

NAG Toolbox

nag_rand_dist_logistic (g05sl)

1 Purpose

nag_rand_dist_logistic (g05sl) generates a vector of pseudorandom numbers from a logistic distribution with mean a and spread b .

2 Syntax

```
[state, x, ifail] = nag_rand_dist_logistic(n, a, b, state)
[state, x, ifail] = g05sl(n, a, b, state)
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{e^{(x-a)/b}}{b(1 + e^{(x-a)/b})^2}.$$

nag_rand_dist_logistic (g05sl) returns the value

$$a + b \ln\left(\frac{y}{1-y}\right),$$

where y is a pseudorandom number uniformly distributed over $(0, 1)$.

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_logistic (g05sl).

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.

3: **b** – REAL (KIND=nag_wp)

b , the spread of the distribution, where ‘spread’ is $\frac{\sqrt{3}}{\pi} \times$ standard deviation.

Constraint: $b \geq 0.0$.

4: **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 logistic 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 = 3

Constraint: $\mathbf{b} \geq 0.0$.

ifail = 4

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 the first five pseudorandom real numbers from a logistic distribution with mean 1.0 and spread 2.0, generated by a single call to `nag_rand_dist_logistic` (g05sl), after initialization by `nag_rand_init_repeat` (g05kf).

9.1 Program Text

```
function g05sl_example

fprintf('g05sl 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;
b = 2;

% Generate variates from a logistic distribution
[state, x, ifail] = g05sl( ...
                      n, a, b, state);

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

9.2 Program Results

```
g05sl example results

Variates
  2.1193
 -3.2544
  3.1552
  3.7510
 -3.2944
```
