G05ECF – 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

G05ECF sets up the reference vector R for a Poisson distribution with mean t.

2 Specification

```
SUBROUTINE G05ECF(T, R, NR, IFAIL)
INTEGER           NR, IFAIL
real              T, R(NR)
```

3 Description

This sets up a reference vector for use in G05EYF. Together these routines produce random numbers from the distribution defined by:

$$P(I = i) = \frac{t^i e^{-t}}{i!} \quad \text{if } i = 0, 1, \ldots$$
$$P(I = i) = 0 \quad \text{otherwise.}$$

The reference array is found using a recurrence relation if t is less than 50 and by Stirling's formula otherwise.

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: T — ***real*** *Input*

On entry: the mean, t, of the distribution.

Constraint: $\mathrm{T} \geq 0$.

2: R(NR) — ***real*** array *Output*

On exit: the reference vector.

3: NR — INTEGER *Input*

On entry: the dimension of the array R as declared in the (sub)program from which G05ECF is called.

Suggested value: approximately $20 + 20 \times \sqrt{\mathrm{T}}$ (for optimum efficiency in G05EYF).

Constraint: $\mathrm{NR} > (\mathrm{INT}[\mathrm{T} + 7.15\sqrt{\mathrm{T}} + 8.5] - \max(0, \mathrm{INT}[\mathrm{T} - 7.15\sqrt{\mathrm{T}}]) + 4)$.

4: 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, T < 0.

IFAIL = 2

On entry, NR is too small (see Section 5).

7 Accuracy

Not applicable.

8 Further Comments

The time taken by the routine increases with NR.

9 Example

The example program sets up a reference for a Poisson distribution with mean 2.7 and 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.

```
*     G05ECF 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,*) 'G05ECF Example Program Results'
      WRITE (NOUT,*)
      CALL G05CBF(0)
      IFAIL = 0
*
      CALL G05ECF(T,R,NR,IFAIL)
*
      DO 20 I = 1, 5
         IX = G05EYF(R,30)
         WRITE (NOUT,99999) IX
```

```
   20 CONTINUE
      STOP
*
99999 FORMAT (1X,I5)
      END
```

9.2 Program Data

None.

9.3 Program Results

```
 G05ECF Example Program Results

     4
     1
     2
     1
     5
```