

NAG C 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 $r = 1, 2, \dots, m$, 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 $i = 1, 2, \dots, n$.

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 (1988a).

4 References

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

5 Arguments

- | | | |
|----|----------------------------|--------------|
| 1: | m – Integer | <i>Input</i> |
| 2: | x[m] – const double | <i>Input</i> |
| 3: | y[m] – const double | <i>Input</i> |
| 4: | f[m] – const double | <i>Input</i> |

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).

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|----|--------------------------------|--------------|
| 5: | iq[dim] – const Integer | <i>Input</i> |
|----|--------------------------------|--------------|

Note: the dimension, *dim*, of the array **iq** must be at least $2 \times m + 1$.

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

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|----|-------------------------------|--------------|
| 6: | rq[dim] – const double | <i>Input</i> |
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Note: the dimension, *dim*, of the array **rq** must be at least $6 \times m + 5$.

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: $n \geq 1$.
- 8: **u[n]** – const double *Input*
9: **v[n]** – const double *Input*
On entry: the evaluation points (u_i, v_i) , for $i = 1, 2, \dots, n$.
- 10: **q[n]** – double *Output*
On exit: the values of the interpolant at (u_i, v_i) , for $i = 1, 2, \dots, n$. 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 $i = 1, 2, \dots, n$. 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 2.6 of 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 (X02ALC) = <value>`.

NE_BAD_PARAM

On entry, argument `<value>` had an illegal value.

NE_INT

On entry, **m** = `<value>`.

Constraint: $m \geq 6$.

On entry, **n** = `<value>`.

Constraint: $n \geq 1$.

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 consult 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 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 \mathbf{x} and \mathbf{y} are approximately uniformly distributed, then the time taken should be only $O(n)$. At worst $O(mn)$ time will be required.

9 Example

See Section 9 of the document for `nag_2d_shep_interp` (e01sgc).
