

# NAG Library Routine Document

## M01EBF

**Note:** before using this routine, please read the Users' Note for your implementation to check the interpretation of *bold italicised* terms and other implementation-dependent details.

### 1 Purpose

M01EBF rearranges a vector of integer numbers into the order specified by a vector of ranks.

### 2 Specification

```
SUBROUTINE M01EBF (IV, M1, M2, IRANK, IFAIL)
  INTEGER IV(M2), M1, M2, IRANK(M2), IFAIL
```

### 3 Description

M01EBF is designed to be used typically in conjunction with the M01D ranking routines. After one of the M01D routines has been called to determine a vector of ranks, M01EBF can be called to rearrange a vector of integer numbers into the rank order. If the vector of ranks has been generated in some other way, then M01ZBF should be called to check its validity before M01EBF is called.

### 4 References

None.

### 5 Parameters

1: IV(M2) – INTEGER array *Input/Output*

*On entry:* elements M1 to M2 of IV must contain integer values to be rearranged.

*On exit:* these values are rearranged into rank order. For example, if  $IRANK(i) = M1$ , then the initial value of  $IV(i)$  is moved to  $IV(M1)$ .

2: M1 – INTEGER *Input*

3: M2 – INTEGER *Input*

*On entry:* M1 and M2 specify the range of the ranks supplied in IRANK and the elements of IV to be rearranged.

*Constraint:*  $0 < M1 \leq M2$ .

4: IRANK(M2) – INTEGER array *Input/Output*

*On entry:* elements M1 to M2 of IRANK must contain a permutation of the integers M1 to M2, which are interpreted as a vector of ranks.

*On exit:* used as internal workspace prior to being restored and hence is unchanged.

5: IFAIL – INTEGER *Input/Output*

*On entry:* IFAIL must be set to 0, -1 or 1. If you are unfamiliar with this parameter you should refer to Section 3.3 in the Essential Introduction for details.

For environments where it might be inappropriate to halt program execution when an error is detected, the value -1 or 1 is recommended. If the output of error messages is undesirable, then the value 1 is recommended. Otherwise, if you are not familiar with this parameter, the

recommended value is 0. **When the value  $-1$  or  $1$  is used it is essential to test the value of IFAIL on exit.**

*On exit:* IFAIL = 0 unless the routine detects an error or a warning has been flagged (see Section 6).

## 6 Error Indicators and Warnings

If on entry IFAIL = 0 or  $-1$ , explanatory error messages are output on the current error message unit (as defined by X04AAF).

Errors or warnings detected by the routine:

IFAIL = 1

On entry,  $M2 < 1$ ,  
or  $M1 < 1$ ,  
or  $M1 > M2$ .

IFAIL = 2

Elements M1 to M2 of IRANK contain a value outside the range M1 to M2.

IFAIL = 3

Elements M1 to M2 of IRANK contain a repeated value.

IFAIL =  $-99$

An unexpected error has been triggered by this routine. Please contact NAG.  
See Section 3.8 in the Essential Introduction for further information.

IFAIL =  $-399$

Your licence key may have expired or may not have been installed correctly.  
See Section 3.7 in the Essential Introduction for further information.

IFAIL =  $-999$

Dynamic memory allocation failed.  
See Section 3.6 in the Essential Introduction for further information.

If IFAIL = 2 or 3, elements M1 to M2 of IRANK do not contain a permutation of the integers M1 to M2. On exit, the contents of IV may be corrupted. To check the validity of IRANK without the risk of corrupting IV, use M01ZBF.

## 7 Accuracy

Not applicable.

## 8 Parallelism and Performance

Not applicable.

## 9 Further Comments

The average time taken by the routine is approximately proportional to  $n$ , where  $n = M2 - M1 + 1$ .

## 10 Example

This example reads a matrix of integers and rearranges its rows so that the elements of the  $k$ th column are in ascending order. To do this, the program first calls M01DBF to rank the elements of the  $k$ th column, and then calls M01EBF to rearrange each column into the order specified by the ranks. The value of  $k$  is read from the datafile.

### 10.1 Program Text

```

Program m01ebfe

!      M01EBF Example Program Text

!      Mark 25 Release. NAG Copyright 2014.

!      .. Use Statements ..
Use nag_library, Only: m01dbf, m01ebf
!      .. Implicit None Statement ..
Implicit None
!      .. Parameters ..
Integer, Parameter          :: nin = 5, nout = 6
!      .. Local Scalars ..
Integer                    :: i, ifail, j, k, m1, m2, n
!      .. Local Arrays ..
Integer, Allocatable       :: im(:,:), irank(:)
!      .. Executable Statements ..
Write (nout,*) 'M01EBF Example Program Results'

!      Skip heading in data file
Read (nin,*)

      Read (nin,*) m2, n, k

      If (k<1 .Or. k>n) Then
        Go To 100
      End If

      Allocate (im(m2,n),irank(m2))

      m1 = 1

      Do i = m1, m2
        Read (nin,*)(im(i,j),j=1,n)
      End Do

      ifail = 0
      Call m01dbf(im(m1,k),m1,m2,'Ascending',irank,ifail)

      Do j = 1, n

        ifail = 0
        Call m01ebf(im(m1,j),m1,m2,irank,ifail)

      End Do

      Write (nout,*)
      Write (nout,99999) 'Matrix sorted on column', k
      Write (nout,*)

      Do i = m1, m2
        Write (nout,99998)(im(i,j),j=1,n)
      End Do

100  Continue

99999 Format (1X,A,I3)
99998 Format (1X,3I7)
      End Program m01ebfe

```

## 10.2 Program Data

```
M01EBF Example Program Data
12 3 1
6 5 4
5 2 1
2 4 9
4 9 6
4 9 5
4 1 2
3 4 1
2 4 6
1 6 4
9 3 2
6 2 5
4 9 6
```

## 10.3 Program Results

```
M01EBF Example Program Results
```

```
Matrix sorted on column 1
```

1	6	4
2	4	9
2	4	6
3	4	1
4	9	6
4	9	5
4	1	2
4	9	6
5	2	1
6	5	4
6	2	5
9	3	2

---