G05EYF – 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

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

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

[2]   Kendall M G and Stuart A (1969) *The Advanced Theory of Statistics (Volume 1)* Griffin (3rd Edition)

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 .

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 14 Revised.  NAG Copyright 1989.
*     .. 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
*     .. Executable Statements ..
      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
```