

NAG C Library Function Document

nag_dsb_norm (f16rec)

1 Purpose

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

2 Specification

```
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

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

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

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

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

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 Parameters

1: **order** – Nag_OrderType *Input*

On entry: the **order** parameter 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 parameter.

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

2: **norm** – Nag_NormType *Input*

On entry: specifies the value to be returned:

if **norm = Nag_OneNorm**, the 1-norm;

if **norm = Nag_InfNorm**, the infinity-norm;

if **norm = Nag_FrobeniusNorm**, the Frobenius (or Euclidean) norm;

if **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 as follows:

if **uplo** = **Nag_Upper**, the upper triangular part of A is stored;

if **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: $n \geq 0$.

5: **k** – Integer *Input*

On entry: k , the number of sub-diagonals or super-diagonals of the matrix A .

Constraint: $k \geq 0$.

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** parameters 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 $j = 1, \dots, n$ and
 $i = \max(1, j - k), \dots, j$;

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

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

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

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**.

Constraints:

if **order** = **Nag_ColMajor**, $\mathbf{pdab} \geq \mathbf{k} + 1$;

if **order** = **Nag_RowMajor**, $\mathbf{pdab} \geq \max(1, \mathbf{n})$.

8: **r** – double * *Output*

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

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

The NAG error parameter (see the Essential Introduction).

6 Error Indicators and Warnings

NE_INT

On entry, **n** = $\langle value \rangle$.

Constraint: **n** \geq 0.

On entry, **k** = $\langle value \rangle$.

Constraint: **k** \geq 0.

On entry, **pdab** = $\langle value \rangle$.

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

NE_BAD_PARAM

On entry, parameter $\langle value \rangle$ had an illegal value.

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).
