameters

1: X(NOBS) – ***real*** array *Input*

*On entry*: the values to be plotted in the $x$-direction.

2: Y(NOBS) – ***real*** array *Input/Output*

*On entry*: the values to be plotted in the $y$-direction.

*On exit*: the elements of Y are sorted into descending order of magnitude.

3: NOBS – INTEGER *Input*

*On entry*: the number of observations to be plotted.

*Constraint*: NOBS $\geq 1$.

4: ISORT(NOBS) – INTEGER array *Output*

*On exit*: the key to the descending order of the elements in array Y, i.e., ISORT($i$) contains the position of the value Y($i$) in the original array Y, for $i = 1, 2, \ldots,$ NOBS.

5: NSTEPX – INTEGER *Input*

*On entry*: the number of steps (character positions) to be plotted in the $x$-direction. If the supplied value of NSTEPX is less than 10, the value 10 will be used by the routine. The maximum value for NSTEPX is the number of character positions available on the chosen output device less 15, up to a maximum of 133. If NSTEPX exceeds 133 on input, the value 133 will be used by the routine.

6: NSTEPY – INTEGER *Input*

*On entry*: the number of steps (character positions) to be plotted in the $y$-direction. If the supplied value of NSTEPY is less than 10, the value 10 will be used by the routine. There is no maximum value for NSTEPY, but users should bear in mind that $(\text{NSTEPY} + 5)$ records (lines) of output are generated by the routine.

7: IFAIL – INTEGER *Input/Output*

*On entry*: IFAIL must be set to $0$, $-1$ or $1$. Users who are unfamiliar with this parameter should refer to Chapter P01 for details.

*On exit*: IFAIL $= 0$ unless the routine detects an error (see Section 6).

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, for users 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.**

## 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, NOBS $< 1$.

## 7 Accuracy

Accuracy is limited by the number of plotting points available.

## 8 Further Comments

The time taken by the routine may be expected to be approximately proportional to the product NOBS $\times$ NSTEPX $\times$ NSTEPY.

No blank records are output before or after the plot.

Users must make sure that it is permissible to write records containing NSTEPX characters to the current advisory message unit.

## 9 Example

The data relate to wheat and potato yields in 48 counties in England in 1936. The example illustrates the use of X04ABF to set the logical unit number, used for the output of G01AGF, to the value specified NOUT.

## 9.1 Program Text

**Note:** the listing of the example program presented below uses ***bold italicised*** terms to denote precision-dependent details. Please read the Users' Note for your implementation to check the interpretation of these terms. As explained in the Essential Introduction to this manual, the results produced may not be identical for all implementations.

```
*     G01AGF Example Program Text
*     Mark 14 Revised.  NAG Copyright 1989.
*     .. Parameters ..
      INTEGER          NOBS
      PARAMETER        (NOBS=48)
      INTEGER          NIN, NOUT
      PARAMETER        (NIN=5,NOUT=6)
*     .. Local Scalars ..
      INTEGER          I, IFAIL, NSTEPX, NSTEPY
*     .. Local Arrays ..
      real             X(NOBS), Y(NOBS)
      INTEGER          ISORT(NOBS)
*     .. External Subroutines ..
      EXTERNAL         G01AGF, X04ABF
*     .. Executable Statements ..
      WRITE (NOUT,*) 'G01AGF Example Program Results'
*     Skip heading in data file
      READ (NIN,*)
      WRITE (NOUT,*)
      WRITE (NOUT,*)
     +  '            Plot of wheat (X) and potato (Y) yields'
      WRITE (NOUT,*) '            in 48 counties in England in 1936.'
      WRITE (NOUT,*)
      READ (NIN,*) (X(I),Y(I),I=1,NOBS)
      CALL X04ABF(1,NOUT)
      IFAIL = 0
      NSTEPX = 40
      NSTEPY = 32
*
      CALL G01AGF(X,Y,NOBS,ISORT,NSTEPX,NSTEPY,IFAIL)
*
      IF (IFAIL.NE.0) THEN
         WRITE (NOUT,*)
         WRITE (NOUT,99999) 'G01AGF fails unexpectedly with IFAIL =',
     +     IFAIL
      END IF
      STOP
*
99999 FORMAT (1X,A,I2)
      END
```

## 9.2 Program Data

```
G01AGF Example Program Data
 16.0 5.3 16.0 6.6 16.4 6.1 20.5 5.5 18.3 6.9 16.3 6.1
 17.7 6.4 15.3 6.3 16.5 7.8 16.9 8.3 21.9 5.7 15.5 6.2
 15.9 6.0 16.1 6.1 18.5 6.6 12.7 4.8 15.7 4.9 14.3 5.1
 13.9 5.5 12.8 6.7 12.0 6.5 15.6 5.2 15.9 5.2 16.7 7.1
 14.3 4.9 14.4 5.6 15.2 6.4 14.1 6.9 15.5 5.6 16.5 6.1
 14.3 5.7 13.2 5.0 13.9 6.5 14.4 6.2 13.5 5.2 11.2 6.6
 14.4 5.8 15.5 6.3 18.5 6.3 16.4 5.8 17.1 5.9 16.9 6.5
 17.5 5.8 15.9 5.7 19.2 7.2 17.7 6.5 15.2 5.4 17.1 6.3
```

## 9.3 Program Results

```
 G01AGF Example Program Results

            Plot of wheat (X) and potato (Y) yields
            in 48 counties in England in 1936.

       9.000+....+....+....+....+....+....+....+....+.
            .                                        .
            .                                        .
            .                                        .
            .                                        .
       8.250+                 1                       +
            .                                        .
            .                                        .
            .               1                        .
            .                                        .
       7.500+                                        +
            .                                        .
            .                       1                .
            .                  1                     .
            .          1           1                 .
       6.750+      1                                  +
            .  1             1      1                 .
            .    1    1  1   1 2                      .
            .              11   1  1                 .
            .           1  113                       .
       6.000+               1                       +
            .           1    1 11                    .
            .           1   1              1          .
            .          11  1            1            .
            .              1                         .
       5.250+         1    12                        +
            .           1                            .
            .        1  1  1                         .
            .       1                                .
            .                                        .
       4.500+                                        +
            .                                        .
            .                                        .
            .                                        .
            +....+....+....+....+....+....+....+....+.
          10.00     14.00     18.00     22.00     26.00
               12.00     16.00     20.00     24.00
```