

NAG C Library Function Document

nag_rngs_uniform (g05lgc)

1 Purpose

nag_rngs_uniform (g05lgc) generates a vector of pseudo-random numbers uniformly distributed over the interval $[a, b]$.

2 Specification

```
void nag_rngs_uniform (double a, double b, Integer n, double x[], Integer igen,
    Integer iseed[], NagError *fail)
```

3 Description

If $a = 0$ and $b = 1$, nag_rngs_uniform (g05lgc) returns the next n values y_i from a uniform (0,1) generator (see nag_rngs_basic (g05kac) for details).

For other values of a and b , nag_rngs_uniform (g05lgc) applies the transformation

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

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

If computing sequentially and using the same generator, nag_rngs_uniform (g05lgc) always generates exactly the same pseudo-random numbers as would n consecutive calls of nag_rngs_basic (g05kac) and on many machines is likely to be much faster.

One of the initialisation functions nag_rngs_init_repeatable (g05kbc) (for a repeatable sequence if computed sequentially) or nag_rngs_init_nonrepeatable (g05kcc) (for a non-repeatable sequence) must be called prior to the first call to nag_rngs_uniform (g05lgc).

4 References

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

5 Parameters

- | | | |
|----|--|---------------|
| 1: | a – double | <i>Input</i> |
| 2: | b – double | <i>Input</i> |
| | <i>On entry:</i> the end-points a and b of the uniform distribution. | |
| | <i>Constraint:</i> $\mathbf{a} \leq \mathbf{b}$. | |
| 3: | n – Integer | <i>Input</i> |
| | <i>On entry:</i> the number, n , of pseudo-random numbers to be generated. | |
| | <i>Constraint:</i> $\mathbf{n} \geq 0$. | |
| 4: | x [<i>dim</i>] – double | <i>Output</i> |
| | Note: the dimension, dim , of the array x must be at least $\max(1, \mathbf{n})$. | |
| | <i>On exit:</i> the n pseudo-random numbers from the specified uniform distribution. | |

- 5: **igen** – Integer *Input*
On entry: must contain the identification number for the generator to be used to return a pseudo-random number and should remain unchanged following initialisation by a prior call to one of the functions `nag_rngs_init_repeatable` (g05kbc) or `nag_rngs_init_nonrepeatable` (g05kcc).
- 6: **iseed**[4] – Integer *Input/Output*
On entry: contains values which define the current state of the selected generator.
On exit: contains updated values defining the new state of the selected generator.
- 7: **fail** – NagError * *Input/Output*
The NAG error parameter (see the Essential Introduction).

6 Error Indicators and Warnings

NE_INT

On entry, **n** = $\langle value \rangle$.
Constraint: **n** \geq 0.

NE_REAL_2

On entry, **a** = $\langle value \rangle$, **b** = $\langle value \rangle$.
Constraint: **b** \geq **a**:

NE_BAD_PARAM

On entry, parameter $\langle value \rangle$ had an illegal value.

NE_INTERNAL_ERROR

An internal error has occurred in this function. Check the function call and any array sizes. If the call is correct then please consult NAG for assistance.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

The example program prints five pseudo-random numbers from a uniform distribution between -1.0 and 1.0 , generated by a single call to `nag_rngs_uniform` (g05lgc), after initialisation by `nag_rngs_init_repeatable` (g05kbc).

9.1 Program Text

```
/* nag_rngs_uniform(g05lgc) Example Program.
 *
 * Copyright 2001 Numerical Algorithms Group.
 *
 * Mark 7, 2001.
 */

#include <stdio.h>
#include <nag.h>
#include <nag_stdlib.h>
```

```

#include <nagg05.h>

int main(void)
{
    /* Scalars */
    Integer  igen, j, m;
    Integer  exit_status=0;
    NagError fail;

    /* Arrays */
    double   *x=0;
    Integer  iseed[4];

    INIT_FAIL(fail);
    Vprintf("g05lgc Example Program Results\n\n");

    m = 5;
    /* Allocate memory */
    if ( !(x = NAG_ALLOC(m, double)) )
    {
        Vprintf("Allocation failure\n");
        exit_status = -1;
        goto END;
    }

    /* Initialise the seed to a repeatable sequence */
    iseed[0] = 1762543;
    iseed[1] = 9324783;
    iseed[2] = 42344;
    iseed[3] = 742355;
    /* igen identifies the stream. */
    igen = 1;
    g05kbc(&igen, iseed);

    g05lgc(-1.0, 1.0, m, x, igen, iseed, &fail);
    if (fail.code != NE_NOERROR)
    {
        Vprintf("Error from g05lgc.\n%s\n", fail.message);
        exit_status = 1;
        goto END;
    }
    for (j = 0; j < m; ++j)
    {
        Vprintf("%10.4f\n", x[j]);
    }
    END:
    if (x) NAG_FREE(x);
    return exit_status;
}

```

9.2 Program Data

None.

9.3 Program Results

g05lgc Example Program Results

```

-0.8214
 0.9019
-0.1872
 0.4864
 0.8995

```
