NAG Fortran Library Routine Document

G05LGF

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

G05LGF generates a vector of pseudo-random numbers uniformly distributed over the interval $[a, b]$.

2 Specification

```
SUBROUTINE G05LGF(A, B, N, X, IGEN, ISEED, IFAIL)
INTEGER            N, IGEN, ISEED(4), IFAIL
real               A, B, X(*)
```

3 Description

If $a = 0$ and $b = 1$, G05LGF returns the next n values y_i from a uniform (0,1) generator (see G05KAF for details).

For other values of a and b, G05LGF applies the transformation

$$x_i = a + (b - a)y_i.$$

The routine ensures that the values x_i lie in the closed interval $[a, b]$.

If computing sequentially and using the same generator, G05LGF always generates exactly the same pseudo-random numbers as would n consecutive calls of G05KAF and on many machines is likely to be much faster.

One of the initialisation routines G05KBF (for a repeatable sequence if computed sequentially) or G05KCF (for a non-repeatable sequence) must be called prior to the first call to G05LGF.

4 References

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

5 Parameters

1: A – ***real*** *Input*

2: B – ***real*** *Input*

On entry: the end-points a and b of the uniform distribution.

Constraint: $\mathrm{A} \leq \mathrm{B}$.

3: N – INTEGER *Input*

On entry: the number, n, of pseudo-random numbers to be generated.

Constraint: $\mathrm{N} \geq 0$.

4: X(*) – ***real*** array *Output*

Note: the dimension of the array X must be at least $\max(1, \mathrm{N})$.

On exit: the n pseudo-random numbers from the specified uniform distribution.

5: IGEN – INTEGER *Input*

On entry: must contain the identification number for the generator to be used to return a pseudo-random number and should remain unchanged following initialisation by a prior call to one of the routines G05KBF or G05KCF.

6: ISEED(4) – INTEGER array *Input/Output*

On entry: contains values which define the current state of the selected generator.

On exit: contains updated values defining the new state of the selected generator.

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, N < 0.

IFAIL $= 2$

On entry, B $<$ A.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

The example program prints five pseudo-random numbers from a uniform distribution between -1.0 and 1.0, generated by a single call to G05LGF, after initialisation by G05KBF.

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.

```
*     G05LGF Example Program Text
*     Mark 20 Release. NAG Copyright 2001.
*     .. Parameters ..
      INTEGER          NOUT, M
      PARAMETER        (NOUT=6,M=5)
*     .. Local Scalars ..
      INTEGER          IFAIL, IGEN
```

```
*     .. Local Arrays ..
      real              X(M)
      INTEGER           ISEED(4)
*     .. External Subroutines ..
      EXTERNAL          G05KBF, G05LGF
*     .. Executable Statements ..
      WRITE (NOUT,*) 'G05LGF Example Program Results'
      WRITE (NOUT,*)
*     Initialise the seed to a repeatable sequence
      ISEED(1) = 1762543
      ISEED(2) = 9324783
      ISEED(3) = 42344
      ISEED(4) = 742355
*     IGEN identifies the stream.
      IGEN = 1
      CALL G05KBF(IGEN,ISEED)
*
      IFAIL = 0
      CALL G05LGF(-1.0e0,1.0e0,M,X,IGEN,ISEED,IFAIL)
*
      WRITE (NOUT,99999) X
      STOP
*
99999 FORMAT (1X,F10.4)
      END
```

9.2 Program Data

None.

9.3 Program Results

```
 G05LGF Example Program Results

    -0.8214
     0.9019
    -0.1872
     0.4864
     0.8995
```