

MATRIX INVERSE

PURPOSE

Compute the inverse of a matrix.

DESCRIPTION

The inverse is the matrix that when multiplied by the original matrix yields the identity matrix (i.e., $AA' = I$ where I has one's on the diagonal and zero's everywhere else).

In practice, the matrix inverse, the determinant, and the solution of a system of a linear equations are all closely related. Each of these can be computed from the LU decomposition of a matrix.

SYNTAX

LET <mat2> = MATRIX INVERSE <mat1> <SUBSET/EXCEPT/FOR qualification>

where <mat1> is a matrix for which the inverse is to be computed;

<mat2> is a matrix where the resulting inverse is saved;

and where the <SUBSET/EXCEPT/FOR qualification> is optional and rarely used in this context.

EXAMPLES

LET C = MATRIX INVERSE A

NOTE 1

Matrices for which the inverse to be computed must have the same number of rows and columns. An error message is printed if they do not.

NOTE 2

DATAPLOT uses LINPACK routines to calculate the LU decomposition (versions prior to 7/93 use the LUDCMP and LUBKSB routines from the Numerical Recipes book).

The reciprocal of the condition number is printed. This number gives an indication of the numerical accuracy that was obtained when calculating the inverse. If this number is approximately $10^{*(-d)}$, then the elements of the LU decomposed matrix generally have d fewer significant digits than the original matrix.

The TRIANGULAR INVERSE command can be used to find the inverse of an upper triangular matrix. The primary advantage of using the TRIANGULAR INVERSE command is that it is faster.

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

MATRIX DETERMINANT	=	Compute a matrix determinant.
MATRIX SIMPLEX SOLUTION	=	Compute a matrix simplex solution.
MATRIX SOLUTION	=	Solve a system of linear equations.
TRIANGULAR SOLVE	=	Solve a triangular system of equations.
TRIANGULAR INVERSE	=	Compute the inverse of a triangular matrix.
TRIDIAGONAL SOLVE	=	Solve a tridiagonal system of equations.

REFERENCE

"LINPACK User's Guide," Dongarra, Bunch, Moler, and Stewart, Siam, 1979.

"Numerical Recipes: The Art of Scientific Programming (FORTRAN Version)," Press, Flannery, Teukolsky, and Vetterling, Cambridge University Press, 1989 (chapter 2).

APPLICATIONS

Linear Algebra

IMPLEMENTATION DATE

87/10

PROGRAM

```
READ MATRIX X
16 16 19 21 20
14 17 15 22 18
24 23 21 24 20
18 17 16 15 20
18 11 9 18 7
END OF DATA
LET A = MATRIX INVERSE X
```

The following inverse matrix is generated.

```
          MATRIX A      --          5 ROWS
                        --          5 COLUMNS

VARIABLES--A1          A2          A3          A4          A5

  0.1992030E-02 -0.8844623E-01 -0.5776891E-01  0.1007968E+00  0.9880479E-01
-0.2159931E+00  0.1186682E+00  0.1923734E+00 -0.4354015E-01 -0.1132613E+00
  0.2040409E+00 -0.1879909E+00  0.1542401E+00 -0.1612407E+00 -0.7956742E-01
  0.2931132E-01  0.8429142E-01 -0.6431417E-01 -0.5970404E-01  0.5384177E-01
-0.3414914E-02  0.6590780E-01 -0.1866818E+00  0.1700626E+00  0.3062036E-01
```