

NAG Toolbox for MATLAB

g05la

1 Purpose

g05la generates a vector of pseudo-random numbers taken from a Normal (Gaussian) distribution with mean μ and variance σ^2 .

2 Syntax

```
[x, iseed, ifail] = g05la(xmu, var, n, igen, iseed)
```

3 Description

The distribution has PDF (probability distribution function)

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(x-\mu)^2}{2\sigma^2}\right).$$

g05la uses the Box–Muller method.

One of the initialization functions g05kb (for a repeatable sequence if computed sequentially) or g05kc (for a non-repeatable sequence) must be called prior to the first call to g05la.

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: **xmu – double scalar**

μ , the mean of the distribution.

2: **var – double scalar**

The variance, σ^2 , of the distribution.

Constraint: **var** ≥ 0.0 .

3: **n – int32 scalar**

n , the number of pseudo-random numbers to be generated.

Constraint: **n** ≥ 0 .

4: **igen – int32 scalar**

Must contain the identification number for the generator to be used to return a pseudo-random number and should remain unchanged following initialization by a prior call to g05kb or g05kc.

5: **iseed(4) – int32 array**

Contains values which define the current state of the selected generator.

5.2 Optional Input Parameters

None.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

1: **x(*)** – **double array**

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

The n pseudo-random numbers from the specified Normal distribution.

2: **iseed(4)** – **int32 array**

Contains updated values defining the new state of the selected generator.

3: **ifail** – **int32 scalar**

0 unless the function detects an error (see Section 6).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail = 1

On entry, **n** < 0.

ifail = 2

On entry, **var** < 0.0.

7 Accuracy

The generated numbers conform to a Normal distribution with an accuracy of $\sqrt{\textit{machine precision}}$.

8 Further Comments

None.

9 Example

```
xmu = 1;
var = 1.5;
n = int32(5);
igen = int32(1);
iseed = [int32(1762543);
         int32(9324783);
         int32(42344);
         int32(742355)];
[x, iseedOut, ifail] = g05la(xmu, var, n, igen, iseed)
```

```
x =
    3.5652
    0.1837
    0.9297
   -0.6421
```

```
0.6371
iseedOut =
1833294
12104498
1897623
8265990
ifail =
0
```
