

NAG Toolbox for MATLAB

m01zc

1 Purpose

m01zc decomposes a permutation into cycles, as an aid to reordering ranked data.

2 Syntax

```
[iperm, icycl, ifail] = m01zc(iperm, m1, 'm2', m2)
```

3 Description

m01zc is provided as an aid to reordering arbitrary data structures without using additional storage. However, you should consider carefully whether it is necessary to rearrange your data, or whether it would be simpler and more efficient to refer to the data in sorted order using an index vector, or to create a copy of the data in sorted order.

To rearrange data into a different order without using additional storage, the simplest method is to decompose the permutation which specifies the new order into cycles and then to do a cyclic permutation of the data items in each cycle. (This is the method used by the M01E reordering functions.) Given a vector IRANK which specifies the ranks of the data (as generated by the M01D functions), m01zc generates a new vector **icycl**, in which the permutation is represented in its component cycles, with the first element of each cycle negated. For example, the permutation

$$5 \ 7 \ 4 \ 2 \ 1 \ 6 \ 3$$

is composed of the cycles

$$(1 \ 5) \ (2 \ 7 \ 3 \ 4) \ (6)$$

and the vector **icycl** generated by m01zc contains

$$-1 \ 5 \ -2 \ 7 \ 3 \ 4 \ -6$$

In order to rearrange the data according to the specified ranks:

item 6 must be left in place;

items 1 and 5 must be interchanged;

items 4, 2, 7 and 3 must be moved right one place round the cycle.

The complete rearrangement can be achieved by the following code:

```
for k=m1:m2
    ii = icycl(k);
    if (ii < 0)
        jj = -ii;
    else
        % swap items ii and jj
    end
end
```

4 References

None.

5 Parameters

5.1 Compulsory Input Parameters

- 1: **iperm(m2)** – int32 array

Elements **m1** to **m2** of **iperm** must contain a permutation of the integers **m1** to **m2**.

- 2: **m1** – int32 scalar

m1 and **m2** must specify the range of elements used in the array **iperm** and the range of values in the permutation, as specified under **iperm**.

Constraint: $0 < \mathbf{m1} \leq \mathbf{m2}$.

5.2 Optional Input Parameters

- 1: **m2** – int32 scalar

Default: The dimension of the arrays **iperm**, **icycl**. (An error is raised if these dimensions are not equal.)

m1 and **m2** must specify the range of elements used in the array **iperm** and the range of values in the permutation, as specified under **iperm**.

Constraint: $0 < \mathbf{m1} \leq \mathbf{m2}$.

5.3 Input Parameters Omitted from the MATLAB Interface

None.

5.4 Output Parameters

- 1: **iperm(m2)** – int32 array

Is used as internal workspace prior to being restored and hence is unchanged.

- 2: **icycl(m2)** – int32 array

Elements **m1** to **m2** of **icycl** contain a representation of the permutation as a list of cycles, with the first integer in each cycle negated. (See Section 3.)

- 3: **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, **m2** < 1,
or **m1** < 1,
or **m1** > **m2**.

ifail = 2

Elements **m1** to **m2** of **iperm** contain a value outside the range **m1** to **m2**.

ifail = 3

Elements **m1** to **m2** of **iperm** contain a repeated value.

If **ifail** = 2 or 3, elements **m1** to **m2** of **iperm** do not contain a permutation of the integers **m1** to **m2**.

7 Accuracy

Not applicable.

8 Further Comments

None.

9 Example

```
iperm = [int32(12);
         int32(1);
         int32(9);
         int32(2);
         int32(4);
         int32(8);
         int32(11);
         int32(3);
         int32(5);
         int32(6);
         int32(10);
         int32(7)];
m1 = int32(1);
[ipermOut, icycl, ifail] = m01zc(iperm, m1)
```

```
ipermOut =
    12
     1
     9
     2
     4
     8
    11
     3
     5
     6
    10
     7

icycl =
    -1
    12
     7
    11
    10
     6
     8
     3
     9
     5
     4
     2

ifail =
     0
```