

## NAG Library Routine Document

### F01VCF (DTPTR)

**Note:** before using this routine, please read the Users' Note for your implementation to check the interpretation of *bold italicised* terms and other implementation-dependent details.

#### 1 Purpose

F01VCF (DTPTR) unpacks a real triangular matrix, stored in packed format in a one-dimensional array, to full format in a two-dimensional array. Packed storage format is described in Section 3.3.2 in the F07 Chapter Introduction.

#### 2 Specification

```
SUBROUTINE F01VCF (UPLO, N, AP, A, LDA, INFO)
INTEGER          N, LDA, INFO
REAL (KIND=nag_wp) AP(N*(N+1)/2), A(LDA,*)
CHARACTER(1)     UPLO
```

The routine may be called by its LAPACK name *dtptr*.

#### 3 Description

F01VCF (DTPTR) unpacks a real  $n$  by  $n$  triangular matrix  $A$ , stored in a one-dimensional array of length  $n(n+1)/2$  to conventional storage in a two-dimensional array. This routine is intended for possible use in conjunction with routines from Chapters F06, F07 and F08 where some routines use triangular matrices stored in the packed form.

#### 4 References

None.

#### 5 Parameters

- |    |  |              |
|----|--|--------------|
| 1: | UPLO – CHARACTER(1)<br><i>On entry:</i> specifies whether $A$ is upper or lower triangular.<br>UPLO = 'U'<br>$A$ is upper triangular.<br>UPLO = 'L'<br>$A$ is lower triangular.<br><i>Constraint:</i> UPLO = 'U' or 'L'. | <i>Input</i> |
| 2: | N – INTEGER<br><i>On entry:</i> $n$ , the order of the matrix $A$ .<br><i>Constraint:</i> $N \geq 1$ .   | <i>Input</i> |
| 3: | AP( $N \times (N + 1)/2$ ) – REAL (KIND=nag_wp) array<br><i>On entry:</i> the $n$ by $n$ triangular matrix $A$ , packed by columns.  | <i>Input</i> |

More precisely,

if UPLO = 'U', the upper triangle of  $A$  must be stored with element  $A_{ij}$  in  $AP(i + j(j - 1)/2)$  for  $i \leq j$ ;

if UPLO = 'L', the lower triangle of  $A$  must be stored with element  $A_{ij}$  in  $AP(i + (2n - j)(j - 1)/2)$  for  $i \geq j$ .

4:  $A(LDA,*)$  – REAL (KIND=nag\_wp) array *Output*

**Note:** the second dimension of the array  $A$  must be at least  $N$ .

*On exit:* the triangular matrix  $A$ .

If UPLO = 'U',  $A$  is upper triangular and the elements of the array below the diagonal are not referenced.

If UPLO = 'L',  $A$  is lower triangular and the elements of the array above the diagonal are not referenced.

5: LDA – INTEGER *Input*

*On entry:* the first dimension of the array  $A$  as declared in the (sub)program from which F01VCF (DTPTR) is called.

*Constraint:*  $LDA \geq \max(1, N)$ .

6: INFO – INTEGER *Output*

*On exit:* INFO = 0 unless the routine detects an error (see Section 6).

## 6 Error Indicators and Warnings

Errors or warnings detected by the routine:

INFO < 0

If INFO =  $-i$ , argument  $i$  had an illegal value. An explanatory message is output, and execution of the program is terminated.

## 7 Accuracy

Not applicable.

## 8 Further Comments

None.

## 9 Example

This example reads in a triangular matrix packed by columns and unpacks it to full format.

### 9.1 Program Text

```

Program f01vcfe
!      F01VCF Example Program Text
!
!      Mark 24 Release. NAG Copyright 2012.
!
!      .. Use Statements ..
!      Use nag_library, Only: dtptr, nag_wp, x04cbf
!      .. Implicit None Statement ..
!      Implicit None

```

```

! .. Parameters ..
Integer, Parameter                :: incl = 1, indent = 0, ncols = 80,    &
                                :: nin = 5, nout = 6
Character (1), Parameter         :: diag = 'N', intlabel = 'I', matrix = &
                                'G', nolabel = 'N'
Character (4), Parameter         :: form = 'F5.2'
! .. Local Scalars ..
Integer                          :: i, ifail, info, lda, lenap, n
Character (18)                   :: title
Character (1)                     :: uplo
! .. Local Arrays ..
Real (Kind=nag_wp), Allocatable :: a(:,,:), ap(:)
Character (1)                     :: clabs(1), rlabs(1)
! .. Executable Statements ..
Write (nout,*) 'F01VCF Example Program Results'
! Skip heading in data file
Read (nin,*)
Write (nout,*)
Flush (nout)
Read (nin,*) n, uplo
lda = n
lenap = (n*(n+1))/2
Allocate (a(lda,n),ap(lenap))

! Read a packed vector of order n
Do i = 1, lenap
  Read (nin,*) ap(i)
End Do

! Print the packed vector
title = 'Packed Matrix AP: '
ifail = 0
Call x04cbf(matrix,diag,lenap,incl,ap,lenap,form,title,intlabel,rlabs, &
  nolabel,clabs,ncols,indent,ifail)

Write (nout,*)
Flush (nout)

! Convert to triangular form
info = 0
! The NAG name equivalent of dtptr is f01vcf
Call dtptr(uplo,n,ap,a,lda,info)

! Print the unpacked matrix
title = 'Unpacked Matrix A:'
ifail = 0
Call x04cbf(uplo,diag,n,n,a,lda,form,title,intlabel,rlabs,intlabel, &
  clabs,ncols,indent,ifail)

End Program f01vcfe

```

## 9.2 Program Data

F01VCF Example Program Data

```

4 'U'                                : n, uplo
1.1                                  : Packed Matrix AP
1.2
2.2
1.3
2.3
3.3
1.4
2.4
3.4
4.4

```

### 9.3 Program Results

F01VCF Example Program Results

Packed Matrix AP:

```
1  1.10
2  1.20
3  2.20
4  1.30
5  2.30
6  3.30
7  1.40
8  2.40
9  3.40
10 4.40
```

Unpacked Matrix A:

```
      1      2      3      4
1  1.10  1.20  1.30  1.40
2      2.20  2.30  2.40
3      3.30  3.40
4
```

---