

# NAG C Library Function Document

## nag\_zhe\_norm (f16ucc)

### 1 Purpose

nag\_zhe\_norm (f16ucc) calculates the value of the 1-norm, the infinity-norm the Frobenius norm, or the maximum absolute value of the elements, of a complex  $n$  by  $n$  Hermitian matrix.

### 2 Specification

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

### 3 Description

Given a complex  $n$  by  $n$  Hermitian matrix,  $A$ , nag\_zhe\_norm (f16ucc) 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](http://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: **a**[*dim*] – const Complex *Input*

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

If **order** = **Nag\_ColMajor**, the  $(i, j)$ th element of the matrix  $A$  is stored in **a**[( $j - 1$ )  $\times$  **pda** +  $i - 1$ ] and 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  $n$  Hermitian 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:*  $\mathbf{pda} \geq \max(1, \mathbf{n})$ .

7: **r** – double \* *Output*

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

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

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

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

### 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 documents for nag\_zpocon (f07fuc) and nag\_zhecon (f07muc).

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