

## G05FBB – 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

G05FBB generates a vector of pseudo-random numbers taken from a (negative) exponential distribution with mean  $a$ .

### 2 Specification

```
SUBROUTINE G05FBB(A, N, X)
  INTEGER          N
  real           A, X(N)
```

### 3 Description

The distribution has PDF (probability density function)

$$f(x) = \begin{cases} \frac{1}{a}e^{-x/a} & \text{if } x > 0, \\ 0 & \text{otherwise.} \end{cases}$$

The routine returns the values

$$x_i = -a \ln y_i$$

where  $y_i$  are the next  $n$  numbers generated by the basic uniform (0,1) generator.

G05FBB always generates exactly the same pseudo-random numbers as would  $n$  consecutive calls of G05DBF, but on vector-processing machines is likely to be much faster.

### 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

- |           |  |               |
|-----------|--|---------------|
| <b>1:</b> | $A$ — <i>real</i><br><i>On entry:</i> the parameter $a$ of the distribution. If $A$ is negative, its absolute value is used. | <i>Input</i>  |
| <b>2:</b> | $N$ — INTEGER<br><i>On entry:</i> the number $n$ of pseudo-random numbers to be generated.                                   | <i>Input</i>  |
| <b>3:</b> | $X(N)$ — <i>real</i> array<br><i>On exit:</i> the $n$ pseudo-random numbers from the specified exponential distribution.     | <i>Output</i> |

### 6 Error Indicators and Warnings

None.

### 7 Accuracy

Not applicable.

## 8 Further Comments

None.

## 9 Example

The example program prints 5 pseudo-random numbers from an exponential distribution with mean 2.0, generated by a single call to G05FBF, after initialization 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.

```

*   G05FBF Example Program Text
*   Mark 14 Release.  NAG Copyright 1989.
*   .. Parameters ..
      INTEGER          NOUT
      PARAMETER       (NOUT=6)
      INTEGER          N
      PARAMETER       (N=5)
*   .. Local Scalars ..
      INTEGER          I
*   .. Local Arrays ..
      real            X(N)
*   .. External Subroutines ..
      EXTERNAL         G05CBF, G05FBF
*   .. Executable Statements ..
      WRITE (NOUT,*) 'G05FBF Example Program Results'
      CALL G05CBF(0)
*
      CALL G05FBF(2.0e0,N,X)
*
      WRITE (NOUT,99999) (X(I),I=1,N)
      STOP
*
99999 FORMAT (1X,F10.4)
      END

```

### 9.2 Program Data

None.

### 9.3 Program Results

```

G05FBF Example Program Results
  0.4585
  2.9769
  1.9816
  2.9830
  0.2585

```

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