NAG Fortran Library Routine Document

G05FDF

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

G05FDF generates a vector of pseudo-random numbers taken from a Normal (Gaussian) distribution with mean a and standard deviation b.

2 Specification

```
SUBROUTINE G05FDF(A, B, N, X)
INTEGER           N
real              A, B, X(N)
```

3 Description

The distribution has PDF (probability distribution function)

$$f(x) = \frac{1}{b\sqrt{2\pi}} \exp\left(-\frac{(x-a)^2}{2b^2}\right).$$

The routine uses the Box–Muller method.

The routine does **not** generate the same pseudo-random numbers as would n consecutive calls of G05DDF, because G05DDF uses a different method. However on many machines G05FDF is likely to be much faster.

4 References

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

Kendall M G and Stuart A (1969) *The Advanced Theory of Statistics (Volume 1)* (3rd Edition) Griffin

5 Parameters

1: A – ***real*** *Input*

On entry: the mean, a, of the distribution.

2: B – ***real*** *Input*

On entry: the standard deviation, b, of the distribution. If B is negative, the distribution of the generated numbers – though not the actual sequence – is the same as if the absolute value of B were used.

3: N – INTEGER *Input*

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

4: X(N) – ***real*** array *Output*

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

6 Error Indicators and Warnings

None.

7 Accuracy

The generated numbers conform to a Normal distribution with an accuracy of $\sqrt{\text{bdi}\, machine\ precision}$.

8 Further Comments

None.

9 Example

The example program prints five pseudo-random numbers from a Normal distribution with mean 1.0 and standard deviation 1.5, generated by a single call to G05FDF, 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.

```
*     G05FDF Example Program Text
*     Mark 20 Revised. NAG Copyright 2001.
*     .. Parameters ..
      INTEGER          NOUT
      PARAMETER        (NOUT=6)
      INTEGER          N
      PARAMETER        (N=5)
*     .. Local Scalars ..
      INTEGER          I
*     .. Local Arrays ..
      real             X(N)
*     .. External Subroutines ..
      EXTERNAL         G05CBF, G05FDF, G05ZAF
*     .. Executable Statements ..
      CALL G05ZAF('O')
      WRITE (NOUT,*) 'G05FDF Example Program Results'
      CALL G05CBF(0)
*
      CALL G05FDF(1.0e0,1.5e0,5,X)
*
      WRITE (NOUT,99999) (X(I),I=1,N)
      STOP
*
99999 FORMAT (1X,F10.4)
      END
```

9.2 Program Data

None.

9.3 Program Results

```
 G05FDF Example Program Results
     1.1544
     2.0039
     1.3299
     3.0856
     1.7290
```