INTERPOLATION

PURPOSE

Perform a cubic spline interpolation of a series of data points.

DESCRIPTION

Interpolation takes a series of (x,y) points and generates estimated values for y's at new x points. Interpolation is used when the function that generated the original (x,y) points is unknown.

Interpolation is related to, but distinct from, fitting a function to a series of points. A fitted curve attempts to estimate an "average" value at a point while interpolation tries to estimate the value for a point in between known points. In particular, an interpolated function goes through all the original points while a fitted function may not.

There are various methods for performing interpolation. Chapter 3 of the Numerical Recipes book (see REFERENCE below) contains a nice discussion of various types of commonly used interpolation schemes (polynomial interpolation, rational function interpolation, cubic spline interpolation). DATAPLOT uses the cubic spline algorithm. Cubic splines have the advantage of being efficient to compute and being more stable than polynomials.

SYNTAX

LET <y2> = INTERPOLATION <y1> <x1> <x2>   <SUBSET/EXCEPT/FOR qualification>

where <y1> is a variable containing the vertical axis data points;
<x1> is a variable containing the horizontal axis data points;
<x2> is a variable containing the horizontal points where the interpolation is to be performed;
<y2> is a variable (same length as <x2>) where the interpolated values are stored;
and where the <SUBSET/EXCEPT/FOR qualification> is optional.

EXAMPLES

LET Y2 = INTERPOLATION Y1 X1 X2

NOTE 1

The interpolation points (i.e., <x2>) must be within the range of the original data points (i.e., <x1>). An error message is generated if this is not the case.

NOTE 2

The original data do not have to be in sorted order. DATAPLOT sorts the original data (on <x1>) automatically.

DEFAULT

None

SYNONYMS

None

RELATED COMMANDS

LINEAR INTERPOLATION	=	Compute a linear interpolation of a series of points.
BILINEAR INTERPOLATION	=	Compute a bilinear interpolation from a grid to random points of a 2D series of points.
BIVARIATE INTERPOLATION	=	Compute a bivariate interpolation from a grid to random points of a 2D series of points.
2D INTERPOLATION	=	Compute a bivariate interpolation from a 2D series of points to a rectangular grid.
FIT	=	Perform a least squares fit.
ROOTS	=	Compute the roots of a function.
INTEGRAL	=	Compute the integral of a function.
DERIVATIVE	=	Compute the derivative of a function.

REFERENCE

"A First Course in Numerical Analysis," Ralston and Rubinowitz, McGraw-Hill, 1978.

"Numerical Recipes: The Art of Scientific Computing (FORTRAN Version)," Press, Flannery, Teukolsky, and Vetterling, Cambridge University Press, 1989 (chapter 3).

APPLICATIONS

Mathematics

IMPLEMENTATION DATE

Pre-1987

PROGRAM

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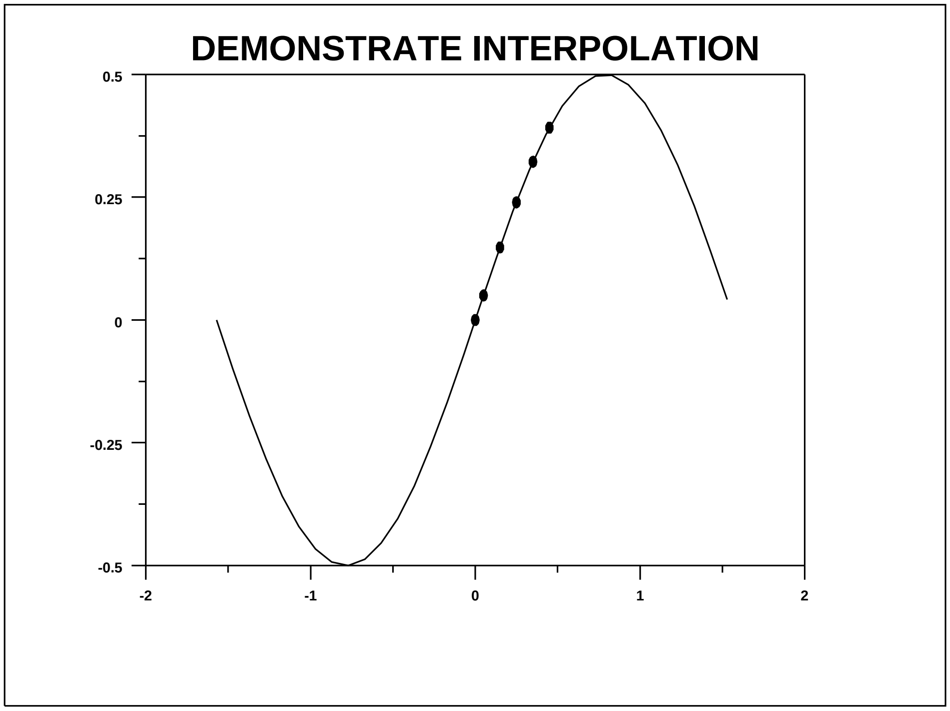
LET FUNCTION F1 = SIN(X1)*COS(X1)
LET START = -PI/2
LET STOP = PI/2
LET X1 = SEQUENCE START 0.1 STOP
LET Y1 = F1
LET X2 = DATA 0 0.05 0.15 0.25 0.35 0.45
LET Y2 = INTERPOLATION Y1 X1 X2
LINES SOLID BLANK
CHARACTER BLANK CIRCLE
CHARACTER SIZE 1.5 ALL
CHARACTER FILL OFF ON
TITLE DEMONSTRATE INTERPOLATION
PLOT Y1 X1 AND
PLOT Y2 X2
PRINT X2 Y2
```


DEMONSTRATE INTERPOLATION