

G05DKF – NAG Fortran Library Routine Document

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

G05DKF returns a pseudo-random real number taken from the F (or Fisher's variance ratio) distribution with m and n degrees of freedom.

2 Specification

```
real FUNCTION G05DKF(M, N, IFAIL)
INTEGER                M, N, IFAIL
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{\left(\frac{m+n-2}{2}\right)! x^{(1/2)m-1}}{\left(\frac{1}{2}m-1\right)! \left(\frac{1}{2}n-1\right)! \left(1 + \frac{m}{n}x\right)^{(1/2)(m+n)}} \times \left(\frac{m}{n}\right)^{1/2} m \quad \text{if } x > 0,$$

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

The routine returns the value

$$\frac{ny}{mz}$$

where y and z are generated by G05DGF from gamma distributions with parameters $(\frac{1}{2}m, 2)$ and $(\frac{1}{2}n, 2)$ respectively (i.e., from χ^2 distributions with m and n degrees of freedom).

4 References

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

5 Parameters

- 1:** M — INTEGER *Input*
On entry: the first degree of freedom, m , of the distribution.
Constraint: M > 0.
- 2:** N — INTEGER *Input*
On entry: the second degree of freedom, n , of the distribution.
Constraint: N > 0.
- 3:** IFAIL — INTEGER *Input/Output*
On entry: IFAIL must be set to 0, -1 or 1. For users not familiar with this parameter (described in Chapter P01) the recommended value is 0.
On exit: IFAIL = 0 unless the routine detects an error (see Section 6).

6 Error Indicators and Warnings

Errors detected by the routine:

IFAIL = 1

On entry, $M < 1$.

IFAIL = 2

On entry, $N < 1$.

7 Accuracy

Not applicable.

8 Further Comments

The time taken by the routine increases with m and n .

9 Example

The example program prints the first five pseudo-random real numbers from the F -distribution with 2 and 3 degrees of freedom, generated by G05DKF 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.

```

*      G05DKF Example Program Text
*      NAG Fortran SMP Library, Release 2.  NAG Copyright 2000.
*      .. Parameters ..
      INTEGER          NOUT
      PARAMETER       (NOUT=6)
*      .. Local Scalars ..
      DOUBLE PRECISION X
      INTEGER          I, IFAIL
*      .. External Functions ..
      DOUBLE PRECISION G05DKF
      EXTERNAL         G05DKF
*      .. External Subroutines ..
      EXTERNAL         G05CBF, G05ZAF
*      .. Executable Statements ..
      CALL G05ZAF('0')
      WRITE (NOUT,*) 'G05DKF Example Program Results'
      WRITE (NOUT,*)
      CALL G05CBF(0)
      IFAIL = 0
      DO 20 I = 1, 5
*
*          X = G05DKF(2,3,IFAIL)
*
*          WRITE (NOUT,99999) X
20    CONTINUE
      STOP

```

```
*  
99999 FORMAT (1X,F10.4)  
END
```

9.2 Program Data

None.

9.3 Program Results

G05DKF Example Program Results

```
0.1252  
10.8233  
0.7821  
0.8655  
0.5804
```
