1 Purpose

nag_rngs_weibull (g05lmc) generates a vector of pseudo-random numbers from a two parameter Weibull distribution with shape parameter \(a\) and scale parameter \(b\).

2 Specification

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

3 Description

The distribution has PDF (probability density function)

\[
f(x) = \frac{a}{b} x^{a-1} e^{-x/b} \quad \text{if} \quad x > 0,
\]

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

nag_rngs_weibull (g05lmc) returns the value \((b \ln y)^{1/a}\), where \(y\) is a pseudo-random number from a uniform distribution over \((0,1)\).

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_weibull (g05lmc).

4 References


5 Parameters

1: \(a\) – double

   **Input**

   *On entry:* the shape parameter, \(a\), of the distribution.

   *Constraint:* \(a > 0.0\).

2: \(b\) – double

   **Input**

   *On entry:* the scale parameter, \(b\), of the distribution.

   *Constraint:* \(b > 0.0\).

3: \(n\) – Integer

   **Input**

   *On entry:* the number, \(n\), of pseudo-random numbers to be generated.

   *Constraint:* \(n \geq 0\).

4: \(x[dim]\) – double

   **Output**

   *Note:* the dimension, \(dim\), of the array \(x\) must be at least \(\max(1, n)\).

   *On exit:* the \(n\) pseudo-random numbers from the specified Weibull distribution.
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).


*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.

fail – NagError *

*Input/Output*

The NAG error parameter (see the Essential Introduction).

6 Error Indicators and Warnings

**NE_INT**

On entry, n = (value).

Constraint: n ≥ 0.

**NE_REAL**

On entry, b = (value).

Constraint: b > 0.0.

On entry, a = (value).

Constraint: a > 0.0.

**NE_BAD_PARAM**

On entry, parameter (value) 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 the first five pseudo-random real numbers from a Weibull distribution with shape parameter 1.0 and scale parameter 2.0, generated by a single call to nag_rngs_weibull (g05lmc), after initialisation by nag_rngs_init_repeatable (g05kbc).

9.1 Program Text

/* nag_rngs_weibull(g05lmc) Example Program. *
 * Copyright 2001 Numerical Algorithms Group. *
 * Mark 7, 2001. */


```c
#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("g05lmc 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);
    g05lmc(1.0, 2.0, m, x, igen, iseed, &fail);
    if (fail.code != NE_NOERROR)
    {
        Vprintf("Error from g05lmc.\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

<table>
<thead>
<tr>
<th>g05lmc Example Program Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.8310</td>
</tr>
<tr>
<td>0.1006</td>
</tr>
<tr>
<td>1.8009</td>
</tr>
<tr>
<td>0.5936</td>
</tr>
<tr>
<td>0.1031</td>
</tr>
</tbody>
</table>

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**g05 – Random Number Generators**

**g05lmc**