1 SUMMARY

Obtains a bound on the largest entry encountered during Gaussian elimination on a sparse matrix A=$\{a_{ij}\}_{n\times n}$. The subroutine is given the **LU** decomposition factors of **A** obtained from the elimination. If the matrix has been scaled this estimate will give an indication of the numerical accuracy of the decomposition.

The estimate is obtained by using Hadamard's inequality on the expression for the matrix elements in terms of the **LU** factors of the decomposition. Further details are given in Erisman and Reid, 'Monitoring the Stability of the Triangular Factorization of a Sparse Matrix', Numer. Math. **22** (1974).

Described by I.S.Duff, Harwell report R.8730 (1977).

ATTRIBUTES — **Version:** 1.0.0. **Types:** `ME24A`, `ME24AD`. **Original date:** March 1977. **Origin:** I.S.Duff, Harwell.

2 HOW TO USE THE PACKAGE

2.1 Argument list

The single precision version

```
CALL ME24A(N,ICN,A,LICN,LENR,LENRL,W)
```

The double precision version

```
CALL ME24AD(N,ICN,A,LICN,LENR,LENRL,W)
```

`N` is an `INTEGER` variable which must be set by the user to the order n of the matrix **A**. It is not altered by the subroutine. **Restriction:** $1\leq n$.

`ICN` is an `INTEGER` array of length `LICN` which must contain the column indices of the nonzeros in the decomposition. Each row (of **L** and **U**) is held contiguously. Row `I` precedes row `I+1, I=1,..., N-1` and there is no wasted space between the rows. Although the column indices need not be in order, those in **L** must precede those in **U** with the pivot being the first entry in the row of **U**. It is not altered by the subroutine.

`A` is a `REAL` (`DOUBLE PRECISION` in the D version) two dimensional array of first dimension 2 and second dimension of length `LICN` which contains the values of the entries in the **LU** decomposition, (`A(1,*), A(2,*)` containing the real and imaginary parts respectively). The nonzero held in `A( ,K)` is in column `ICN(K).` It is not altered by the subroutine.

`LICN` is an `INTEGER` variable which must be set by the user to be the length of arrays `ICN` and `A.` It is not altered by the subroutine.

`LENR` is an `INTEGER` array of length `N. LENR(I)` must be set by the user to the combined number of nonzeros in rows `I` of **L** and **U**, `I=1,..., N.` It is not altered by the subroutine.

`LENRL` is an `INTEGER` array of length `N. LENRL(I)` must be set by the user to the number of nonzeros in row `I` of **L**, `I=1,2,..., N.` It is not altered by the subroutine.

`W` is a `REAL` (`DOUBLE PRECISION` in the D version) array of length `N.` It is used as workspace and, on output, `W(1)` is equal to the estimate of the largest entry encountered during the **LU** decomposition.

2.2 Parameter usage summary

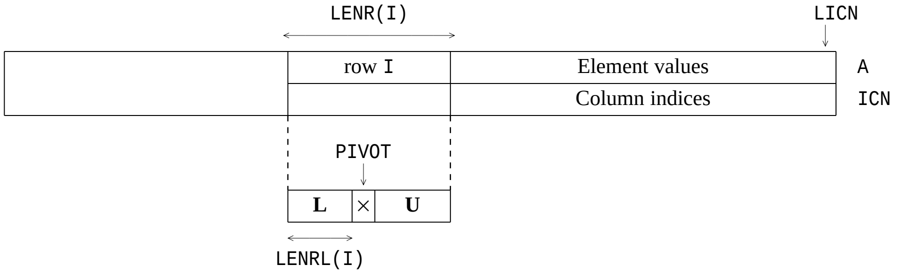
Input: N, ICN(LICN), A(LICN), LICN, LENR(N), LENRL(N)

Unchanged by ME24A/AD: N, ICN, A, LICN, LENR, LENRL

Work array: W(N)

Output: W(1)

2.3 Data structure summary



3 GENERAL INFORMATION

Use of common: None.

Workspace: W of length N.

Other routines called directly: None.

Input/output: None.

4 METHOD

The estimate is obtained by using Hadamard's inequality on the expression for the matrix entries in terms of the **LU** factors of the decomposition. For further details, the reader is referred to Erisman and Reid (1974).

Reference

Erisman, A.M. and Reid, J.K. (1974). Monitoring the stability of the triangular factorization of a sparse matrix. Numer. Math. **22**, 183-186.