

NAG Library Routine Document

G05SSF

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

G05SSF generates a vector of pseudorandom numbers from a two parameter Weibull distribution with shape parameter a and scale parameter b .

2 Specification

SUBROUTINE G05SSF (N, A, B, STATE, X, IFAIL)

INTEGER N, STATE(*), IFAIL

REAL (KIND=nag_wp) A, B, X(N)

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{a}{b} x^{a-1} e^{-x^a/b} \quad \text{if } x > 0,$$

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

G05SSF returns the value $(-b \ln y)^{1/a}$, where y is a pseudorandom number from a uniform distribution over $(0, 1]$.

One of the initialization routines G05KFF (for a repeatable sequence if computed sequentially) or G05KGF (for a non-repeatable sequence) must be called prior to the first call to G05SSF.

4 References

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

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

5 Parameters

- | | | |
|----|--|--------------|
| 1: | N – INTEGER | <i>Input</i> |
| | <i>On entry:</i> n , the number of pseudorandom numbers to be generated. | |
| | <i>Constraint:</i> $N \geq 0$. | |
| 2: | A – REAL (KIND=nag_wp) | <i>Input</i> |
| | <i>On entry:</i> a , the shape parameter of the distribution. | |
| | <i>Constraint:</i> $A > 0.0$. | |
| 3: | B – REAL (KIND=nag_wp) | <i>Input</i> |
| | <i>On entry:</i> b , the scale parameter of the distribution. | |
| | <i>Constraint:</i> $B > 0.0$. | |

- 4: STATE(*) – INTEGER array *Communication Array*
Note: the actual argument supplied must be the array STATE supplied to the initialization routines G05KFF or G05KGF.
On entry: contains information on the selected base generator and its current state.
On exit: contains updated information on the state of the generator.
- 5: X(N) – REAL (KIND=nag_wp) array *Output*
On exit: the n pseudorandom numbers from the specified Weibull distribution.
- 6: IFAIL – INTEGER *Input/Output*
On entry: IFAIL must be set to 0, -1 or 1. If you are unfamiliar with this parameter you should refer to Section 3.3 in the Essential Introduction for details.
 For environments where it might be inappropriate to halt program execution when an error is detected, the value -1 or 1 is recommended. If the output of error messages is undesirable, then the value 1 is recommended. Otherwise, if you are not familiar with this parameter, the recommended value is 0. **When the value -1 or 1 is used it is essential to test the value of IFAIL on exit.**
On exit: IFAIL = 0 unless the routine detects an error or a warning has been flagged (see Section 6).

6 Error Indicators and Warnings

If on entry IFAIL = 0 or -1, explanatory error messages are output on the current error message unit (as defined by X04AAF).

Errors or warnings detected by the routine:

IFAIL = 1

On entry, $N < 0$.

IFAIL = 2

On entry, $A \leq 0.0$.

IFAIL = 3

On entry, $B \leq 0.0$.

IFAIL = 4

On entry, STATE vector was not initialized or has been corrupted.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

This example prints the first five pseudorandom numbers from a Weibull distribution with shape parameter 1.0 and scale parameter 2.0, generated by a single call to G05SSF, after initialization by G05KFF.

9.1 Program Text

```

Program g05ssf

!      G05SSF Example Program Text

!      Mark 24 Release. NAG Copyright 2012.

!      .. Use Statements ..
!      Use nag_library, Only: g05kff, g05ssf, nag_wp
!      .. Implicit None Statement ..
!      Implicit None
!      .. Parameters ..
!      Integer, Parameter          :: lseed = 1, nin = 5, nout = 6
!      .. Local Scalars ..
!      Real (Kind=nag_wp)          :: a, b
!      Integer                     :: genid, ifail, lstate, n, subid
!      .. Local Arrays ..
!      Real (Kind=nag_wp), Allocatable :: x(:)
!      Integer                       :: seed(lseed)
!      Integer, Allocatable          :: state(:)
!      .. Executable Statements ..
!      Write (nout,*) 'G05SSF Example Program Results'
!      Write (nout,*)

!      Skip heading in data file
!      Read (nin,*)

!      Read in the base generator information and seed
!      Read (nin,*) genid, subid, seed(1)

!      Initial call to initialiser to get size of STATE array
!      lstate = 0
!      Allocate (state(lstate))
!      ifail = 0
!      Call g05kff(genid,subid,seed,lseed,state,lstate,ifail)

!      Reallocate STATE
!      Deallocate (state)
!      Allocate (state(lstate))

!      Initialize the generator to a repeatable sequence
!      ifail = 0
!      Call g05kff(genid,subid,seed,lseed,state,lstate,ifail)

!      Read in sample size
!      Read (nin,*) n

!      Allocate (x(n))

!      Read in the distribution parameters
!      Read (nin,*) a, b

!      Generate the variates
!      ifail = 0
!      Call g05ssf(n,a,b,state,x,ifail)

!      Display the variates
!      Write (nout,99999) x(1:n)

99999 Format (1X,F10.4)
End Program g05ssf

```

9.2 Program Data

```

G05SSF Example Program Data
1 1 1762543      :: GENID,SUBID,SEED(1)
5 3             :: N,NMIX
1.0 2.0        :: A,B

```

9.3 Program Results

G05SSF Example Program Results

0.9039
4.4796
0.5860
0.4506
4.5154
