

NAG Toolbox

nag_rand_dist_exp (g05sf)

1 Purpose

nag_rand_dist_exp (g05sf) generates a vector of pseudorandom numbers from a (negative) exponential distribution with mean a .

2 Syntax

```
[state, x, ifail] = nag_rand_dist_exp(n, a, state)
[state, x, ifail] = g05sf(n, a, state)
```

3 Description

The exponential distribution has PDF (probability density function):

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

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

nag_rand_dist_exp (g05sf) returns the values

$$x_i = -a \ln y_i$$

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

One of the initialization functions nag_rand_init_repeat (g05kf) (for a repeatable sequence if computed sequentially) or nag_rand_init_nonrepeat (g05kg) (for a non-repeatable sequence) must be called prior to the first call to nag_rand_dist_exp (g05sf).

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

5.1 Compulsory Input Parameters

1: **n** – INTEGER

n , the number of pseudorandom numbers to be generated.

Constraint: $n \geq 0$.

2: **a** – REAL (KIND=nag_wp)

a , the mean of the distribution.

Constraint: $a > 0.0$.

3: **state**(:) – INTEGER array

Note: the actual argument supplied **must** be the array **state** supplied to the initialization routines nag_rand_init_repeat (g05kf) or nag_rand_init_nonrepeat (g05kg).

Contains information on the selected base generator and its current state.

5.2 Optional Input Parameters

None.

5.3 Output Parameters

- 1: **state**(:) – INTEGER array
Contains updated information on the state of the generator.
- 2: **x**(**n**) – REAL (KIND=nag_wp) array
The n pseudorandom numbers from the specified exponential distribution.
- 3: **ifail** – INTEGER
ifail = 0 unless the function detects an error (see Section 5).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail = 1

Constraint: $\mathbf{n} \geq 0$.

ifail = 2

Constraint: $\mathbf{a} > 0.0$.

ifail = 3

On entry, **state** vector has been corrupted or not initialized.

ifail = -99

An unexpected error has been triggered by this routine. Please contact NAG.

ifail = -399

Your licence key may have expired or may not have been installed correctly.

ifail = -999

Dynamic memory allocation failed.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

This example prints five pseudorandom numbers from an exponential distribution with mean 1.0, generated by a single call to `nag_rand_dist_exp` (g05sf), after initialization by `nag_rand_init_repeat` (g05kf).

9.1 Program Text

```
function g05sf_example
fprintf('g05sf example results\n\n');

% Initialize the base generator to a repeatable sequence
seed = [nag_int(1762543)];
genid = nag_int(1);
subid = nag_int(1);
[state, ifail] = g05kf( ...
                    genid, subid, seed);

% Number of variates
n = nag_int(5);

% Parameters
a = 1;

% Generate variates from an exponential distribution
[state, x, ifail] = g05sf( ...
                    n, a, state);

disp('Variates');
disp(x);
```

9.2 Program Results

```
g05sf example results

Variates
  0.4520
  2.2398
  0.2930
  0.2253
  2.2577
```
