NAG Fortran Library Routine Document

G05DPF

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

G05DPF returns a pseudo-random real number taken from a two parameter Weibull distribution with shape parameter a and scale parameter b.

2 Specification

```
real FUNCTION G05DPF(A, B, IFAIL)
INTEGER              IFAIL
real                 A, B
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{a}{b}x^{a-1}e^{-x^a/b} \quad \text{if } x > 0,$$

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

The routine returns the value $(-b\ln y)^{1/a}$, where y is a pseudo-random number from a uniform distribution 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 shape parameter, a, of the distribution.

Constraint: A > 0.0.

2: B – ***real*** *Input*

On entry: the scale parameter, b, of the distribution.

Constraint: B > 0.0.

3: 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, A ≤ 0.0.

IFAIL $= 2$

On entry, B ≤ 0.0.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

The example program prints out the first five pseudo-random real numbers from a Weibull distribution with shape parameter 1.0 and scale parameter 2.0, generated by G05DPF 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.

```
*     G05DPF Example Program Text
*     Mark 20 Revised. NAG Copyright 2001.
*     .. Parameters ..
      INTEGER          NOUT
      PARAMETER        (NOUT=6)
*     .. Local Scalars ..
      real             X
      INTEGER          I, IFAIL
*     .. External Functions ..
      real             G05DPF
      EXTERNAL         G05DPF
*     .. External Subroutines ..
      EXTERNAL         G05CBF, G05ZAF
*     .. Executable Statements ..
      CALL G05ZAF('O')
      WRITE (NOUT,*) 'G05DPF Example Program Results'
      WRITE (NOUT,*)
      CALL G05CBF(0)
      IFAIL = 0
      DO 20 I = 1, 5
*
         X = G05DPF(1.0e0,2.0e0,IFAIL)
*
         WRITE (NOUT,99999) X
   20 CONTINUE
      STOP
*
99999 FORMAT (1X,F10.4)
      END
```

9.2 Program Data

None.

9.3 Program Results

```
 G05DPF Example Program Results

     0.4585
     2.9769
     1.9816
     2.9830
     0.2585
```