1 SUMMARY

To calculate the generalized inverse of an m by n \((m \leq n)\) rectangular matrix \(A\) in the special case that the rank of \(A\) is equal to \(m\), i.e. such that \(AA' = A\) which with full rank can be defined as \(A' = A'(AA')^{-1}\).

Householder type orthogonal transformations with row and column interchanges are used in a method described in M.J.D. Powell, AERE R.6072.


2 HOW TO USE THE PACKAGE

2.1 The argument list and calling sequence

The single precision version:

\[
\text{CALL MB11A}(M,N,A,IA,W)
\]

The double precision version:

\[
\text{CALL MB11AD}(M,N,A,IA,W)
\]

\(M\) is an INTEGER variable set to \(m\) the number of rows in the matrix \(A\).

\(N\) is an INTEGER variable set to \(n\) the number of columns in the matrix \(A\).

\(A\) is a REAL (DOUBLE PRECISION in the D version) two dimensional array which must be set to contain the elements of the matrix \(A\) i.e. \(A(I,J) = a_{ij} I=1,2,\ldots,M\ ,\ J=1,2,\ldots,N\).

On exit the array \(A\) will have been overwritten by its generalised inverse so that \(A(I,J)\) will be changed to the \((I,J)\) th element of \(A'^T\).

\(IA\) is an INTEGER variable set to the first dimension of the array \(A\). Note that we must have \(IA \geq M\).

\(W\) is a REAL (DOUBLE PRECISION in the D version) workspace array of length at least \(2m+n\)

3 GENERAL INFORMATION

Use of Common: none.

Workspace: all supplied by the user in the arrays \(W\).

Other subroutines: None

Input/Output: none.

4 METHOD

First \(A\) is transformed to a lower triangular form, by a sequence of \(m\) elementary Householder transformations, taking account of row and column interchanges. This lower triangular matrix is inverted, and then it is replaced by another matrix that contains the same information in a more convenient form. Because of this replacement, we can now re-apply the elementary transformations to the inverted matrix, to obtain the required generalised inverse, without requiring extra storage space. The method is given in M.J.D.Powell, ‘A Fortran subroutine to invert a rectangular matrix of full rank’, AERE Report R-6072.