NAG Library Function Document

nag_2d_panel_sort (e02zac)

1 Purpose

nag_2d_panel_sort (e02zac) sorts two-dimensional data into rectangular panels.

2 Specification

```c
#include <nag.h>
#include <nage02.h>

void nag_2d_panel_sort (Integer px, Integer py, const double lamda[],
                       const double mu[], Integer m, const double x[], const double y[],
                       Integer point[], NagError *fail)
```

3 Description

A set of \( m \) data points with rectangular Cartesian coordinates \( x_r, y_r \) are sorted into panels defined by lines parallel to the \( y \) and \( x \) axes. The intercepts of these lines on the \( x \) and \( y \) axes are given in \( \text{lamda}[i-1] \), for \( i = 5, 6, \ldots, px - 4 \) and \( \text{mu}[j-1] \), for \( j = 5, 6, \ldots, py - 4 \), respectively. The function orders the data so that all points in a panel occur before data in succeeding panels, where the panels are numbered from bottom to top and then left to right, with the usual arrangement of axes, as shown in the diagram. Within a panel the points maintain their original order.

```
    panel 4  8  12
    panel 3  7  11
    panel 2  6  10
    panel 1  5  9
```

Figure 1

A data point lying exactly on one or more panel sides is taken to be in the highest-numbered panel adjacent to the point. The function does not physically rearrange the data, but provides the array point...
which contains a linked list for each panel, pointing to the data in that panel. The total number of panels is \( (px - 7) \times (py - 7) \).

4 References
None.

5 Arguments
1: \( px \) – Integer \hspace{1cm} Input
2: \( py \) – Integer \hspace{1cm} Input
   
   \( On \ entry: \ px \) and \( py \) must specify eight more than the number of intercepts on the \( x \) axis and \( y \) axis, respectively.
   
   \( Constraint: \ px \geq 8 \) and \( py \geq 8 \).

3: \( \lambda[px] \) – const double \hspace{1cm} Input
   
   \( On \ entry: \lambda[4] \) to \( \lambda[px - 5] \) must contain, in nondecreasing order, the intercepts on the \( x \) axis of the sides of the panels parallel to the \( y \) axis.

4: \( \mu[py] \) – const double \hspace{1cm} Input
   
   \( On \ entry: \mu[4] \) to \( \mu[py - 5] \) must contain, in nondecreasing order, the intercepts on the \( y \) axis of the sides of the panels parallel to the \( x \) axis.

5: \( m \) – Integer \hspace{1cm} Input
   
   \( On \ entry: \) the number \( m \) of data points.

6: \( x[m] \) – const double \hspace{1cm} Input
7: \( y[m] \) – const double \hspace{1cm} Input
   
   \( On \ entry: \) the coordinates of the \( r \)th data point \( (x_r, y_r) \), for \( r = 1, 2, \ldots, m \).

8: \( \text{point}[dim] \) – Integer \hspace{1cm} Output
   
   \( Note: \) the dimension, \( dim \), of the array \( \text{point} \) must be at least \( (m + (px - 7) \times (py - 7)) \).
   
   \( On \ exit: \) for \( i = 1, 2, \ldots, (m + (px - 7) \times (py - 7)) \), \( \text{point}[m + i - 1] = 11 \) is the index of the first point in panel \( i \), \( \text{point}[11 - 1] = 12 \) is the index of the second point in panel \( i \) and so on.
   
   \( \text{point}[In - 1] = 0 \) indicates that \( x[In - 1], y[In - 1] \) was the last point in the panel.

9: \( \text{fail} \) – NagError * \hspace{1cm} Input/Output
   
   The NAG error argument (see Section 3.6 in the Essential Introduction).

6 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 \( \langle \text{value} \rangle \) had an illegal value.
On entry, $m = \langle\text{value}\rangle$.
Constraint: $m > 0$.

On entry, $px = \langle\text{value}\rangle$.
Constraint: $px \geq 8$.

On entry, $py = \langle\text{value}\rangle$.
Constraint: $py \geq 8$.

On entry, $px = \langle\text{value}\rangle$ and $py = \langle\text{value}\rangle$.
Constraint: $px \geq 8$ and $py \geq 8$.

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.

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.

On entry, $I = \langle\text{value}\rangle$, $\text{lambd}[I - 1] = \langle\text{value}\rangle$ and $\text{lambd}[I - 2] = \langle\text{value}\rangle$.
Constraint: $\text{lambd}[I - 1] \geq \text{lambd}[I - 2]$.

On entry, $I = \langle\text{value}\rangle$, $\text{mu}[I - 1] = \langle\text{value}\rangle$ and $\text{mu}[I - 2] = \langle\text{value}\rangle$.
Constraint: $\text{mu}[I - 1] \geq \text{mu}[I - 2]$.

Not applicable.

Not applicable.

The time taken is approximately proportional to $m \times \log ((m + (px - 7) \times (py - 7)))$.

This function was written to sort two-dimensional data in the manner required by function
nag_2d_spline_fit_panel (e02dac). The first 9 arguments of nag_2d_panel_sort (e02zac) are the same
as the arguments in nag_2d_spline_fit_panel (e02dac) which have the same name.

