

NAG Toolbox for MATLAB

g05ed

1 Purpose

g05ed sets up the reference vector **r** for a binomial distribution of the number of successes in n trials, each with probability of success p .

2 Syntax

```
[r, ifail] = g05ed(n, p, nr)
```

3 Description

g05ed sets up a reference vector for use in g05ey. Together these functions produce random numbers from the distribution defined by:

$$P(I = i) = \frac{n!}{i!(n-i)!p^i(1-p)^{n-i}} \quad \text{if } i = 0, \dots, n,$$

$$P(I = i) = 0 \quad \text{otherwise.}$$

The reference array is found by a recurrence relation if $np(1-p) < 50$; otherwise Stirling's approximation is used.

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: **n** – **int32 scalar**

n , the number of trials of the distribution.

Constraint: $n \geq 0$.

2: **p** – **double scalar**

p , the probability of success of the distribution.

Constraint: $0 \leq p \leq 1$.

3: **nr** – **int32 scalar**

Suggested value: $nr = 20 + 20\sqrt{n \times p(1-p)}$ approximately (for optimum efficiency in g05ey).

Constraint:

$$\begin{aligned} nr &> \min\left(n, \text{int}\left[n \times p + 7.15\sqrt{n \times p(1-p)} + 1\right]\right) \\ &\quad - \max\left(0, \text{int}\left[n \times p - 7.15\sqrt{n \times p(1-p)} - 7.15\right]\right) + 4 \end{aligned}$$

5.2 Optional Input Parameters

None.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

1: **r(nr)** – double array

The reference vector.

2: **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** < 0.

ifail = 2

On entry, **p** < 0,
or **p** > 1.

ifail = 3

On entry, **nr** is too small (see Section 5).

7 Accuracy

Not applicable.

8 Further Comments

The time taken by g05ed increases with **nr**.

9 Example

```
n = int32(100);  
p = 0.5;  
nr = int32(125);  
g05za('O');  
g05cb(int32(0));  
[r, ifail] = g05ed(n, p, nr)
```

```
r =  
    array elided  
ifail =  
    0
```