NAG Library Function Document

nag_dtr_load (f16qgc)

1 Purpose

nag_dtr_load (f16qgc) initializes a real triangular matrix.

2 Specification

```
#include <nag.h>
#include <nagf16.h>
void nag_dtr_load (Nag_OrderType order, Nag_UploType uplo, Integer n,
     double alpha, double diag, double a[], Integer pda, NagError *fail)
```

3 Description

nag_dtr_load (f16qgc) forms the real n by n triangular matrix A given by

$$a_{ij} = \begin{cases} d & \text{if } i = j \\ \alpha & \text{if } i \neq j \end{cases}.$$

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: **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.

3: **n** – Integer *Input*

On entry: n, the order of the matrix A.

Constraint: **n** ≥ 0.

4: **alpha** – double *Input*

On entry: the value, α, to be assigned to the off-diagonal elements of A.

5: **diag** – double *Input*

On entry: the value, d, to be assigned to the diagonal elements of A.

6: **a**[dim] – double *Output*

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

On exit: the n by n triangular matrix A.

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

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

If **uplo** = Nag_Upper, A is upper triangular and the elements of the array corresponding to the lower triangular part of A are not referenced.

If **uplo** = Nag_Lower, A is lower triangular and the elements of the array corresponding to the upper triangular part of A are not referenced.

7: **pda** – Integer *Input*

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

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

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 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, **n** = ⟨*value*⟩.
Constraint: **n** ≥ 0.

NE_INT_2

On entry, **pda** = ⟨*value*⟩, **n** = ⟨*value*⟩.
Constraint: **pda** $\geq \max(1, \mathbf{n})$.

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_dtr_load (f16qgc) is not threaded in any implementation.

9 Further Comments

None.

10 Example

This example initializes the lower triangular matrix A with diagonal elements given by $d = 3.45$ and off-diagonal elements given by $\alpha = 1.23$.

10.1 Program Text

```
/* nag_dtr_load (f16qgc) 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>
#include <nagx04.h>

int main(void)
{

  /* Scalars */
  double alpha, diag;
  Integer exit_status, n, pda;

  /* Arrays */
  double *a = 0;
  char nag_enum_arg[40];

  /* Nag Types */
  NagError fail;
  Nag_MatrixType matrix;
  Nag_OrderType order;
  Nag_UploType uplo;

#ifdef NAG_COLUMN_MAJOR
  order = Nag_ColMajor;
#else
  order = Nag_RowMajor;
#endif

  exit_status = 0;
  INIT_FAIL(fail);
```

```
  printf("nag_dtr_load (f16qgc) Example Program Results\n\n");

  /* Skip heading in data file */
#ifdef _WIN32
  scanf_s("%*[^\n] ");
#else
  scanf("%*[^\n] ");
#endif
  /* Read the problem dimension */
#ifdef _WIN32
  scanf_s("%" NAG_IFMT "%*[^\n] ", &n);
#else
  scanf("%" NAG_IFMT "%*[^\n] ", &n);
#endif
  /* Read uplo */
#ifdef _WIN32
  scanf_s("%39s%*[^\n] ", nag_enum_arg, (unsigned)_countof(nag_enum_arg));
#else
  scanf("%39s%*[^\n] ", nag_enum_arg);
#endif
  /* nag_enum_name_to_value (x04nac).
   * Converts NAG enum member name to value
   */
  uplo = (Nag_UploType) nag_enum_name_to_value(nag_enum_arg);
  /* Read scalar parameters */
#ifdef _WIN32
  scanf_s("%lf%lf%*[^\n] ", &alpha, &diag);
#else
  scanf("%lf%lf%*[^\n] ", &alpha, &diag);
#endif

  pda = n;

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

  /* nag_dtr_load (f16qgc).
   * Triangular matrix initialize.
   *
   */
  nag_dtr_load(order, uplo, n, alpha, diag, a, pda, &fail);
  if (fail.code != NE_NOERROR) {
    printf("Error from nag_dtr_load (f16qgc).\n%s\n", fail.message);
    exit_status = 1;
    goto END;
  }

  /* Print output */
  /* nag_gen_real_mat_print (x04cac).
   * Print real general matrix (easy-to-use)
   */
  if (uplo == Nag_Upper)
    matrix = Nag_UpperMatrix;
  else
    matrix = Nag_LowerMatrix;

  fflush(stdout);
  nag_gen_real_mat_print(order, matrix, Nag_NonUnitDiag,
```

```
                        n, n, a, pda, "Matrix A", 0, &fail);
  if (fail.code != NE_NOERROR) {
    printf("Error from nag_gen_real_mat_print (x04cac).\n%s\n", fail.message);
    exit_status = 1;
    goto END;
  }

END:
  NAG_FREE(a);

  return exit_status;
}
```

10.2 Program Data

```
nag_dtr_load (f16qgc) Example Program Data
  4                           :Value of n
  Nag_Lower                   :Value of uplo
  1.23 3.45                   :Values of alpha, diag
```

10.3 Program Results

```
nag_dtr_load (f16qgc) Example Program Results

 Matrix A
             1          2          3          4
 1      3.4500
 2      1.2300     3.4500
 3      1.2300     1.2300     3.4500
 4      1.2300     1.2300     1.2300     3.4500
```