

NAG Library Routine Document

M01DCF

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

M01DCF ranks a vector of character data in ASCII or reverse ASCII order of a specified substring.

2 Specification

```
SUBROUTINE M01DCF(CH, M1, M2, L1, L2, ORDER, IRANK, IFAIL)
INTEGER          M1, M2, L1, L2, IRANK(M2), IFAIL
CHARACTER*(*)    CH(M2)
CHARACTER*1      ORDER
```

3 Description

M01DCF uses a variant of list-merging, as described by Knuth (1973), pp 165-166. The routine takes advantage of natural ordering in the data, and uses a simple list insertion in a preparatory pass to generate ordered lists of length at least 10. The ranking is stable: equal elements preserve their ordering in the input data.

Only the substring (L1:L2) of each element of the array CH is used to determine the rank order.

4 References

Knuth D E (1973) *The Art of Computer Programming (Volume 3)* (2nd Edition) Addison–Wesley

5 Parameters

- | | | |
|----|--|--------------|
| 1: | CH(M2) – CHARACTER*(*) array | <i>Input</i> |
| | <i>On entry:</i> elements M1 to M2 of CH must contain character data to be ranked. | |
| | <i>Constraint:</i> the length of each element of CH must not exceed 255. | |
| 2: | M1 – INTEGER | <i>Input</i> |
| | <i>On entry:</i> the index of the first element of CH to be ranked. | |
| | <i>Constraint:</i> M1 > 0. | |
| 3: | M2 – INTEGER | <i>Input</i> |
| | <i>On entry:</i> the index of the last element of CH to be ranked. | |
| | <i>Constraint:</i> M2 ≥ M1. | |
| 4: | L1 – INTEGER | <i>Input</i> |
| 5: | L2 – INTEGER | <i>Input</i> |
| | <i>On entry:</i> only the substring (L1:L2) of each element of CH is to be used in determining the rank order. | |
| | <i>Constraint:</i> 0 < L1 ≤ L2 ≤ LEN(CH(1)). | |

- 6: ORDER – CHARACTER*1 *Input*
On entry: if ORDER = 'A', the values will be ranked in ASCII order.
 If ORDER = 'R', in reverse ASCII order.
Constraint: ORDER = 'A' or 'R'.
- 7: IRANK(M2) – INTEGER array *Output*
On exit: elements M1 to M2 of IRANK contain the ranks of the corresponding elements of CH. Note that the ranks are in the range M1 to M2: thus, if CH(*i*) is the first element in the rank order, IRANK(*i*) is set to M1.
- 8: 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.
On exit: IFAIL = 0 unless the routine detects an error (see Section 6).
 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.**

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,
 or L2 < 1,
 or L1 < 1,
 or L1 > L2,
 or L2 > LEN(CH(1)).

IFAIL = 2

On entry, ORDER is not 'A' or 'R'.

IFAIL = 3

On entry, the length of each element of CH exceeds 255.

7 Accuracy

Not applicable.

8 Further Comments

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

The routine relies on the Fortran 77 intrinsic functions LLT and LGT to order characters according to the ASCII collating sequence.

9 Example

This example reads a file of 12-character records, and ranks them in reverse ASCII order on characters 7 to 12.

9.1 Program Text

```
*      M01DCF Example Program Text
*      Mark 14 Revised. NAG Copyright 1989.
*      .. Parameters ..
      INTEGER          NIN, NOUT
      PARAMETER        (NIN=5,NOUT=6)
      INTEGER          MMAX
      PARAMETER        (MMAX=100)
*      .. Local Scalars ..
      INTEGER          I, IFAIL, L1, L2, M
*      .. Local Arrays ..
      INTEGER          IRANK(MMAX)
      CHARACTER*12     CH(MMAX)
*      .. External Subroutines ..
      EXTERNAL         M01DCF
*      .. Executable Statements ..
      WRITE (NOUT,*) 'M01DCF Example Program Results'
*      Skip heading in data file
      READ (NIN,*)
      DO 20 M = 1, MMAX
         READ (NIN,'(A)',END=40) CH(M)
20    CONTINUE
40    M = M - 1
        L1 = 7
        L2 = 12
        IFAIL = 0
*
*      CALL M01DCF(CH,1,M,L1,L2,'Reverse ASCII',IRANK,IFAIL)
*
      WRITE (NOUT,*)
      WRITE (NOUT,99999) 'Records ranked on columns ', L1, ' to ', L2
      WRITE (NOUT,*)
      WRITE (NOUT,*) 'Data          Ranks'
      WRITE (NOUT,*)
      WRITE (NOUT,99998) (CH(I),IRANK(I),I=1,M)
*
99999 FORMAT (1X,A,I2,A,I2)
99998 FORMAT (1X,A,I7)
      END
```

9.2 Program Data

```
M01DCF Example Program Data
A02AAF      289
A02ABF      523
A02ACF      531
C02ADF      169
C02AEF      599
C05ADF     1351
C05AGF      240
C05AJF      136
C05AVF      211
C05AXF      183
C05AZF     2181
```

9.3 Program Results

M01DCF Example Program Results

Records ranked on columns 7 to 12

Data	Ranks
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A02AAF	289	6
A02ABF	523	5
A02ACF	531	4
C02ADF	169	10
C02AEF	599	3
C05ADF	1351	2
C05AGF	240	7
C05AJF	136	11
C05AVF	211	8
C05AXF	183	9
C05AZF	2181	1
