

# NAG 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, NS, X, LDX, IRL, IFAIL)
INTEGER IP, N, NS, LDX, IRL(N), IFAIL
LOGICAL X(LDX,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

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

where the  $x$  take the value of 0 or 1 and  $\underline{x}_l = (x_{l1}, x_{l2}, \dots, x_{lp})$ , for  $l = 1, 2, \dots, n$ , denotes the score pattern of the  $l$ th individual. 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:*  $p$ , the number of dichotomous variables.  
*Constraint:*  $IP \geq 3$ .
- 2: N – INTEGER *Input*  
*On entry:*  $n$ , the number of individuals in the sample.  
*Constraint:*  $N \geq 7$ .
- 3: NS – INTEGER *Output*  
*On exit:* the number of different score patterns,  $s$ .
- 4: X(LDX, 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  $i = 1, 2, \dots, n$  and  $j = 1, 2, \dots, p$ .

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

5: LDX – INTEGER *Input*

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

*Constraint:*  $LDX \geq N$ .

6: IRL(N) – INTEGER array *Output*

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

7: 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,  $IP < 3$ ,  
or  $N < 7$ ,  
or  $LDX < N$ .

IFAIL =  $-99$

An unexpected error has been triggered by this routine. Please contact NAG.  
See Section 3.8 in the Essential Introduction for further information.

IFAIL =  $-399$

Your licence key may have expired or may not have been installed correctly.  
See Section 3.7 in the Essential Introduction for further information.

IFAIL =  $-999$

Dynamic memory allocation failed.  
See Section 3.6 in the Essential Introduction for further information.

## 7 Accuracy

Exact.

## 8 Parallelism and Performance

Not applicable.

## 9 Further Comments

The time taken by G11SBF is small and increases with  $n$ .

## 10 Example

This example counts the frequencies of different score patterns in the following list:

```

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

```

### 10.1 Program Text

```

Program g11sbfe

!      G11SBF Example Program Text
!
!      Mark 25 Release. NAG Copyright 2014.
!
!      .. Use Statements ..
!      Use nag_library, Only: g11sbf
!      .. Implicit None Statement ..
!      Implicit None
!      .. Parameters ..
!      Integer, Parameter          :: nin = 5, nout = 6
!      .. Local Scalars ..
!      Integer                     :: i, ifail, ip, ldx, n, ns
!      .. Local Arrays ..
!      Integer, Allocatable        :: irl(:)
!      Logical, Allocatable        ::  x(:, :)
!      .. Executable Statements ..
!      Write (nout,*) 'G11SBF Example Program Results'
!      Write (nout,*)
!
!      Skip heading in data file
!      Read (nin,*)
!      Read (nin,*) n, ip
!
!      ldx = n
!      Allocate (x(ldx,ip),irl(n))
!
!      Read in data
!      Read (nin,*)(x(i,1:ip),i=1,n)
!
!      ifail = 0
!      Call g11sbf(ip,n,ns,x,ldx,irl,ifail)
!
!      Display results
!      Write (nout,*) 'Frequency      Score pattern'
!      Write (nout,*)
!      Do i = 1, ns
!         Write (nout,99999) irl(i), x(i,1:ip)
!      End Do
!
99999 Format (1X,I5,12X,5(L2))
End Program g11sbfe

```

## 10.2 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
```

## 10.3 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

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