

NAG Toolbox

nag_matop_real_gen_trans_inplace (f01cr)

1 Purpose

`nag_matop_real_gen_trans_inplace (f01cr)` transposes a rectangular matrix in-situ.

2 Syntax

```
[a, ifail] = nag_matop_real_gen_trans_inplace(a, m, n, 'mn', mn)
[a, ifail] = f01cr(a, m, n, 'mn', mn)
```

3 Description

`nag_matop_real_gen_trans_inplace (f01cr)` requires that the elements of an m by n matrix A are stored consecutively by columns in a one-dimensional array. It reorders the elements so that on exit the array holds the transpose of A stored in the same way. For example, if $m = 4$ and $n = 3$, on entry the array must hold:

$$a_{11} \quad a_{21} \quad a_{31} \quad a_{41} \quad a_{12} \quad a_{22} \quad a_{32} \quad a_{42} \quad a_{13} \quad a_{23} \quad a_{33} \quad a_{43}$$

and on exit it holds

$$a_{11} \quad a_{12} \quad a_{13} \quad a_{21} \quad a_{22} \quad a_{23} \quad a_{31} \quad a_{32} \quad a_{33} \quad a_{41} \quad a_{42} \quad a_{43}.$$

4 References

Cate E G and Twigg D W (1977) Algorithm 513: Analysis of in-situ transposition *ACM Trans. Math. Software* **3** 104–110

5 Parameters

5.1 Compulsory Input Parameters

1: **a(mn)** – REAL (KIND=nag_wp) array

The elements of the m by n matrix A , stored by columns.

2: **m** – INTEGER

m , the number of rows of the matrix A .

3: **n** – INTEGER

n , the number of columns of the matrix A .

5.2 Optional Input Parameters

1: **mn** – INTEGER

Default: the dimension of the array **a**.

n , the value $m \times n$.

5.3 Output Parameters

- 1: **a(mn)** – REAL (KIND=nag_wp) array
 The elements of the transpose matrix, also stored by columns.
- 2: **ifail** – INTEGER
 ifail = 0 unless the function detects an error (see Section 5).

6 Error Indicators and Warnings

Errors or warnings detected by the function:

ifail = 1

On entry, $mn \neq m \times n$.

ifail = 2

On entry, $lmove \leq 0$.

ifail < 0

A serious error has occurred. Check all function calls and array sizes. Seek expert help.

ifail = -99

An unexpected error has been triggered by this routine. Please contact NAG.

ifail = -399

Your licence key may have expired or may not have been installed correctly.

ifail = -999

Dynamic memory allocation failed.

7 Accuracy

Exact results are produced.

8 Further Comments

The time taken by nag_matop_real_gen_trans_inplace (f01cr) is approximately proportional to mn .

9 Example

This example transposes a 7 by 3 matrix and prints out, for convenience, its transpose.

9.1 Program Text

```
function f01cr_example

fprintf('f01cr example results\n\n');

a = [ 1      2      3      4      5      6      7;
      8      9     10     11     12     13     14;
      15     16     17     18     19     20     21];
[m,n] = size(a);
```

```
[atrans, ifail] = f01cr(a, nag_int(m), nag_int(n));  
  
atrans = reshape(atrans,[n,m]);  
disp('Transpose of A');  
disp(atrans);
```

9.2 Program Results

f01cr example results

Transpose of A

1	8	15
2	9	16
3	10	17
4	11	18
5	12	19
6	13	20
7	14	21
