NAG Fortran Library Routine Document

G11SBF

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

G11SBF is a service routine which may be used prior to calling G11SAF to calculate the frequency distribution of a set of dichotomous score patterns.

2   Specification

```
SUBROUTINE G11SBF(IP, N, IS, X, NRX, IRL, IFAIL)
INTEGER          IP, N, IS, NRX, IRL(N), IFAIL
LOGICAL          X(NRX,IP)
```

3   Description

When each of n individuals responds to each of p dichotomous variables the data assumes the form of the matrix X defined below

$$
X = \begin{bmatrix} x_{11} & x_{12} & \ldots & x_{1p} \\ x_{21} & x_{22} & \ldots & x_{2p} \\ \vdots & \vdots & & \vdots \\ x_{n1} & x_{n2} & \ldots & x_{np} \end{bmatrix} = \begin{bmatrix} \underline{x}'_1 \\ \underline{x}'_2 \\ \vdots \\ \underline{x}'_n \end{bmatrix},
$$

where the x take the value of 0 or 1 and $\underline{x}_l = (x_{l1}, x_{l2}, \ldots, x_{lp})'$, for $l = 1, 2, \ldots, n$ denotes the score pattern of the lth individual ($'$ denoting the transpose of a vector). G11SBF calculates the number of different score patterns, s, and the frequency with which each occurs. This information can then be passed to G11SAF.

4   References

None.

5   Parameters

1:    IP – INTEGER   *Input*

   On entry: the number of dichotomous variables, p.

   Constraint: IP $\geq$ 3.

2:    N – INTEGER   *Input*

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

   Constraint: N $\geq$ 7.

3:    IS – INTEGER   *Output*

   On exit: the number of different score patterns, s.

4:    X(NRX,IP) – LOGICAL array   *Input/Output*

   On entry: $X(i,j)$ must be set equal to .TRUE. if $x_{ij} = 1$, and .FALSE. if $x_{ij} = 0$, for $i = 1, 2, \ldots, n$; $j = 1, 2, \ldots, p$.

   On exit: the first s rows of X contain the s different score patterns.

5:    NRX – INTEGER   *Input*

   On entry: the first dimension of the array X as declared in the (sub)program from which G11SBF is called.

   Constraint: NRX $\geq$ N.

6:    IRL(N) – INTEGER array   *Output*

   On exit: the frequency with which the lth row of X occurs, for $l = 1, 2, \ldots, s$.

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, IP < 3,
   or   N < 7,
   or   NRX $<$ N.

7   Accuracy

Exact.

8   Further Comments

The time taken by the routine is small and increases with n.

9 Example

A program to count the frequencies of different score patterns in the following list:

<div align="center">

Score Patterns
000
010
111
000
001
000
000
110
001
011

</div>

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.

```
*      G11SBF Example Program Text
*      Mark 14 Revised.  NAG Copyright 1989.
*      .. Parameters ..
       INTEGER          NIN, NOUT
       PARAMETER        (NIN=5,NOUT=6)
       INTEGER          NRX, IPMAX
       PARAMETER        (NRX=100,IPMAX=5)
*      .. Local Scalars ..
       INTEGER          I, IFAIL, IP, IS, J, N
*      .. Local Arrays ..
       INTEGER          IRL(NRX)
       LOGICAL          X(NRX,IPMAX)
*      .. External Subroutines ..
       EXTERNAL         G11SBF
*      .. Executable Statements ..
       WRITE (NOUT,*) 'G11SBF Example Program Results'
*      Skip heading in data file
       READ (NIN,*)
       READ (NIN,*) N, IP
       IF (N.GT.0 .AND. N.LE.NRX .AND. IP.GT.0 .AND. IP.LE.IPMAX) THEN
          DO 20 I = 1, N
             READ (NIN,*) (X(I,J),J=1,IP)
   20     CONTINUE
          IFAIL = 0
*
          CALL G11SBF(IP,N,IS,X,NRX,IRL,IFAIL)
*
          WRITE (NOUT,*)
          WRITE (NOUT,*) 'Frequency     Score pattern'
          WRITE (NOUT,*)
          DO 40 I = 1, IS
             WRITE (NOUT,99999) IRL(I), (X(I,J),J=1,IP)
   40     CONTINUE
       END IF
       STOP
*
99999 FORMAT (1X,I5,12X,5L2)
       END
```

9.2 Program Data

```
G11SBF Example Program Data
10 3
F F F
F T F
T T T
F F F
F F T
F F F
F F F
T T F
F F T
F T T
```

9.3 Program Results

```
 G11SBF Example Program Results

 Frequency      Score pattern

      4             F F F
      1             F T F
      1             T T T
      2             F F T
      1             T T F
      1             F T T
```