NAG Library Function Document

nag_2d_shep_eval (e01shc)

1 Purpose

nag_2d_shep_eval (e01shc) evaluates the two-dimensional interpolating function generated by nag_2d_shep_interp (e01sgc) and its first partial derivatives.

2 Specification

```
#include <nag.h>
#include <nage01.h>
void nag_2d_shep_eval (Integer m, const double x[], const double y[],
     const double f[], const Integer iq[], const double rq[], Integer n,
     const double u[], const double v[], double q[], double qx[],
     double qy[], NagError *fail)
```

3 Description

nag_2d_shep_eval (e01shc) takes as input the interpolant $Q(x,y)$ of a set of scattered data points (x_r, y_r, f_r), for $r = 1, 2, \ldots, m$, as computed by nag_2d_shep_interp (e01sgc), and evaluates the interpolant and its first partial derivatives at the set of points (u_i, v_i), for $i = 1, 2, \ldots, n$.

nag_2d_shep_eval (e01shc) must only be called after a call to nag_2d_shep_interp (e01sgc).

This function is derived from the function QS2GRD described by Renka (1988).

4 References

Renka R J (1988) Algorithm 660: QSHEP2D: Quadratic Shepard method for bivariate interpolation of scattered data *ACM Trans. Math. Software* **14** 149–150

5 Arguments

1: **m** – Integer *Input*

2: **x**[**m**] – const double *Input*

3: **y**[**m**] – const double *Input*

4: **f**[**m**] – const double *Input*

On entry: **m**, **x**, **y** and **f** must be the same values as were supplied in the preceding call to nag_2d_shep_interp (e01sgc).

5: **iq**[$(\mathbf{2} \times \mathbf{m} + \mathbf{1})$] – const Integer *Input*

On entry: must be unchanged from the value returned from a previous call to nag_2d_shep_interp (e01sgc).

6: **rq**[$(\mathbf{6} \times \mathbf{m} + \mathbf{5})$] – const double *Input*

On entry: must be unchanged from the value returned from a previous call to nag_2d_shep_interp (e01sgc).

7: **n** – Integer *Input*

On entry: n, the number of evaluation points.

Constraint: $\mathbf{n} \geq 1$.

8: **u**[**n**] – const double *Input*
9: **v**[**n**] – const double *Input*

On entry: the evaluation points (u_i, v_i), for $i = 1, 2, \ldots, n$.

10: **q**[**n**] – double *Output*

On exit: the values of the interpolant at (u_i, v_i), for $i = 1, 2, \ldots, n$. If any of these evaluation points lie outside the region of definition of the interpolant the corresponding entries in **q** are set to the largest machine representable number (see nag_real_largest_number (X02ALC)), and nag_2d_shep_eval (e01shc) returns with **fail**.**code** = NE_BAD_INTERPOLANT.

11: **qx**[**n**] – double *Output*
12: **qy**[**n**] – double *Output*

On exit: the values of the partial derivatives of the interpolant $Q(x, y)$ at (u_i, v_i), for $i = 1, 2, \ldots, n$. If any of these evaluation points lie outside the region of definition of the interpolant, the corresponding entries in **qx** and **qy** are set to the largest machine representable number (see nag_real_largest_number (X02ALC)), and nag_2d_shep_eval (e01shc) returns with **fail**.**code** = NE_BAD_INTERPOLANT.

13: **fail** – NagError * *Input/Output*

The NAG error argument (see Section 3.6 in the Essential Introduction).

6 Error Indicators and Warnings

NE_BAD_INTERPOLANT

On entry, at least one evaluation point lies outside the region of definition of the interpolant. At all such points the corresponding values in **q**, **qx** and **qy** have been set to nag_real_largest_number = ⟨*value*⟩.

NE_BAD_PARAM

On entry, argument ⟨*value*⟩ had an illegal value.

NE_INT

On entry, **m** = ⟨*value*⟩.
Constraint: **m** ≥ 6.

On entry, **n** = ⟨*value*⟩.
Constraint: **n** ≥ 1.

NE_INTERNAL_ERROR

An internal error has occurred in this function. Check the function call and any array sizes. If the call is correct then please contact NAG for assistance.

NE_INVALID_ARRAY

On entry, values in **iq** appear to be invalid. Check that **iq** has not been corrupted between calls to nag_2d_shep_interp (e01sgc) and nag_2d_shep_eval (e01shc).

On entry, values in **rq** appear to be invalid. Check that **rq** has not been corrupted between calls to nag_2d_shep_interp (e01sgc) and nag_2d_shep_eval (e01shc).

7 Accuracy

Computational errors should be negligible in most practical situations.

8 Parallelism and Performance

nag_2d_shep_eval (e01shc) is threaded by NAG for parallel execution in multithreaded implementations of the NAG Library.

Please consult the Users' Note for your implementation for any additional implementation-specific information.

9 Further Comments

The time taken for a call to nag_2d_shep_eval (e01shc) will depend in general on the distribution of the data points. If **x** and **y** are approximately uniformly distributed, then the time taken should be only $O(n)$. At worst $O(mn)$ time will be required.

10 Example

See Section 10 in nag_2d_shep_interp (e01sgc).