

NAG Toolbox for MATLAB

g05ld

1 Purpose

g05ld generates a vector of pseudo-random numbers taken from a F (or Fisher's variance ratio) distribution with μ and ν degrees of freedom.

2 Syntax

```
[x, iseed, ifail] = g05ld(df1, df2, n, igen, iseed)
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{\left(\frac{\mu+\nu-2}{2}\right)! x^{\frac{1}{2}\mu-1}}{(\frac{1}{2}\mu-1)!(\frac{1}{2}\nu-1)!(1+\frac{\mu}{\nu}x)^{\frac{1}{2}(\mu+\nu)}} \times \left(\frac{\mu}{\nu}\right)^{\frac{1}{2}\mu} \quad \text{if } x > 0,$$

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

g05ld calculates the values

$$\frac{\nu y_i}{\mu z_i}, \quad i = 1, \dots, n,$$

where y_i and z_i are generated by g05lf from gamma distributions with parameters $(\frac{1}{2}\mu, 2)$ and $(\frac{1}{2}\nu, 2)$ respectively (i.e., from χ^2 -distributions with μ and ν degrees of freedom).

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 g05ld.

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: **df1** – int32 scalar

μ , the number of degrees of freedom of the distribution.

Constraint: **df1** ≥ 1 .

2: **df2** – int32 scalar

ν , the number of degrees of freedom of the distribution.

Constraint: **df2** ≥ 1 .

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 F 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, **df1** < 1.

ifail = 2

On entry, **df2** < 1.

ifail = 3

On entry, **n** < 0.

7 Accuracy

Not applicable.

8 Further Comments

The time taken by g05ld increases with μ and ν .

9 Example

```
df1 = int32(2);
```

```
df2 = int32(3);  
n = int32(5);  
igen = int32(1);  
iseed = [int32(1762543);  
         int32(9324783);  
         int32(42344);  
         int32(742355)];  
[x, iseedOut, ifail] = g05ld(df1, df2, n, igen, iseed)
```

```
x =  
    14.2359  
     0.8889  
     0.4055  
     2.3299  
     0.0689  
iseedOut =  
    10930834  
    14507887  
    11627374  
     7690932  
ifail =  
         0
```
