NAG Library Function Document

nag_imax_val (f16dnc)

1 Purpose
nag_imax_val (f16dnc) computes the largest component of an integer vector, along with the index of that component.

2 Specification

```c
#include <nag.h>
#include <nagf16.h>
void nag_imax_val (Integer n, const Integer x[], Integer incx, Integer *k, 
                      Integer *i, NagError *fail)
```

3 Description
nag_imax_val (f16dnc) computes the largest component, \( i \), of an \( n \)-element integer vector \( x \), and determines the smallest index, \( k \), such that

\[
i = x_k = \max_j x_j.
\]

4 References

5 Arguments

1: \( n \) – Integer
   \( \text{Input} \)
   On entry: \( n \), the number of elements in \( x \).
   Constraint: \( n \geq 0 \).

2: \( x[\text{dim}] \) – const Integer
   \( \text{Input} \)
   Note: the dimension, \( \text{dim} \), of the array \( x \) must be at least \( \max(1, 1 + (n - 1) \times |\text{incx}|) \).
   On entry: the \( n \)-element vector \( x \).
   If \( \text{incx} > 0 \), \( x_i \) must be stored in \( x[(i - 1) \times |\text{incx}|] \), for \( i = 1, 2, \ldots, n \).
   If \( \text{incx} < 0 \), \( x_i \) must be stored in \( x[(n - i) \times |\text{incx}|] \), for \( i = 1, 2, \ldots, n \).
   Intermediate elements of \( x \) are not referenced. If \( n = 0 \), \( x \) is not referenced and may be \text{NULL}.

3: \( \text{incx} \) – Integer
   \( \text{Input} \)
   On entry: the increment in the subscripts of \( x \) between successive elements of \( x \).
   Constraint: \( \text{incx} \neq 0 \).

4: \( k \) – Integer *
   \( \text{Output} \)
   On exit: \( k \), the index, from the set \( \{0, |\text{incx}|, \ldots, (n - 1) \times |\text{incx}|\} \), of the largest component of \( x \).
   If \( n = 0 \) on input then \( k \) is returned as \(-1\).
5: i – Integer * 
   On exit: i, the largest component of x. If n = 0 on input then i is returned as 0.

6: fail – NagError * 
   The NAG error argument (see Section 3.6 in the Essential Introduction).

6 Error Indicators and Warnings

NE_ALLOC_FAIL
   Dynamic memory allocation failed. 
   See Section 3.2.1.2 in the Essential Introduction 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 3.6.6 in the Essential Introduction 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 the Essential Introduction 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

Not applicable.

9 Further Comments

None.

10 Example

This example computes the largest component and index of that component for the vector

\[ x = (1, 10, 11, -2, 9)^T. \]
10.1 Program Text

/* nag_imax_val (f16dnc) Example Program.
 * Copyright 2014 Numerical Algorithms Group.
 * Mark 9, 2009.
 */

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

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

    exit_status = 0;
    INIT_FAIL(fail);

    printf("nag_imax_val (f16dnc) 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

    xlen = MAX(1, 1 + (n - 1)*ABS(incx));

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

    /* Input vector x */
    for (j = 0; j < xlen; j = j + incx)
    {
        #ifdef _WIN32
            scanf_s("%"NAG_IFMT"", &x[j]);
        #else
            scanf("%"NAG_IFMT"", &x[j]);
        #endif
    }

    END:
    return exit_status;
}
/* nag_imax_val (f16dnc).
* Get maximum value (i) and location of that value (k)
* of Integer vector */
int nag_imax_val(int n, int *x, int incx, int *k, int *i, NagError *fail);

if (fail.code != NE_NOERROR)
{
    printf("Error from nag_imax_val (f16dnc).\n%s\n", fail.message);
    exit_status = 1;
    goto END;
}

/* Print the maximum value */
printf("Maximum element of x is %12"NAG_IFMT"\n", i);
/* Print its location */
printf("Index of maximum element of x is %3"NAG_IFMT"\n", k);

END:
NAG_FREE(x);
return exit_status;

10.2 Program Data

nag_imax_val (f16dnc) Example Program Data
5 1
1 10 11 -2 9
: n and incx
: Array x

10.3 Program Results

nag_imax_val (f16dnc) Example Program Results

Maximum element of x is 11
Index of maximum element of x is 2