

# NAG Library Function Document

## nag\_dge\_norm (f16rac)

### 1 Purpose

nag\_dge\_norm (f16rac) calculates the value of the 1-norm, the  $\infty$ -norm, the Frobenius norm, or the maximum absolute value of the elements of a real  $m$  by  $n$  matrix.

### 2 Specification

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

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

### 3 Description

Given a real  $m$  by  $n$  matrix,  $A$ , nag\_dge\_norm (f16rac) calculates one of the values given by

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

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

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

or

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

### 4 References

Basic Linear Algebra Subprograms Technical (BLAST) Forum (2001) *Basic Linear Algebra Subprograms Technical (BLAST) Forum Standard* University of Tennessee, Knoxville, Tennessee <http://www.netlib.org/blas/blast-forum/blas-report.pdf>

### 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 2.3.1.3 in How to Use the NAG Library and its Documentation 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  $\max_{i,j} |a_{ij}|$  (not a norm).

*Constraint:* **norm** = Nag\_OneNorm, Nag\_InfNorm, Nag\_FrobeniusNorm or Nag\_MaxNorm.

3: **m** – Integer *Input*

*On entry:*  $m$ , the number of rows of the matrix  $A$ .

If  $m = 0$ , then **r** is set to zero.

*Constraint:*  $\mathbf{m} \geq 0$ .

4: **n** – Integer *Input*

*On entry:*  $n$ , the number of columns of the matrix  $A$ .

If  $n = 0$ , then **r** is set to zero.

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

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

**Note:** the dimension, *dim*, of the array **a** must be at least

$\max(1, \mathbf{pda} \times \mathbf{n})$  when **order** = Nag\_ColMajor;  
 $\max(1, \mathbf{m} \times \mathbf{pda})$  when **order** = Nag\_RowMajor.

If **order** = Nag\_ColMajor,  $A_{ij}$  is stored in **a**[( $j - 1$ )  $\times$  **pda** +  $i - 1$ ].

If **order** = Nag\_RowMajor,  $A_{ij}$  is stored in **a**[( $i - 1$ )  $\times$  **pda** +  $j - 1$ ].

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

6: **pda** – Integer *Input*

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

*Constraints:*

if **order** = Nag\_ColMajor,  $\mathbf{pda} \geq \max(1, \mathbf{m})$ ;  
if **order** = Nag\_RowMajor,  $\mathbf{pda} \geq \mathbf{n}$ .

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 2.7 in How to Use the NAG Library and its Documentation).

## 6 Error Indicators and Warnings

### NE\_ALLOC\_FAIL

Dynamic memory allocation failed.

See Section 3.2.1.2 in How to Use the NAG Library and its Documentation for further information.

**NE\_BAD\_PARAM**

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

**NE\_INT**

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

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

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

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

**NE\_INT\_2**

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

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

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

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

**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 How to Use the NAG Library and its Documentation 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 How to Use the NAG Library and its Documentation for further information.

**7 Accuracy**

The BLAS standard requires accurate implementations which avoid unnecessary over/underflow (see Section 2.7 of Basic Linear Algebra Subprograms Technical (BLAST) Forum (2001)).

**8 Parallelism and Performance**

nag\_dge\_norm (f16rac) is not threaded in any implementation.

**9 Further Comments**

None.

**10 Example**

See Section 10 in nag\_dgecon (f07agc) and nag\_dtrsna (f08qlc).

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