

# NAG C Library Function Document

## nag\_dsy\_norm (f16rcc)

### 1 Purpose

nag\_dsy\_norm (f16rcc) calculates the value of the 1-norm, the  $\infty$ -norm, the Frobenius norm or the maximum absolute value of the elements of a real  $n$  by  $n$  symmetric matrix.

### 2 Specification

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

```
void nag_dsy_norm (Nag_OrderType order, Nag_NormType norm, Nag_UploType uplo,
                  Integer n, const double a[], Integer pda, double *r, NagError *fail)
```

### 3 Description

Given a real  $n$  by  $n$  symmetric matrix,  $A$ , nag\_dsy\_norm (f16rcc) 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](http://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  $\infty$ -norm.

**norm = Nag\_FrobeniusNorm**

The Frobenius (or Euclidean) norm.

**norm = Nag\_MaxNorm**

The value  $\max_{ij} |a_{ij}|$  (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:*  **$n \geq 0$ .**

5: **a[*dim*]** – const double *Input*

**Note:** the dimension,  $dim$ , of the array **a** must be at least  $\max(1, pda \times n)$ .

If **order = Nag\_ColMajor**, the  $(i,j)$ th element of the matrix  $A$  is stored in **a**[( $j-1$ )  $\times$  **pda** +  $i-1$ ].

If **order = Nag\_RowMajor**, the  $(i,j)$ th element of the matrix  $A$  is stored in **a**[( $i-1$ )  $\times$  **pda** +  $j-1$ ].

*On entry:* the  $n$  by  $n$  symmetric matrix  $A$ .

If **uplo = Nag\_Upper**, the upper triangle of  $A$  must be stored and the elements of the array below the diagonal are not referenced.

If **uplo = Nag\_Lower**, the lower triangle of  $A$  must be stored and the elements of the array above the diagonal are not referenced.

6: **pda** – Integer *Input*

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

*Constraint:*  **$pda \geq \max(1, n)$ .**

7: **r** – double \* *Output*

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

8: **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  $\langle value \rangle$  had an illegal value.

**NE\_INT**

On entry,  $\mathbf{n} = \langle value \rangle$ .

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

**NE\_INT\_2**

On entry,  $\mathbf{pda} = \langle value \rangle$ ,  $\mathbf{n} = \langle value \rangle$ .

Constraint:  $\mathbf{pda} \geq \max(1, \mathbf{n})$ .

**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 documents for nag\_dpocon (f07fgc) and nag\_dsycon (f07mgc).

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