

## NAG Library Function Document

### nag\_zamax\_val (f16jsc)

#### 1 Purpose

nag\_zamax\_val (f16jsc) computes, with respect to absolute value, the largest component of a complex vector, along with the index of that component.

#### 2 Specification

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

void nag_zamax_val (Integer n, const Complex x[], Integer incx, Integer *k,
                   double *r, NagError *fail)
```

#### 3 Description

nag\_zamax\_val (f16jsc) computes, with respect to absolute value, the largest component,  $r$ , of an  $n$ -element complex vector  $x$ , and determines the smallest index,  $k$ , such that

$$r = |\operatorname{Re} x_k| + |\operatorname{Im} x_k| = \max_j |\operatorname{Re} x_j| + |\operatorname{Im} x_j|.$$

#### 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: **n** – Integer *Input*  
*On entry:*  $n$ , the number of elements in  $x$ .  
*Constraint:*  $n \geq 0$ .
- 2: **x**[*dim*] – const Complex *Input*  
**Note:** the dimension, *dim*, of the array **x** must be at least  $\max(1, 1 + (n - 1) \times |\mathbf{incx}|)$ .  
*On entry:* the  $n$ -element vector  $x$ .  
 If  $\mathbf{incx} > 0$ ,  $x_i$  must be stored in  $\mathbf{x}[(i - 1) \times \mathbf{incx}]$ , for  $i = 1, 2, \dots, n$ .  
 If  $\mathbf{incx} < 0$ ,  $x_i$  must be stored in  $\mathbf{x}[(n - i) \times |\mathbf{incx}|]$ , for  $i = 1, 2, \dots, n$ .  
 Intermediate elements of **x** are not referenced. If  $n = 0$ , **x** is not referenced and may be **NULL**.
- 3: **incx** – Integer *Input*  
*On entry:* the increment in the subscripts of **x** between successive elements of  $x$ .  
*Constraint:*  $\mathbf{incx} \neq 0$ .
- 4: **k** – Integer \* *Output*  
*On exit:*  $k$ , the index, from the set  $\{0, 1, \dots, n - 1\}$ , of the largest component of  $x$  with respect to absolute value. If  $n = 0$  on input then **k** is returned as  $-1$ .

- 5: **r** – double \* *Output*  
*On exit:* *r*, the largest component of *x* with respect to absolute value. If **n** = 0 on input then **r** is returned as 0.0.
- 6: **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 2.3.1.2 in How to Use the NAG Library and its Documentation for further information.

### NE\_BAD\_PARAM

On entry, argument *<value>* had an illegal value.

### NE\_INT

On entry, **incx** = *<value>*.  
 Constraint: **incx** ≠ 0.

On entry, **n** = *<value>*.  
 Constraint: **n** ≥ 0.

### NE\_INTERNAL\_ERROR

An unexpected error has been triggered by this function. Please contact NAG.  
 See Section 2.7.6 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 2.7.5 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\_zamax\_val (f16jsc) is not threaded in any implementation.

## 9 Further Comments

None.

## 10 Example

This example computes the largest component with respect to absolute value and index of that component for the vector

$$x = (-4 + 2.1i, 3.7 + 4.5i, -6 + 1.2i)^T.$$

## 10.1 Program Text

```

/* nag_zamax_val (f16jsc) Example Program.
 *
 * NAGPRODCODE Version.
 *
 * Copyright 2016 Numerical Algorithms Group.
 *
 * Mark 26, 2016.
 */

#include <stdio.h>
#include <nag.h>
#include <nag_stdlib.h>
#include <nagf16.h>

int main(void)
{
    /* Scalars */
    Integer exit_status, i, incx, ix, k, n;
    double r;
    /* Arrays */
    Complex *x = 0;
    /* Nag Types */
    NagError fail;

    exit_status = 0;
    INIT_FAIL(fail);

    printf("nag_zamax_val (f16jsc) Example Program Results\n\n");

    /* Skip heading in data file */
#ifdef _WIN32
    scanf_s("%*[\n] ");
#else
    scanf("%*[\n] ");
#endif
    /* Read the number of elements and the increment */
#ifdef _WIN32
    scanf_s("%" NAG_IFMT "%" NAG_IFMT "%*[\n] ", &n, &incx);
#else
    scanf("%" NAG_IFMT "%" NAG_IFMT "%*[\n] ", &n, &incx);
#endif

    if (n > 0) {
        /* Allocate memory */
        if (!(x = NAG_ALLOC(MAX(1, 1 + (n - 1) * ABS(incx)), Complex)))
        {
            printf("Allocation failure\n");
            exit_status = -1;
            goto END;
        }
    }
    else {
        printf("Invalid n\n");
        exit_status = 1;
        goto END;
    }

    /* Read the vector x and store forwards or backwards
     * as determined by incx. */
    for (i = 0, ix = (incx > 0 ? 0 : (1-n)*incx); i < n; i++, ix += incx)
#ifdef _WIN32
        scanf_s(" ( %lf , %lf ) ", &x[ix].re, &x[ix].im);
#else
        scanf(" ( %lf , %lf ) ", &x[ix].re, &x[ix].im);
#endif
#ifdef _WIN32
    scanf_s("%*[\n] ");
#else
    scanf("%*[\n] ");
}

```

```

#endif

/* nag_zamax_val (f16jsc).
 * Get absolutely maximum value (r) and location of that value (k)
 * of Complex array */
nag_zamax_val(n, x, incx, &k, &r, &fail);

if (fail.code != NE_NOERROR) {
    printf("Error from nag_zamax_val (f16jsc).\n%s\n", fail.message);
    exit_status = 1;
    goto END;
}

/* Print the absolutely maximum value */
printf("Absolutely maximum element of x is %12.5f\n", r);
/* Print its location */
printf("Index of absolutely maximum element of x is %3" NAG_IFMT "\n", k);

END:
    NAG_FREE(x);

    return exit_status;
}

```

## 10.2 Program Data

```

nag_zamax_val (f16jsc) Example Program Data
  3      1                               : n and incx
 (-4., 2.1) ( 3.7, 4.5) (-6., 1.2)     : Vector x

```

## 10.3 Program Results

```

nag_zamax_val (f16jsc) Example Program Results

Absolutely maximum element of x is      8.20000
Index of absolutely maximum element of x is  1

```

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