

NAG Toolbox for MATLAB

g05lh

1 Purpose

g05lh generates a vector of pseudo-random numbers from a triangular distribution with parameters $x_{\min}$, $x_{\max}$ and x_{med} .

2 Syntax

```
[x, iseed, ifail] = g05lh(xmin, xmax, xmed, n, igen, iseed)
```

3 Description

The triangular distribution has a PDF (probability density function) that is triangular in profile. The base of the triangle ranges from $x = x_{\min}$ to $x = x_{\max}$ and the PDF has a maximum value of $\frac{2}{x_{\max} - x_{\min}}$ at $x = x_{\text{med}}$. If $x_{\min} = x_{\text{med}} = x_{\max}$ then $x = x_{\text{med}}$ with probability 1; otherwise the triangular distribution has PDF:

$$f(x) = \frac{x - x_{\min}}{x_{\text{med}} - x_{\min}} \times \frac{2}{x_{\max} - x_{\min}} \quad \text{if } x_{\min} < x \leq x_{\text{med}},$$

$$f(x) = \frac{x_{\max} - x}{x_{\max} - x_{\text{med}}} \times \frac{2}{x_{\max} - x_{\min}} \quad \text{if } x_{\text{med}} < x \leq x_{\max},$$

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

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 g05lh.

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: **xmin** – double scalar

2: **xmax** – double scalar

The end points $x_{\min}$ and $x_{\max}$ of the uniform distribution.

Constraint: **xmin** ≤ **xmax**.

3: **xmed** – double scalar

The median of the distribution x_{med} (also the location of the vertex of the triangular distribution at which the PDF reaches a maximum).

Constraint: **xmin** ≤ **xmed** ≤ **xmax**.

4: **n** – int32 scalar

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

Constraint: **n** ≥ 0.

5: 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.

6: 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 triangular 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, **xmax** < **xmin**.

ifail = 2

On entry, **xmed** < **xmin**,
or **xmed** > **xmax**.

ifail = 3

On entry, **n** < 0.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

```
xmin = -1;  
xmax = 1;  
xmed = 0.5;  
n = int32(5);  
igen = int32(1);  
iseed = [int32(1762543);  
         int32(9324783);  
         int32(42344);  
         int32(742355)];  
[x, iseedOut, ifail] = g05lh(xmin, xmax, xmed, n, igen, iseed)
```

```
x =  
  -0.4823  
   0.7786  
   0.1042  
   0.4932  
   0.7759  
iseedOut =  
  16516983  
   2826895  
   4504715  
   8850212  
ifail =  
      0
```
