

NAG Toolbox for MATLAB

g05mj

1 Purpose

g05mj generates a vector of pseudo-random integers from the discrete binomial distribution with parameters m and p .

2 Syntax

```
[x, iseed, r, ifail] = g05mj(mode, m, p, n, igen, iseed, r)
```

3 Description

g05mj generates n integers x_i from a discrete binomial distribution, where the probability of $x_i = I$ is

$$P(x_i = I) = \frac{m!}{I!(m-I)!} p^I \times (1-p)^{m-I}, \quad I = 0, 1, \dots, m,$$

where $0 \leq m$ and $0 \leq p \leq 1$. This represents the probability of achieving I successes in m trials when the probability of success at a single trial is p .

The variates can be generated with or without using a search table and index. If a search table is used then it is stored with the index in a reference vector and subsequent calls to g05mj with the same parameter values can then use this reference vector to generate further variates.

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 g05mj.

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: **mode** – int32 scalar

A code for selecting the operation to be performed by the function:

mode = 0

Set up reference vector only.

mode = 1

Generate variates using reference vector set up in a prior call to g05mj.

mode = 2

Set up reference vector and generate variates.

mode = 3

Generate variates without using the reference vector.

Constraint: $0 \leq \text{mode} \leq 3$.

- 2: **m – int32 scalar**
 m , the number of trials of the distribution.
Constraint: $m \geq 0$.

- 3: **p – double scalar**
The probability of success p of the binomial distribution.
Constraint: $0.0 \leq p \leq 1.0$.

- 4: **n – int32 scalar**
 n , the number of pseudo-random numbers to be generated.
Constraint: $n \geq 1$.

- 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.

- 7: **r(nr) – double array**
If **mode** = 1, the reference vector from the previous call to g05mj.

5.2 Optional Input Parameters

None.

5.3 Input Parameters Omitted from the MATLAB Interface

nr

5.4 Output Parameters

- 1: **x(n) – int32 array**
The n pseudo-random numbers from the specified binomial distribution.

- 2: **iseed(4) – int32 array**
Contains updated values defining the new state of the selected generator.

- 3: **r(nr) – double array**
The reference vector.

- 4: **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, $n < 1$.

ifail = 2

On entry, **nr** is too small when **mode** = 0 or 2 (see Section 5).

ifail = 3

On entry, **p** < 0.0
or **p** > 1.0.

ifail = 4

On entry, **m** < 0.

ifail = 5

On entry, **mode** < 0
or **mode** > 3.

ifail = 6

m or **p** is not the same as when **r** was set up in a previous call with **mode** = 0 or 2.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

```
mode = int32(2);
m = int32(6000);
p = 0.8;
n = int32(20);
igen = int32(1);
iseed = [int32(1762543);
         int32(9324783);
         int32(42344);
         int32(742355)];
r = zeros(6007, 1);
[x, iseedOut, rOut, ifail] = g05mj(mode, m, p, n, igen, iseed, r)
```

```
x =
    4758
    4851
    4793
    4820
    4851
    4795
    4807
    4792
    4787
    4842
    4801
    4794
    4806
    4878
    4745
    4790
    4832
    4789
    4743
```

```
          4812
iseedOut =
          7198201
          6860924
          8806996
          4852644
rOut =
    array elided
ifail =
          0
```
