NAG Library Function Document
nag_2d_triang_bary_eval (e01ebc)

1 Purpose

nag_2d_triang_bary_eval (e01ebc) performs barycentric interpolation, at a given set of points, using a set of function values on a scattered grid and a triangulation of that grid computed by nag_2d_triangulate (e01eac).

2 Specification

#include <nag.h>
#include <nage01.h>
void nag_2d_triang_bary_eval (Integer m, Integer n, const double x[],
const double y[], const double f[], const Integer triang[],
const double px[], const double py[], double pf[], NagError *fail)

3 Description

nag_2d_triang_bary_eval (e01ebc) takes as input a set of scattered data points \((x_r, y_r, f_r)\), for \(r = 1, 2, \ldots, n\), and a Thiessen triangulation of the \((x_r, y_r)\) computed by nag_2d_triangulate (e01eac), and interpolates at a set of points \((px_i, py_i)\), for \(i = 1, 2, \ldots, m\).

If the \(i\)th interpolation point \((px_i, py_i)\) is equal to \((x_r, y_r)\) for some value of \(r\), the returned value will be equal to \(f_r\); otherwise a barycentric transformation will be used to calculate the interpolant.

For each point \((px_i, py_i)\), a triangle is sought which contains the point; the vertices of the triangle and \(f_r\) values at the vertices are then used to compute the value \(F(px_i, py_i)\).

If any interpolation point lies outside the triangulation defined by the input arguments, the returned value is the value provided, \(f_s\), at the closest node \((x_s, y_s)\).

nag_2d_triang_bary_eval (e01ebc) must only be called after a call to nag_2d_triangulate (e01eac).

4 References


5 Arguments

1: \(m\) – Integer

Input

On entry: \(m\), the number of points to interpolate.

Constraint: \(m \geq 1\).
2: \textbf{n} – Integer \hspace{1cm} \textit{Input}

\textit{On entry}: \( n \), the number of data points. \textbf{n} must be unchanged from the previous call of \texttt{nag_2d_triangulate (e01eac)}.

\textit{Constraint}: \( n \geq 3 \).

3: \textbf{x}[\text{n}] – const double \hspace{1cm} \textit{Input}
4: \textbf{y}[\text{n}] – const double \hspace{1cm} \textit{Input}

\textit{On entry}: the coordinates of the \( r \)th data point, \((x_r, y_r)\), for \( r = 1, 2, \ldots, n \). \textbf{x} and \textbf{y} must be unchanged from the previous call of \texttt{nag_2d_triangulate (e01eac)}.

5: \textbf{f}[\text{n}] – const double \hspace{1cm} \textit{Input}

\textit{On entry}: the function values \( f_r \) at \((x_r, y_r)\), for \( r = 1, 2, \ldots, n \).

6: \texttt{triang[7 x n]} – const Integer \hspace{1cm} \textit{Input}

\textit{On entry}: the triangulation computed by the previous call of \texttt{nag_2d_triangulate (e01eac)}. See Section 9 in \texttt{nag_2d_triangulate (e01eac)} for details of how the triangulation used is encoded in \texttt{triang}.

7: \textbf{px}[\text{m}] – const double \hspace{1cm} \textit{Input}
8: \textbf{py}[\text{m}] – const double \hspace{1cm} \textit{Input}

\textit{On entry}: the coordinates \((px_i, py_i)\), for \( i = 1, 2, \ldots, m \), at which interpolated function values are sought.

9: \textbf{pf}[\text{m}] – double \hspace{1cm} \textit{Output}

\textit{On exit}: the interpolated values \( F(px_i, py_i) \), for \( i = 1, 2, \ldots, m \).

10: \textbf{fail} – NagError* \hspace{1cm} \textit{Input/Output}

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

6 \quad \textbf{Error Indicators and Warnings}

\textbf{NE_ALLOC_FAIL}

Dynamic memory allocation failed.
See Section 3.2.1.2 in the Essential Introduction for further information.

\textbf{NE_BAD_PARAM}

On entry, argument \texttt{(value)} had an illegal value.

\textbf{NE_INT}

On entry, \( m = \langle \text{value} \rangle \).
\textit{Constraint}: \( m \geq 1 \).

On entry, \( n = \langle \text{value} \rangle \).
\textit{Constraint}: \( n \geq 3 \).

\textbf{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.

An unexpected error has been triggered by this function. Please contact NAG.
See Section 3.6.6 in the Essential Introduction for further information.
NE_NO_LICENCE
Your licence key may have expired or may not have been installed correctly.
See Section 3.6.5 in the Essential Introduction for further information.

NE_TRIANG_INVALID
On entry, the triangulation information held in the array triang does not specify a valid
triangulation of the data points. triang has been corrupted since the call to nag_2d_triangulate
(e01eac).

NW_EXTRAPOLATION
At least one evaluation point lies outside the nodal triangulation. For each such point the value
returned in pf is that corresponding to a node on the closest boundary line segment.

7 Accuracy
Not applicable.

8 Parallelism and Performance
Not applicable.

9 Further Comments
The time taken for a call of nag_2d_triang_bary_eval (e01ebc) is approximately proportional to the
number of interpolation points, m.

10 Example
See Section 10 in nag_2d_triangulate (e01eac).