

## NAG C Library Function Document

### nag\_zhp\_norm (f16udc)

#### 1 Purpose

nag\_zhp\_norm (f16udc) calculates the value of the 1-norm, the  $\infty$ -norm, the Frobenius norm or the maximum absolute value of the elements of a complex  $n$  by  $n$  Hermitian matrix, stored in packed form.

#### 2 Specification

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

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

#### 3 Description

Given a complex  $n$  by  $n$  Hermitian matrix,  $A$ , in packed storage, nag\_zhp\_norm (f16udc) 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  $\max_{i,j} |a_{ij}|$  (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:*  **$n \geq 0$ .**

5: **ap[*dim*]** – const Complex *Input*

**Note:** the dimension,  $dim$ , of the array **ap** must be at least  $\max(1, n \times (n + 1)/2)$ .

*On entry:* the  $n$  by  $n$  Hermitian matrix  $A$ , packed by rows or columns. 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 **ap** $[(j - 1) \times j/2 + i - 1]$ , for  $i \leq j$ ;  
 if **order = Nag\_ColMajor** and **uplo = Nag\_Lower**,  
 $a_{ij}$  is stored in **ap** $[(2n - j) \times (j - 1)/2 + i - 1]$ , for  $i \geq j$ ;  
 if **order = Nag\_RowMajor** and **uplo = Nag\_Upper**,  
 $a_{ij}$  is stored in **ap** $[(2n - i) \times (i - 1)/2 + j - 1]$ , for  $i \leq j$ ;  
 if **order = Nag\_RowMajor** and **uplo = Nag\_Lower**,  
 $a_{ij}$  is stored in **ap** $[(i - 1) \times i/2 + j - 1]$ , for  $i \geq j$ .

6: **r** – double \* *Output*

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

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

## **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\_zppcon (f07guc) and nag\_zhpcon (f07puc).

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