

NAG Fortran Library Routine Document

X04CEF

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

X04CEF is an easy-to-use routine to print a ***real*** band matrix stored in a packed two-dimensional array.

2 Specification

```
SUBROUTINE X04CEF(M, N, KL, KU, A, LDA, TITLE, IFAIL)
INTEGER          M, N, KL, KU, LDA, IFAIL
real           A(LDA,*)
CHARACTER*(*)    TITLE
```

3 Description

X04CEF prints a ***real*** band matrix stored in a packed two-dimensional array. It is an easy-to-use driver for X04CFF. The routine uses default values for the format in which numbers are printed, for labelling the rows and columns, and for output record length.

X04CEF will choose a format code such that numbers will be printed with an F8.4, and F11.4 or a 1PE13.4 format. The F8.4 code is chosen if the sizes of all the matrix elements to be printed lie between 0.001 and 1.0. The F11.4 code is chosen if the sizes of all the matrix elements to be printed lie between 0.001 and 9999.9999. Otherwise the 1PE13.4 code is chosen.

The matrix is printed with integer row and column labels, and with a maximum record length of 80.

The matrix is output to the unit defined by X04ABF.

4 References

None.

5 Parameters

- | | | |
|----|-------------|--------------|
| 1: | M – INTEGER | <i>Input</i> |
| 2: | N – INTEGER | <i>Input</i> |

On entry: the number of rows and columns of the band matrix, respectively, to be printed.

If either M or N is less than 1, X04CEF will exit immediately after printing TITLE; no row or column labels are printed.

- | | | |
|----|--------------|--------------|
| 3: | KL – INTEGER | <i>Input</i> |
|----|--------------|--------------|

On entry: the number of sub-diagonals of the band matrix *A*.

Constraint: $KL \geq 0$.

- | | | |
|----|--------------|--------------|
| 4: | KU – INTEGER | <i>Input</i> |
|----|--------------|--------------|

On entry: the number of super-diagonals of the band matrix *A*.

Constraint: $KU \geq 0$.

5: A(LDA,*) – *real* array Input

Note: the second dimension of the array A must be at least $\max(1, \min(M + KU, N))$.

On entry: the band matrix to be printed. The leading $(KL + KU + 1)$ by $\min(M + KU, N)$ part of array A must contain band elements of the matrix, packed column by column, with the leading diagonal of the matrix in row $(KU + 1)$ of the array, the first super-diagonal starting at position 2 in row KU, the first sub-diagonal starting at position 1 in row $(KU + 2)$, and so on. Elements in the array A that do not correspond to elements in the band matrix (such as the top left KU by KU triangle) are not referenced, and need not be set.

6: LDA – INTEGER Input

On entry: the first dimension of the array A as declared in the (sub)program from which X04CEF is called.

Constraint: $LDA \geq KL + KU + 1$.

7: TITLE – CHARACTER*(*) Input

On entry: a title to be printed above the matrix. If TITLE = ' ', no title (and no blank line) will be printed.

If TITLE contains more than 80 characters, the contents of TITLE will be wrapped onto more than one line, with the break after 80 characters.

Any trailing blank characters in TITLE are ignored.

8: IFAIL – INTEGER Input/Output

On entry: IFAIL must be set to 0, -1 or 1. Users who are unfamiliar with this parameter should refer to Chapter P01 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, for users 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, $KL < 0$.

IFAIL = 2

On entry, $KU < 0$.

IFAIL = 3

On entry, $LDA < KL + KU + 1$.

7 Accuracy

Not applicable.

8 Further Comments

A call to X04CEF is equivalent to a call to X04CFF with the following argument values:

```
NCOLS = 80
INDENT = 0
LABROW = 'I'
LABCOL = 'I'
FORMAT = ' '
```

9 Example

The example program calls X04CEF to print a 5 by 5 band matrix with one sub-diagonal and one super-diagonal.

9.1 Program Text

Note: the listing of the example program presented below uses *bold italicised* terms to denote precision-dependent details. Please read the Users' Note for your implementation to check the interpretation of these terms. As explained in the Essential Introduction to this manual, the results produced may not be identical for all implementations.

```
*      X04CEF Example Program Text
*      Mark 14 Release.  NAG Copyright 1989.
*      .. Parameters ..
      INTEGER          NOUT
      PARAMETER        (NOUT=6)
      INTEGER          NMAX, LDA
      PARAMETER        (NMAX=5,LDA=NMAX)
*      .. Local Scalars ..
      INTEGER          I, IFAIL, J
*      .. Local Arrays ..
      real              A(LDA,NMAX)
*      .. External Subroutines ..
      EXTERNAL         X04CEF
*      .. Executable Statements ..
      WRITE (NOUT,*) 'X04CEF Example Program Results'
      WRITE (NOUT,*)

*
*      Generate an array of data
      DO 40 J = 1, NMAX
        DO 20 I = 1, LDA
          A(I,J) = 10*I + J
20      CONTINUE
40     CONTINUE
*
*      IFAIL = 0
*
*      Print 5 by 5 band matrix with 1 sub-diagonal and 1 super-diagonal
      CALL X04CEF(5,5,1,1,A,LDA,'Band Matrix:',IFAIL)
*
*      STOP
      END
```

9.2 Program Data

None.

9.3 Program Results

X04CEF Example Program Results

Band Matrix:

	1	2	3	4	5
1	21.0000	12.0000			
2	31.0000	22.0000	13.0000		
3		32.0000	23.0000	14.0000	
4			33.0000	24.0000	15.0000
5				34.0000	25.0000
