> **Warning:** Subroutine EA06 performs functions which are adequately treated by routines in other standard subroutine libraries (for example, LAPACK). The use of this routine is not recommended, and it may be removed from future releases of this library.

1 SUMMARY

Given a **real symmetric** matrix **A**, finds **all its eigenvalues** λ_i and **eigenvectors** $\mathbf{x}_i$, i.e. finds the non-trivial solutions of $\mathbf{Ax} = \lambda\mathbf{x}$. The eigenvectors are normalized to have unit length.

The matrix is reduced to tri-diagonal form by applying Householder transformations. The eigenvalue problem for the reduced problem is then solved by calling EA08 which uses the QR algorithm.

ATTRIBUTES — **Version:** 1.0.0. **Types:** EA06C; EA06CD. **Calls:** EA08 and MC04. **Original date:** February 1970. **Origin:** J.K.Reid, Harwell.

2 HOW TO USE THE PACKAGE

2.1 Argument list

The single precision version

        CALL EA06C(A,VALUE,X,M,IA,IX,W)

The double precision version

        CALL EA06CD(A,VALUE,X,M,IA,IX,W)

A   is a REAL (DOUBLE PRECISION in the D version) two-dimensional array with first dimension IA. The user must store the lower triangle of the matrix **A** into the lower triangle of the array A, i.e. put a_{ij} into A(i,j) for $i \geq j$. The space above the diagonal of the array A, is used by the subroutine as work space, the lower triangle set by the user will remain unchanged on return.

VALUE   is a REAL (DOUBLE PRECISION in the D version) array in which the subroutine puts the eigenvalues λ_i, i=1,2,...,m. These are not necessarily in order.

X   is a REAL (DOUBLE PRECISION in the D version) two-dimensional array with first dimension IX, containing the eigenvectors. The components of the eigenvector $\mathbf{x}_i$ corresponding to the eigenvalue λ_i (in VALUE(i)) are placed in X(j,i), j=1,2,...,M. The eigenvectors are normalized so that $\mathbf{x}_i^T\mathbf{x}_i = 1$ for i=1,2,...,m.

M   is an INTEGER variable and should be set to m the order of the matrix.

IA   is an INTEGER variable set to the first dimension of the array **A**, i.e. if the allocation for the array A was specified by

        REAL A(1OO,50)

then it would be set to 100.

IX   is an INTEGER variable set to the first dimension of the two-dimensional array X.

W   is a REAL (DOUBLE PRECISION in the D version) array used by the subroutine for work space. It must have dimension at least 5m.

3 GENERAL INFORMATION

Use of common: None.

Workspace: None.

Other routines called directly: MC04B/BD, EA08C/CD and EA09C/CD are called

Input/output: None.

4 METHOD

Householder reduction to tri-diagonal form is performed by MC04B/BD and the eigenvalue problem for the then reduced matrix is solved by EA08C/CD using the QR algorithm.