

NAG Toolbox for MATLAB

g05eh

1 Purpose

g05eh performs a pseudo-random permutation of a vector of integers.

2 Syntax

```
[index, ifail] = g05eh(index, 'n', n)
```

3 Description

g05eh permutes the elements of **index** without inspecting their values. Each of the $n!$ possible permutations of the n values may be regarded as being equally probable.

Even for modest values of n (greater than 25 say), it is theoretically impossible that all $n!$ permutations may occur, as $n!$ exceeds the cycle length of g05ca. For practical purposes this is irrelevant, as the time necessary to generate all possible permutations is many millenia.

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: **index(n)** – int32 array
The n integer values to be permuted.

5.2 Optional Input Parameters

- 1: **n** – int32 scalar
the number of values to be permuted.
Constraint: $n \geq 1$.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

- 1: **index(n)** – int32 array
The n permuted integer values.
- 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** < 1.

7 Accuracy

Not applicable.

8 Further Comments

The time taken by g05eh is of order n .

In order to permute other kinds of vectors, or matrices of higher dimension, the following technique may be used:

- (a) Set **index**(i) = i , for $i = 1, 2, \dots, n$
- (b) Use g05eh to permute **index**
- (c) Use the contents of **index** as a set of indices to access the relevant vector or matrix.

In order to divide pseudo-randomly a vector or matrix into subgroups of chosen sizes, a similar procedure may be used. **index** is first set to the number of 1s, 2s, etc., corresponding to the size of each group, then permuted, and used to index the groups.

9 Example

```
index = [int32(1);  
         int32(2);  
         int32(3);  
         int32(4);  
         int32(5);  
         int32(6);  
         int32(7);  
         int32(8)];  
g05za('O');  
g05cb(int32(0));  
[indexOut, ifail] = g05eh(index)
```

```
indexOut =  
         7  
         8  
         1  
         2  
         4  
         6  
         3  
         5  
  
ifail =  
         0
```