

## NAG Toolbox

### nag\_rand\_int\_uniform (g05tl)

#### 1 Purpose

nag\_rand\_int\_uniform (g05tl) generates a vector of pseudorandom integers uniformly distributed over the interval  $[a, b]$ .

#### 2 Syntax

```
[state, x, ifail] = nag_rand_int_uniform(n, a, b, state)
[state, x, ifail] = g05tl(n, a, b, state)
```

#### 3 Description

nag\_rand\_int\_uniform (g05tl) generates the next  $n$  values  $y_i$  from a uniform  $(0, 1]$  generator (see nag\_rand\_dist\_uniform01 (g05sa) for details) and applies the transformation

$$x_i = a + \lfloor (b - a + 1)y_i \rfloor,$$

where  $\lfloor z \rfloor$  is the integer part of the real value  $z$ . 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\_int\_uniform (g05tl).

#### 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** – INTEGER

3: **b** – INTEGER

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**) – INTEGER 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

None.

## 9 Example

This example prints five pseudorandom integers from a discrete uniform distribution between  $-5$  and  $5$ , generated by a single call to `nag_rand_int_uniform` (g05tl), after initialization by `nag_rand_init_repeat` (g05kf).

## 9.1 Program Text

```
function g05tl_example
fprintf('g05tl 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 = nag_int(-5);
b = nag_int(5);

% Generate integer variates from Uniform (a,b) distribution
[state, x, ifail] = g05tl( ...
                      n, a, b, state);

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

## 9.2 Program Results

```
g05tl example results

Variates
     2
    -4
     3
     3
    -4
```

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