NAG Fortran Library Routine Document

G05DEF

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

G05DEF returns a pseudo-random real number taken from a log-normal distribution with parameters a and b.

2 Specification

```
real FUNCTION G05DEF(A, B)
real                 A, B
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{1}{bx\sqrt{2\pi}} \exp\left(-\frac{(\ln x - a)^2}{2b^2}\right) \quad \text{if } x > 0,$$

$$f(x) = 0 \quad \text{otherwise,}$$

i.e., $\ln x$ is normally distributed with mean a and standard deviation b. The routine returns the value exp y, where y is generated by G05DDF from a Normal distribution with mean a and standard deviation b.

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 of ln x.

2: B – ***real*** *Input*

On entry: the standard deviation b, of the distribution of $\ln x$. 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.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

The example program prints the first five pseudo-random real numbers from a log-normal distribution with mean 1.0 and standard deviation 1.5, generated by G05DEF 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.

```
*     G05DEF Example Program Text
*     Mark 20 Revised. NAG Copyright 2001.
*     .. Parameters ..
      INTEGER          NOUT
      PARAMETER        (NOUT=6)
*     .. Local Scalars ..
      real             X
      INTEGER          I
*     .. External Functions ..
      real             G05DEF
      EXTERNAL         G05DEF
*     .. External Subroutines ..
      EXTERNAL         G05CBF, G05ZAF
*     .. Executable Statements ..
      CALL G05ZAF('O')
      WRITE (NOUT,*) 'G05DEF Example Program Results'
      WRITE (NOUT,*)
      CALL G05CBF(0)
      DO 20 I = 1, 5
*
         X = G05DEF(1.0e0,1.5e0)
*
         WRITE (NOUT,99999) X
   20 CONTINUE
      STOP
*
99999 FORMAT (1X,F10.4)
      END
```

9.2 Program Data

None.

9.3 Program Results

```
 G05DEF Example Program Results

     6.0767
    18.9017
    29.0802
     2.6121
    26.4446
```