

1 SUMMARY

Forms the normal equations of the linear least squares problem, i.e. given an over-determined system of m linear algebraic equations in n unknowns

$$\sum_{j=1}^n a_{ij}x_{jl} = b_{il} \quad i=1,2,\dots,n, \quad l=1,2,\dots,k$$

$$m \geq n,$$

or more compactly $\mathbf{AX} = \mathbf{B}$, the subroutine sets up the equations $\mathbf{A}^T \mathbf{AX} = \mathbf{A}^T \mathbf{B}$.

ATTRIBUTES — **Version:** 1.0.0. **Remark:** If the solution is required see MA09A. **Types:** MA08A; MA08AD. **Original date:** June 1964. **Origin:** M.J.Hopper, Harwell.

2 HOW TO USE THE PACKAGE

2.1 The argument list and calling sequence

The single precision version:

```
CALL MA08A(A,B,ATA,ATB,M,N,K,IA,IB,IS)
```

The double precision version:

```
CALL MA08AD(A,B,ATA,ATB,M,N,K,IA,IB,IS)
```

- A is a two-dimensional REAL (DOUBLE PRECISION in the D version) array with dimensions at least m by n (the first dimension specified in IA), which must be set by the user to the elements of the matrix \mathbf{A} , i.e. put a_{ij} $i=1,2,\dots,m$ $j=1,2,\dots,n$ into $A(I,J)$ $I=1,M$ $J=1,N$. This argument is not altered by the subroutine.
- B is a two-dimensional REAL (DOUBLE PRECISION in the D version) array with dimensions at least m by k (the first dimension specified in IB), which must be set by the user to the elements of the right-hand side matrix \mathbf{B} , i.e. put b_{il} $i=1,2,\dots,m$ $l=1,2,\dots,k$ into $B(I,L)$ $I=1,M$ $L=1,K$. This argument is not altered by the subroutine.
- ATA is a two-dimensional REAL (DOUBLE PRECISION in the D version) array of dimensions at least n by n (first dimension specified in IS), which will be set by the subroutine to the elements of the matrix $\mathbf{A}^T \mathbf{A}$. **N.B.** if the rank of \mathbf{A} is equal to n this matrix will be positive definite.
- ATB is a two-dimensional REAL (DOUBLE PRECISION in the D version) array of dimensions at least n by k (first dimension specified in IS), which will be set by the subroutine to the elements of the matrix $\mathbf{A}^T \mathbf{B}$.
- M is an INTEGER variable which must be set by the user to m the number of equations. This argument is not altered by the subroutine.
- N is an INTEGER variable which must be set by the user to n the number of unknowns. This argument is not altered by the subroutine.
- K is an INTEGER variable which must be set by the user to k the number of right-hand sides (number of columns in \mathbf{B}). This argument is not altered by the subroutine.
- IA is an INTEGER variable which must be set by the user to the first dimension of the array A. This argument is not altered by the subroutine.
- IB is an INTEGER variable which must be set by the user to the first dimension of the array B. This argument is not altered by the subroutine.

IS is an INTEGER variable which must be set by the user to the first dimension of the arrays ATA and ATB. This argument is not altered by the subroutine.

3 GENERAL INFORMATION

Use of Common: none.

Workspace: none.

Other subroutines: none.

Input/Output: none.

Restrictions: none.