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Function Interpolation

Function subprogram DIVDIF interpolates in a table of arguments a_j and function values $f_j = f(a_j)$, using an interpolating polynomial of specified degree which passes through tabular points which are symmetrically-positioned around the interpolation argument. The table arguments a_j need not be equidistant.

Structure:

FUNCTION subprogram
User Entry Names: DIVDIF
Files Referenced: Printer
External References: KERMTR (N001), ABEND (Z035)

Usage:

In any arithmetic expression,

```
DIVDIF(F,A,N,X,M)
```

has an approximate value of $f(\mathtt{X})$.

- F (REAL) One-dimensional array. F(j) must be equal to the value at A(j) of the function to be interpolated, $(j = 1, 2, \ldots, \mathtt{N})$.
- A (REAL) One-dimensional array. A(j) must be equal to the table argument a_j, $(j = 1, 2, \ldots, \mathtt{N})$.
- N (INTEGER) Number of values in arrays F and A.
- X (REAL) Argument at which the interpolating polynomial is to be evaluated.
- M (INTEGER) Requested degree of the interpolating polynomial. If M exceeds $M_{max} = \min(10, \mathtt{N} - 1)$ the interpolation is carried out using a polynomial of degree M_{max} instead of M. The original value of M is unchanged on exit.

Method:

Newton's divided difference formula is used. Except when X lies near one end of the table (in which case unsymmetrically-situated interpolation points are used), the interpolation procedure is as follows:
M **odd**:
An interpolating polynomial passing through $\mathtt{M} + 1$ successive points (a_j, f_j) symmetrically placed with respect to X is used.
M **even**:
The mean of two interpolating polynomials is used, each passing through $\mathtt{M} + 1$ successive points (a_j, f_j), one polynomial having an extra point to the left of X, the other having an extra point to the right of X.
If X lies too close to either end of the table for symmetrically-positioned tabular values to be used, the $\mathtt{M} + 1$ values at the end of the table are used. If X lies outside the range of the table, the interpolation becomes an extrapolation, with corresponding loss of accuracy.

Restrictions:

The argument values $\mathtt{A}(1), \mathtt{A}(2), \ldots$ must be in either strictly increasing order or strictly decreasing order. No error message is printed if this is not true.

Error handling:

Error `E105.1`: `N` $<$ `2` or `M` $<$ `1`. `DIVDIF` is set equal to zero and a message is printed unless subroutine `KERSET (N001)` has been called.

Notes:

See also the write-up for `POLINT` (E100).

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