NAG Toolbox for MATLAB

g05df

1 Purpose

g05df returns a pseudo-random real number taken from a Cauchy distribution with median a and semi-interquartile range b.

2 Syntax

```
[result] = g05df(a, b)
```

3 Description

The distribution has PDF (probability density function)

$$f(x) = \frac{1}{\pi b\left(1 + \left(\frac{x-a}{b}\right)^2\right)}.$$

g05df returns the value

$$a + b\frac{2y_1 - 1}{y_2},$$

where y_1 and y_2 are a pair of consecutive pseudo-random numbers from a uniform distribution over $(0, 1)$, generated by g05ca, such that

$$(2y_1 - 1)^2 + y_2^2 \leq 1.$$

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: **a – double scalar**

The median a, of the distribution.

2: **b – double scalar**

The semi-interquartile range b, of the distribution. If **b** is negative, the distribution of the generated numbers – though not the actual sequence – is the same as if the absolute value of **b** were used.

5.2 Optional Input Parameters

None.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

1: **result – double scalar**

The result of the function.

6 Error Indicators and Warnings

None.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

```
a = 1;
b = 1.5;
g05za('O');
g05cb(int32(0));
[result] = g05df(a, b)
```

```
result =
    4.9225
```