NAG Toolbox for MATLAB

g05ca

1 Purpose

g05ca returns a pseudo-random number taken from a uniform distribution between 0 and 1.

2 Syntax

```
[result] = g05ca()
```

3 Description

g05ca returns the next pseudo-random number from a uniform $(0, 1)$ generator.

The particular mechanism used to generate random numbers can be selected by a prior call to g05za. Consult the G05 Chapter Introduction for details of the algorithms that can be used and refer to the g05za function document on how to select a generator mechanism. If a prior call to g05za is not made the default mechanism is used.

The current state of each generator used is saved internally in the code. Initial states are set by default but the sequence may be re-initialized by a call to g05cb (for a repeatable sequence if computed sequentially) or g05cc (for a non-repeatable sequence). The current state may be saved by a call to g05cf, and restored by a call to g05cg.

g05fa may be used to generate a vector of n pseudo-random numbers which, if computed sequentially using the same generator, are exactly the same as n successive values of g05ca. On many machines g05fa is likely to be much faster.

4 References

Knuth D E 1981 *The Art of Computer Programming (Volume 2)* (2nd Edition) Addison–Wesley

5 Parameters

5.1 Compulsory Input Parameters

None.

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

The generator with the smallest period that can be selected is the basic generator. The period of the basic generator is 2^{57}.

Its performance has been analysed by the Spectral Test, see Section 3.3.4 of Knuth 1981, yielding the following results in the notation of Knuth 1981.

n	ν_n	Upper bound for ν_n
2	3.44×10^8	4.08×10^8
3	4.29×10^5	5.88×10^5
4	1.72×10^4	2.32×10^4
5	1.92×10^3	3.33×10^3
6	593	939
7	198	380
8	108	197
9	67	120

The right-hand column gives an upper bound for the values of ν_n attainable by any multiplicative congruential generator working modulo 2^{59}.

An informal interpretation of the quantities ν_n is that consecutive n-tuples are statistically uncorrelated to an accuracy of $1/\nu_n$. This is a theoretical result; in practice the degree of randomness is usually much greater than the above figures might support. More details are given in Knuth 1981, and in the references cited therein.

Note that the achievable accuracy drops rapidly as the number of dimensions increases. This is a property of all multiplicative congruential generators and is the reason why very long periods are needed even for samples of only a few random numbers.

9 Example

```
g05za('O');
g05cb(int32(0));
[result] = g05ca()
```

```
result =
    0.7951
```