NAG Fortran Library Routine Document

G05EYF

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

G05EYF returns a pseudo-random integer taken from a discrete distribution defined by a reference vector R.

2 Specification

```
INTEGER FUNCTION G05EYF(R, NR)
INTEGER                 NR
real                    R(NR)
```

3 Description

This routine is designed for use in conjunction with other routines in this chapter, which set up the reference vector R for specific distributions or according to a distribution specified in terms of the PDF (probability density function) or CDF (cumulative distribution function). See the G05 Chapter Introduction.

The routine generates a random number x from G05CAF and searches the CDF in R for the smallest value y such that $\text{CDF}(y) \geq x$ and $\text{CDF}(y-1) < x$. R will contain an index to speed this process and the more space allotted to R the faster this will become.

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: R(NR) – ***real*** array *Input*

On entry: the reference vector R.

2: NR – INTEGER *Input*

On entry: the dimension of the array R as declared in the (sub)program from which G05EYF is called. It must be the same as the value of NR specified in a call to a routine to set up the reference vector.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Further Comments

The time taken by the routine decreases as the space allotted to the index part of R increases. There is a point, depending on the distribution, where the improvement becomes very small and the recommended values for NR in other routines are designed to approximate this point.

9 Example

The example program calls G05ECF to set up a reference vector for a Poisson distribution with mean 2.7; it then prints the first five pseudo-random numbers generated by G05EYF 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.

```
*     G05EYF Example Program Text
*     Mark 20 Revised. NAG Copyright 2001.
*     .. Parameters ..
      real              T
      INTEGER           NR
      PARAMETER         (T=2.7e0,NR=30)
      INTEGER           NOUT
      PARAMETER         (NOUT=6)
*     .. Local Scalars ..
      INTEGER           I, IFAIL, IX
*     .. Local Arrays ..
      real              R(NR)
*     .. External Functions ..
      INTEGER           G05EYF
      EXTERNAL          G05EYF
*     .. External Subroutines ..
      EXTERNAL          G05CBF, G05ECF, G05ZAF
*     .. Executable Statements ..
      CALL G05ZAF('O')
      WRITE (NOUT,*) 'G05EYF Example Program Results'
      WRITE (NOUT,*)
      CALL G05CBF(0)
      IFAIL = 0
*
      CALL G05ECF(T,R,NR,IFAIL)
*
      DO 20 I = 1, 5
*
         IX = G05EYF(R,NR)
*
         WRITE (NOUT,99999) IX
   20 CONTINUE
      STOP
*
99999 FORMAT (1X,I5)
      END
```

9.2 Program Data

None.

9.3 Program Results

```
 G05EYF Example Program Results

     4
     1
     2
     1
     5
```