

NAG Toolbox for MATLAB

f01cr

1 Purpose

f01cr transposes a rectangular matrix in-situ.

2 Syntax

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

3 Description

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) – double array**
The elements of the m by n matrix A , stored by columns.
- 2: **m – int32 scalar**
 m , the number of rows of the matrix A .
- 3: **n – int32 scalar**
 n , the number of columns of the matrix A .

5.2 Optional Input Parameters

- 1: **mn – int32 scalar**
Default: The dimension of the array **a**.
 n , the value $m \times n$.

5.3 Input Parameters Omitted from the MATLAB Interface

move, lmove

5.4 Output Parameters

1: **a(mn)** – double array

The elements of the transpose matrix, also stored by columns.

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, **mn** $\neq$ **m** $\times$ **n**.

ifail = 2

On entry, **lmove** $\leq$ 0.

ifail < 0

A serious error has occurred. Check all (sub)program calls and array sizes. Seek expert help.

7 Accuracy

Exact results are produced.

8 Further Comments

The time taken by f01cr is approximately proportional to *mn*.

9 Example

```
a = [1;  
      2;  
      3;  
      4;  
      5;  
      6;  
      7;  
      8;  
      9;  
     10;  
     11;  
     12;  
     13;  
     14;  
     15;  
     16;  
     17;  
     18;  
     19;  
     20;  
     21];  
m = int32(3);  
n = int32(7);  
[aOut, ifail] = f01cr(a, m, n)  
  
aOut =  
      1
```

```
      4
      7
     10
     13
     16
     19
      2
      5
      8
     11
     14
     17
     20
      3
      6
      9
     12
     15
     18
     21
ifail =
      0
```