This example reads in data points and the intercepts of the panel sides on the $x$ and $y$ axes; it calls
nag_2d_panel_sort (e02zac) to set up the index array point; and finally it prints the data points in panel order.
10.1 Program Text

/* nag_2d_panel_sort (e02zac) Example Program. 
* 
* Copyright 2014 Numerical Algorithms Group. 
* 
*/

#include <stdio.h>
#include <nag.h>
#include <nag_stdlib.h>
#include <nage02.h>

int main(void)
{
    /* Scalars */
    Integer exit_status, i, iadres, m, nadres, npoint, px, py;

    /* Arrays */
    double *lamda = 0, *mu = 0, *x = 0, *y = 0;
    Integer *point = 0;

    /* Nag types */
    NagError fail;

    INIT_FAIL(fail);

    printf("nag_2d_panel_sort (e02zac) Example Program Results\n");

    /* Skip heading in data file */
    #ifdef _WIN32
    scanf_s("%*[\n] ");
    #else
    scanf("%*[\n] ");
    #endif

    if (m > 0)
    {
        /* Allocate memory */
        if (!(x = NAG_ALLOC(m, double)) ||
            !(y = NAG_ALLOC(m, double)))
        {
            printf("Allocation failure\n");
            exit_status = -1;
            goto END;
        }
    }
    else
    {
        printf("Invalid m.\n");
        exit_status = 1;
        return exit_status;
    }

    if (m > 0)
    {
        /* Allocate memory */
        if (!((x = NAG_ALLOC(m, double)) ||
            (y = NAG_ALLOC(m, double)))
        {
            printf("Allocation failure\n");
            exit_status = -1;
            goto END;
        }
    }
    else
    {
        printf("Invalid m.\n");
        exit_status = 1;
        return exit_status;
    }

    nadres = (px - 7) * (py - 7);
    npoint = m+nadres;
    if (px >= 8 && py >= 8)
    {
        /* Allocate memory */

    END:

    // Other code...
}

// Additional code...

// Example output...

// End of program...
if (!(lamda = NAG_ALLOC(px, double)) ||
! (mu = NAG_ALLOC(py, double)) ||
!(point = NAG_ALLOC(npoint, Integer)))
{
    printf("Allocation failure\n");
    exit_status = -1;
    goto END;
}

else {
    printf("Invalid px or py.\n");
    exit_status = 1;
    goto END;
}

/* Read data points and intercepts of panel sides */
for (i = 1; i <= m; ++i)
{
    #ifdef _WIN32
        scanf_s("%lf%lf", &x[i - 1], &y[i - 1]);
    #else
        scanf("%lf%lf", &x[i - 1], &y[i - 1]);
    #endif
    #ifdef _WIN32
        scanf_s("%*[\n"]");
    #else
        scanf("%*[\n"]");
    #endif
    if (px > 8)
    {
        for (i = 5; i <= px - 4; ++i)
        {
            #ifdef _WIN32
                scanf_s("%lf", &lamda[i - 1]);
            #else
                scanf("%lf", &lamda[i - 1]);
            #endif
            #ifdef _WIN32
                scanf_s("%*[\n"]");
            #else
                scanf("%*[\n"]");
            #endif
        }
    } else {
        scanf("%*[\n"]");
    }
    if (py > 8)
    {
        for (i = 5; i <= py - 4; ++i)
        {
            #ifdef _WIN32
                scanf_s("%lf", &mu[i - 1]);
            #else
                scanf("%lf", &mu[i - 1]);
            #endif
            #ifdef _WIN32
                scanf_s("%*[\n"]");
            #else
                scanf("%*[\n"]");
            #endif
        }
    }
    /* Sort points into panel order */
    /* nag_2d_panel_sort (e02zac).
     * Sort two-dimensional data into panels for fitting bicubic
     * splines
     */
    nag_2d_panel_sort(px, py, lamda, mu, m, x, y, point, &fail);
    if (fail.code != NE_NOERROR)
printf("Error from nag_2d_panel_sort (e02zac).\n%s\n",
fail.message);
exit_status = 1;
goto END;
}
/* Output points in panel order */
for (i = 1; i <= nadres; ++i)
{
    printf("%s\n", "Panel", i);
    iadres = m + i;
    while ((iadres = point[iadres - 1]) > 0)
    {
        printf("%7.2f%7.2f\n", x[iadres - 1], y[iadres - 1]);
    }
}
NAG_FREE(lamda);
NAG_FREE(mu);
NAG_FREE(x);
NAG_FREE(y);
NAG_FREE(point);
return exit_status;

10.2 Program Data

e02zac Example Program Data
10
  9
  10
  0  0.77
  0.70 1.06
  1.44 0.33
  0.21 0.44
  1.01 0.50
  1.84 0.02
  0.71 1.95
  1.00 1.20
  0.54 0.04
  1.53 0.18
  1.00
  0.80
  1.20

10.3 Program Results

e02zac Example Program Results
Panel 1

  0.00  0.77
  0.21  0.44
  0.54  0.04

Panel 2

  0.70  1.06

Panel 3

  0.71  1.95

Panel 4

  1.44  0.33
### Panel 5

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.01</td>
<td>0.50</td>
</tr>
<tr>
<td>1.84</td>
<td>0.02</td>
</tr>
<tr>
<td>1.53</td>
<td>0.18</td>
</tr>
</tbody>
</table>

### Panel 6

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.00</td>
<td>1.20</td>
</tr>
</tbody>
</table>