

NAG Library Routine Document

G05TLF

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

G05TLF generates a vector of pseudorandom integers uniformly distributed over the interval $[a, b]$.

2 Specification

```
SUBROUTINE G05TLF(N, A, B, STATE, X, IFAIL)
INTEGER          N, A, B, STATE(lstate), X(N), IFAIL
```

3 Description

G05TLF generates the next n values y_i from a uniform $(0, 1]$ generator (see G05SAF for details) and applies the transformation

$$x_i = a + \lfloor (b - a + 1)y_i \rfloor,$$

where $\lfloor z \rfloor$ is the integer part of the real value z . The routine ensures that the values x_i lie in the closed interval $[a, b]$.

One of the initialization routines G05KFF (for a repeatable sequence if computed sequentially) or G05KGF (for a non-repeatable sequence) must be called prior to the first call to G05TLF.

4 References

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

5 Parameters

- | | | |
|----|---|----------------------------|
| 1: | N – INTEGER | <i>Input</i> |
| | <i>On entry:</i> n , the number of pseudorandom numbers to be generated. | |
| | <i>Constraint:</i> $N \geq 0$. | |
| 2: | A – INTEGER | <i>Input</i> |
| 3: | B – INTEGER | <i>Input</i> |
| | <i>On entry:</i> the end points a and b of the uniform distribution. | |
| | <i>Constraint:</i> $A \leq B$. | |
| 4: | STATE(lstate) – INTEGER array | <i>Communication Array</i> |
| | Note: $lstate = LSTATE$, the dimension of STATE as supplied to the initialization routine G05KFF or G05KGF. | |
| | <i>On entry:</i> contains information on the selected base generator and its current state. | |
| | <i>On exit:</i> contains updated information on the state of the generator. | |
| 5: | X(N) – INTEGER array | <i>Output</i> |
| | <i>On exit:</i> the n pseudorandom numbers from the specified uniform distribution. | |

6: 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.

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, 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.**

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 = 3

On entry, $B < A$.

IFAIL = 4

On entry, STATE vector was not initialized or has been corrupted.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

This example prints five pseudorandom integers from a discrete uniform distribution between -5 and 5 , generated by a single call to G05TLF, after initialization by G05KFF.

9.1 Program Text

```
*      G05TLF Example Program Text
*      Mark 22 Release. NAG Copyright 2006.
*      .. Parameters ..
INTEGER          NOUT
PARAMETER        (NOUT=6)
INTEGER          MSEED, MSTATE, N
PARAMETER        (MSEED=1,MSTATE=633,N=5)
*      .. Local Scalars ..
INTEGER          A, B, GENID, I, IFAIL, LSEED, LSTATE, SUBID
*      .. Local Arrays ..
INTEGER          SEED(MSEED), STATE(MSTATE), X(N)
*      .. External Subroutines ..
EXTERNAL         G05KFF, G05TLF
*      .. Executable Statements ..
WRITE (NOUT,*) 'G05TLF Example Program Results'
WRITE (NOUT,*)
*      Initialize the seed
```

```

      SEED(1) = 1762543
*      GENID and SUBID identify the base generator
      GENID = 1
      SUBID = 1
*      Initialize the generator to a repeatable sequence
      LSTATE = MSTATE
      LSEED = MSEED
      IFAIL = 1
      CALL G05KFF(GENID,SUBID,SEED,LSEED,STATE,LSTATE,IFAIL)
      IF (IFAIL.NE.0) THEN
        WRITE (NOUT,99998) IFAIL
        GO TO 20
      END IF
      A = -5
      B = 5
*      Generate the variates
      IFAIL = 1
      CALL G05TLF(N,A,B,STATE,X,IFAIL)
      IF (IFAIL.NE.0) THEN
        WRITE (NOUT,99997) IFAIL
        GO TO 20
      END IF
*      Display the variates
      WRITE (NOUT,99999) (X(I),I=1,N)
*
      20 CONTINUE
*
99999 FORMAT (1X,I12)
99998 FORMAT (1X,' ** G05KFF returned with IFAIL = ',I5)
99997 FORMAT (1X,' ** G05TLF returned with IFAIL = ',I5)
      END

```

9.2 Program Data

None.

9.3 Program Results

G05TLF Example Program Results

```

      2
     -4
      3
      3
     -4

```
