E01SFF – NAG Fortran Library Routine Document

Note. Before using this routine, please read the Users' Note for your implementation to check the interpretation of bold italicised terms and other implementation-dependent details.

1 Purpose

E01SFF evaluates at a given point the two-dimensional interpolating function computed by E01SEF.

2 Specification

```
SUBROUTINE E01SFF(M, X, Y, F, RNW, FNODES, PX, PY, PF, IFAIL)
INTEGER           M, IFAIL
real              X(M), Y(M), F(M), RNW, FNODES(5*M), PX, PY, PF
```

3 Description

This routine takes as input the interpolant $F(x, y)$ of a set of scattered data points (x_r, y_r, f_r), for $r = 1, 2, \ldots, m$, as computed by E01SEF, and evaluates the interpolant at the point (px, py).

If (px, py) is equal to (x_r, y_r) for some value of r, the returned value will be equal to f_r.

If (px, py) is not equal to (x_r, y_r) for any r, all points that are within distance RNW of (px, py), along with the corresponding nodal functions given by FNODES, will be used to compute a value of the interpolant.

E01SFF must only be called after a call to E01SEF.

4 References

[1] Franke R and Nielson G (1980) Smooth interpolation of large sets of scattered data *Internat. J. Num. Methods Engrg.* **15** 1691–1704

[2] Shepard D (1968) A two-dimensional interpolation function for irregularly spaced data *Proc. 23rd Nat. Conf. ACM* Brandon/Systems Press Inc., Princeton 517–523

5 Parameters

1: M — INTEGER *Input*

2: X(M) — ***real*** array *Input*

3: Y(M) — ***real*** array *Input*

4: F(M) — ***real*** array *Input*

5: RNW — ***real*** *Input*

6: FNODES(5∗M) — ***real*** array *Input*

On entry: M, X, Y, F, RNW and FNODES must be unchanged from the previous call of E01SEF.

7: PX — ***real*** *Input*

8: PY — ***real*** *Input*

On entry: the point (px, py) at which the interpolant is to be evaluated.

9: PF — ***real*** *Output*

On exit: the value of the interpolant evaluated at the point (px, py).

10: IFAIL — INTEGER *Input/Output*

On entry: IFAIL must be set to 0, -1 or 1. For users not familiar with this parameter (described in Chapter P01) the recommended value is 0.

On exit: IFAIL = 0 unless the routine detects an error (see Section 6).

6 Error Indicators and Warnings

If on entry IFAIL = 0 or −1, explanatory error messages are output on the current error message unit (as defined by X04AAF).

Errors detected by the routine:

IFAIL = 1

On entry, M < 3.

IFAIL = 2

The interpolant cannot be evaluated because the evaluation point (PX,PY) lies outside the support region of the data supplied in X, Y and F. This error exit will occur if (PX,PY) lies at a distance greater than or equal to RNW from every point given by arrays X and Y.

The value 0.0 is returned in PF. This value will not provide continuity with values obtained at other points (PX,PY), i.e., values obtained when IFAIL = 0 on exit.

7 Accuracy

Computational errors should be negligible in most practical situations.

8 Further Comments

The time taken for a call of E01SFF is approximately proportional to the number of data points, m.

The results returned by this routine are particularly suitable for applications such as graph plotting, producing a smooth surface from a number of scattered points.

9 Example

See the example for E01SEF.