

NAG Toolbox

nag_rand_dist_uniform (g05sq)

1 Purpose

nag_rand_dist_uniform (g05sq) generates a vector of pseudorandom numbers uniformly distributed over the interval $[a, b]$.

2 Syntax

```
[state, x, ifail] = nag_rand_dist_uniform(n, a, b, state)
[state, x, ifail] = g05sq(n, a, b, state)
```

3 Description

If $a = 0$ and $b = 1$, nag_rand_dist_uniform (g05sq) returns the next n values y_i from a uniform $(0, 1]$ generator (see nag_rand_dist_uniform01 (g05sa) for details).

For other values of a and b , nag_rand_dist_uniform (g05sq) applies the transformation

$$x_i = a + (b - a)y_i.$$

The function ensures that the values x_i lie in the closed interval $[a, b]$.

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_uniform (g05sq).

4 References

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)

3: **b** – REAL (KIND=nag_wp)

The end points a and b of the uniform distribution.

Constraint: $a \leq b$.

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 uniform 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: $\mathbf{b} \geq \mathbf{a}$.

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

Although y_i takes a value from the half closed interval $(0, 1]$ and $x_i = a + (b - a)y_i$, x_i is documented as taking values from the closed interval $[a, b]$. This is because for some values of a and b , nag_rand_dist_uniform (g05sq) may return a value of a due to numerical rounding.

9 Example

This example prints five pseudorandom numbers from a uniform distribution between -1.0 and 1.0 , generated by a single call to nag_rand_dist_uniform (g05sq), after initialization by nag_rand_init_repeat (g05kf).

9.1 Program Text

```
function g05sq_example
fprintf('g05sq 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 = 1;

% Generate variates from a Uniform (a,b) distribution
[state, x, ifail] = g05sq( ...
                        n, a, b, state);

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

9.2 Program Results

```
g05sq example results

Variates
  0.2727
 -0.7870
  0.4921
  0.5965
 -0.7908
```
