

TRIANGULAR SOLUTION

PURPOSE

Solve a system of linear equations in the following form:

$$A * X = B$$

where A is an upper triangular (or lower triangular) matrix of coefficients, B is a vector of constants, and X are the variables to be solved for.

DESCRIPTION

An upper triangular matrix is one with all zeros below the diagonal. Likewise, a lower triangular matrix is one with all zeros above the diagonal. For example, the Cholesky decomposition factors a positive definite matrix (such as a variance-covariance) into an upper triangular matrix and its transpose. Solving an upper triangular system allows some simplifications that provide a faster solution than the standard LU decomposition used by the MATRIX SOLUTION command. The TRIANGULAR SOLUTION command checks whether the matrix is upper or lower triangular by scanning the upper half of the matrix. If a non-zero element is found, the matrix is assumed to be upper triangular. Otherwise it is assumed to be lower triangular.

SYNTAX

LET <var2> = TRIANGULAR SOLUTION <mat> <var1> <SUBSET/EXCEPT/FOR qualification>
 where <mat> is a triangular matrix (either upper or lower) containing the coefficients of the equation;
 <var1> is an array of constants (i.e., the values for the right hand side of the equation);
 <var2> is a vector where the resulting matrix solution is saved;
 and where the <SUBSET/EXCEPT/FOR qualification> is optional and rarely used in this context.

EXAMPLES

LET X = TRIANGULAR SOLUTION A B

NOTE 1

DATAPLOT uses the LINPACK routine STRSL to solve the triangular system.

NOTE 2

Matrices used to solve systems of linear equations must have the same number of rows and columns. An error message is printed if they do not.

DEFAULT

None

SYNONYMS

TRIANGULAR SOLVE

RELATED COMMANDS

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

REFERENCE

"LINPACK User's Guide," Dongarra, Bunch, Moler, 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

93/10

PROGRAM

```
READ MATRIX A
2.0 2.0 -4.0
0.0 -1.0 2.0
0.0 0.0 5.0
END OF DATA
LET B = DATA 2.0 5.0 0.0
LET X = TRIANGULAR SOLVE A B
PRINT X
```

The values 6, -5, and 0 are printed for X.