

# NAG C Library Function Document

## dtbsv (f06pkc)

### 1 Purpose

dtbsv (f06pkc) performs one of the matrix-vector operations

$$x \leftarrow A^{-1}x \text{ or } x \leftarrow A^{-T}x,$$

where  $A$  is an  $n$  by  $n$  real triangular band matrix with  $k$  sub-diagonals or super-diagonals, and  $x$  is an  $n$  element real vector.  $A^{-T}$  denotes  $(A^T)^{-1}$  or equivalently  $(A^{-1})^T$ .

No test for singularity or near-singularity of  $A$  is included in this function. Such tests must be performed before calling this function.

### 2 Specification

```
#include <nag.h>
#include <nagf06.h>
```

```
void dtbsv (MatrixTriangle uplo, MatrixTranspose trans, MatrixUnitTriangular diag,
           Integer n, Integer k, const double a[], Integer tda, double x[], Integer incx)
```

### 3 Arguments

- 1: **uplo** – MatrixTriangle *Input*  
*On entry:* specifies whether  $A$  upper or lower triangular as follows:  
     if **uplo** = **UpperTriangle**,  $A$  is upper triangular;  
     if **uplo** = **LowerTriangle**,  $A$  is lower triangular.  
*Constraint:* **uplo** = **UpperTriangle** or **LowerTriangle**.
- 2: **trans** – MatrixTranspose *Input*  
*On entry:* specifies the operation to be performed as follows:  
     if **trans** = **NoTranspose**,  $x \leftarrow Ax$ ;  
     if **trans** = **Transpose** or **ConjugateTranspose**,  $x \leftarrow A^T x$ .  
*Constraint:* **trans** = **NoTranspose**, **Transpose** or **ConjugateTranspose**.
- 3: **diag** – MatrixUnitTriangular *Input*  
*On entry:* specifies whether  $A$  has non-unit or unit diagonal elements, as follows:  
     if **diag** = **NotUnitTriangular**, the diagonal elements are stored explicitly;  
     if **diag** = **UnitTriangular**, the diagonal elements are assumed to be 1, and are not referenced.  
*Constraint:* **diag** = **NotUnitTriangular** or **UnitTriangular**.
- 4: **n** – Integer *Input*  
*On entry:*  $n$ , the order of the matrix  $A$ .  
*Constraint:*  $n \geq 0$ .
- 5: **k** – Integer *Input*  
*On entry:*  $k$ , the number of sub-diagonals or super-diagonals of the matrix  $A$ .  
*Constraint:*  $k \geq 0$ .

- 6: **a**[**n** × **tda**] – const double *Input*  
*On entry:* the  $n$  by  $n$  triangular band matrix  $A$ , stored in  $n$  rows and  $k + 1$  columns. More precisely,  
 if **uplo** = **UpperTriangle**, the elements of the upper triangle of  $A$  within the band must be stored with element  $a_{ij}$  in **a**[ $i - 1$ ][ $j - i$ ] for  $1 \leq i \leq n$  and  $i \leq j \leq \min(n, i + k)$ ;  
 if **uplo** = **LowerTriangle**, the elements of the lower triangle of  $A$  within the band must be stored with element  $a_{ij}$  in **a**[ $i - 1$ ][ $k + j - i$ ] for  $1 \leq i \leq n$  and  $\max(1, i - k) \leq j \leq i$ .
- 7: **tda** – Integer *Input*  
*On entry:* the second dimension of the array **a** as declared in the function from which dtbsv (f06pkc) is called.  
*Constraint:* **tda**  $\geq$  **k** + 1.
- 8: **x**[**n**] – double *Input/Output*  
*On entry:* the vector  $x$  of length  $n$ .  
*On exit:* the updated vector  $x$ .
- 9: **incx** – Integer *Input*  
*On entry:* the increment in the subscripts of **x** between successive elements of  $x$ .  
*Constraint:* **incx**  $\neq$  0.

#### 4 Error Indicators and Warnings

If a function is called with an invalid argument then an error message is output on stderr, giving the name of the function and the number of the first invalid argument, and execution is terminated.

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