NAG C Library Function Document

nag_dsb_norm (f16rec)

1 Purpose

nag_dsb_norm (f16rec) calculates the value of the 1-norm, the ∞-norm, the Frobenius norm or the maximum absolute value of the elements of a real n by n symmetric band matrix.

2 Specification

```
#include <nag.h>
#include <nagf16.h>
```

```
void nag_dsb_norm (Nag_OrderType order, Nag_NormType norm, Nag_UploType uplo,
     Integer n, Integer k, const double ab[], Integer pdab, double *r,
     NagError *fail)
```

3 Description

Given a real n by n symmetric band matrix, A, nag_dsb_norm (f16rec) calculates one of the values given by

$$\|A\|_1 = \max_j \sum_{i=1}^{n} |a_{ij}|,$$

$$\|A\|_\infty = \max_i \sum_{j=1}^{n} |a_{ij}|,$$

$$\|A\|_F = \left(\sum_{i=1}^{n} \sum_{j=1}^{n} |a_{ij}|^2 \right)^{1/2}$$

or

$$\max_{i,j} |a_{ij}|.$$

Note that, since A is symmetric, $\|A\|_1 = \|A\|_\infty$.

4 References

The BLAS Technical Forum Standard (2001) *www.netlib.org/blas/blast-forum*

5 Arguments

1: **order** – Nag_OrderType *Input*

On entry: the **order** argument specifies the two-dimensional storage scheme being used, i.e., row-major ordering or column-major ordering. C language defined storage is specified by **order** = **Nag_RowMajor**. See Section 2.2.1.4 of the Essential Introduction for a more detailed explanation of the use of this argument.

Constraint: **order** = **Nag_RowMajor** or **Nag_ColMajor**.

2: **norm** – Nag_NormType *Input*

On entry: specifies the value to be returned.

norm = **Nag_OneNorm**

The 1-norm.

norm = **Nag_InfNorm**

The ∞-norm.

norm = **Nag_FrobeniusNorm**

The Frobenius (or Euclidean) norm.

norm = **Nag_MaxNorm**

The value $\max_{i,j} |a_{ij}|$ (not a norm).

Constraint: **norm** = **Nag_OneNorm**, **Nag_InfNorm**, **Nag_FrobeniusNorm** or **Nag_MaxNorm**.

3: **uplo** – Nag_UploType *Input*

On entry: specifies whether the upper or lower triangular part of A is stored.

uplo = **Nag_Upper**

The upper triangular part of A is stored.

uplo = **Nag_Lower**

The lower triangular part of A is stored.

Constraint: **uplo** = **Nag_Upper** or **Nag_Lower**.

4: **n** – Integer *Input*

On entry: n, the order of the matrix A.

Constraint: $\mathbf{n} \geq 0$.

5: **k** – Integer *Input*

On entry: k, the number of subdiagonals or superdiagonals of the matrix A.

Constraint: $\mathbf{k} \geq 0$.

6: **ab**[dim] – const double *Input*

Note: the dimension, *dim*, of the array **ab** must be at least $\max(1, \mathbf{pdab} \times \mathbf{n})$.

On entry: the n by n symmetric band matrix A. This is stored as a notional two-dimensional array with row elements or column elements stored contiguously. The storage of elements a_{ij} depends on the **order** and **uplo** arguments as follows:

if **order** = **Nag_ColMajor** and **uplo** = **Nag_Upper**,
a_{ij} is stored in **ab**$[k + i - j + (j-1) \times \mathbf{pdab}]$,
for $j = 1, \ldots, n$ and $i = \max(1, j-k), \ldots, j$;
if **order** = **Nag_ColMajor** and **uplo** = **Nag_Lower**,
a_{ij} is stored in **ab**$[i - j + (j-1) \times \mathbf{pdab}]$,
for $j = 1, \ldots, n$ and $i = j, \ldots, \min(n, j+k)$;
if **order** = **Nag_RowMajor** and **uplo** = **Nag_Upper**,
a_{ij} is stored in **ab**$[j - i + (i-1) \times \mathbf{pdab}]$,
for $i = 1, \ldots, n$ and $j = i, \ldots, \min(n, i+k)$;
if **order** = **Nag_RowMajor** and **uplo** = **Nag_Lower**,
a_{ij} is stored in **ab**$[k + j - i + (i-1) \times \mathbf{pdab}]$,
for $i = 1, \ldots, n$ and $j = \max(1, i-k), \ldots, i$.

7: **pdab** – Integer *Input*

On entry: the stride separating row or column elements (depending on the value of **order**) of the matrix A in the array **ab**.

Constraint: **pdab** $\geq$ **k** $+ 1$.

8: **r** – double * *Output*

On exit: the value of the norm specified by **norm**.

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

The NAG error argument (see Section 2.6 of the Essential Introduction).

6 Error Indicators and Warnings

NE_ALLOC_FAIL

Dynamic memory allocation failed.

NE_BAD_PARAM

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

NE_INT

On entry, **k** $=$ ⟨*value*⟩.
Constraint: **k** ≥ 0.

On entry, **n** $=$ ⟨*value*⟩.
Constraint: **n** ≥ 0.

NE_INT_2

On entry, **pdab** $=$ ⟨*value*⟩, **k** $=$ ⟨*value*⟩.
Constraint: **pdab** $\geq$ **k** $+ 1$.

7 Accuracy

The BLAS standard requires accurate implementations which avoid unnecessary over/underflow (see Section 2.7 of The BLAS Technical Forum Standard (2001)).

8 Further Comments

None.

9 Example

See Section 9 of the document for nag_dpbcon (f07hgc).