NAG Fortran Library Routine Document

G05DCF

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

G05DCF returns a pseudo-random real number taken from a logistic distribution with mean a and spread b.

2 Specification

```
real FUNCTION G05DCF(A, B)
real            A, B
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{e^{(x-a)/b}}{b\left(1 + e^{(x-a)/b}\right)^2}.$$

The routine returns the value

$$a + b \ln\left(\frac{y}{1-y}\right)$$

where y is a pseudo-random number uniformly distributed over (0,1), generated by G05CAF.

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 spread b, of the distribution, where 'spread' is $\frac{\sqrt{3}}{\pi} \times$ standard deviation. 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 logistic distribution with mean 1.0 and spread 1.5, generated by G05DCF 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.

```
*      G05DCF Example Program Text
*      Mark 20 Revised. NAG Copyright 2001.
*      .. Parameters ..
       INTEGER          NOUT
       PARAMETER        (NOUT=6)
*      .. Local Scalars ..
       real             X
       INTEGER          I
*      .. External Functions ..
       real             G05DCF
       EXTERNAL         G05DCF
*      .. External Subroutines ..
       EXTERNAL         G05CBF, G05ZAF
*      .. Executable Statements ..
       CALL G05ZAF('O')
       WRITE (NOUT,*) 'G05DCF Example Program Results'
       WRITE (NOUT,*)
       CALL G05CBF(0)
       DO 20 I = 1, 5
*
          X = G05DCF(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

```
 G05DCF Example Program Results

     3.0341
    -0.8490
     0.2099
    -0.8548
     3.9709
```