# NAG Fortran Library Routine Document

# G05EBF

**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

G05EBF sets up the reference vector, R, for a discrete uniform distribution over the interval $[m, n]$.

## 2    Specification

```
SUBROUTINE G05EBF(M, N, R, NR, IFAIL)
INTEGER          M, N, NR, IFAIL
real             R(NR)
```

## 3    Description

G05EBF sets up a reference vector for use in G05EYF. Together these routines produce random numbers from the distribution defined by:

$$P(I = i) = \frac{1}{n-m+1} \quad \text{if } m \le i \le n,$$

$$P(I = i) = 0 \qquad \text{otherwise,}$$

assuming $m \le n$. If $m > n$, the roles of $m$ and $n$ are reversed.

The reference array is formed in the natural manner (described in more detail in G05EXF).

## 4    References

Knuth D E (1981) *The Art of Computer Programming (Volume 2)* (2nd Edition) Addison-Wesley

## 5    Parameters

1:    M – INTEGER                                                                                            *Input*
2:    N – INTEGER                                                                                            *Input*

   *On entry*: the end-points $m$ and $n$ of the distribution. It is not necessary that $m < n$.

3:    R(NR) – **real** array                                                                                *Output*

   *On exit*: the reference vector R.

4:    NR – INTEGER                                                                                          *Input*

   *On entry*: the dimension of the array R as declared in the (sub)program from which G05EBF is called.

   *Suggested value*: approximately $5 + 1.4 \times |M - N|$ (for optimum efficiency in G05EYF).

   *Constraint*: $NR > |M - N| + 3$.

5:    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

Errors detected by the routine:

IFAIL = 1

On entry, $\text{NR} \le |\text{M} - \text{N}| + 3$.

## 7    Accuracy

Not applicable.

## 8    Further Comments

The time taken by the routine increases with NR.

## 9    Example

The example program sets up a reference vector for a uniform distribution between $-5$ and 5, and then prints the first five pseudo-random numbers generated by G05EYF, after initialisation by G05CBF.

The generator mechanism used is selected by an initial call to G05ZAF.

### 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.

```
*      G05EBF Example Program Text
*      Mark 20 Revised. NAG Copyright 2001.
*      .. Parameters ..
       INTEGER         M, N, NR
       PARAMETER       (M=-5,N=5,NR=19)
       INTEGER         NOUT
       PARAMETER       (NOUT=6)
*      .. Local Scalars ..
       INTEGER         I, IFAIL, IX
*      .. Local Arrays ..
       real            R(NR)
*      .. External Functions ..
       INTEGER         G05EYF
       EXTERNAL        G05EYF
*      .. External Subroutines ..
       EXTERNAL        G05CBF, G05EBF, G05ZAF
*      .. Executable Statements ..
       CALL G05ZAF('O')
       WRITE (NOUT,*) 'G05EBF Example Program Results'
       WRITE (NOUT,*)
       CALL G05CBF(0)
       IFAIL = 0
*
       CALL G05EBF(M,N,R,NR,IFAIL)
*
       DO 20 I = 1, 5
          IX = G05EYF(R,NR)
          WRITE (NOUT,99999) IX
   20 CONTINUE
       STOP
*
```

```
99999 FORMAT (1X,I5)
      END
```

## 9.2 Program Data

None.

## 9.3 Program Results

```
 G05EBF Example Program Results

    3
   -3
   -1
   -3
    4
```