

# NAG Library Routine Document

## F06QKF

**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

F06QKF permutes the rows or columns of a real rectangular matrix using a real array of permutations.

### 2 Specification

```
SUBROUTINE F06QKF (SIDE, TRANS, N, PERM, K, B, LDB)
INTEGER          N, K, LDB
REAL (KIND=nag_wp) PERM(*), B(LDB,*)
CHARACTER(1)    SIDE, TRANS
```

### 3 Description

F06QKF performs one of the permutation operations

$$\begin{aligned} B &\leftarrow P^T B, & B &\leftarrow PB, \\ B &\leftarrow BP^T & \text{or} & B &\leftarrow BP, \end{aligned}$$

where  $B$  is a real matrix, and  $P$  is a permutation matrix.

$P$  is represented in the form

$$P = P_{1,p_1} P_{2,p_2} \cdots P_{n,p_n},$$

where  $P_{i,j}$  is the permutation matrix that interchanges items  $i$  and  $j$ ; that is,  $P_{i,j}$  is the unit matrix with rows and columns  $i$  and  $j$  interchanged. If  $i = j$ ,  $P_{i,j} = I$ .

Let  $m$  denote the number of rows of  $B$  if  $\text{SIDE} = \text{'L'}$ , or the number of columns of  $B$  if  $\text{SIDE} = \text{'R'}$ : the routine does not require  $m$  to be passed as an argument, but assumes that  $m \geq p_i$ , for  $i = 1, 2, \dots, n$ .

This routine requires the indices  $p_i$  to be supplied in a real array (the routine takes the integer part of the array elements); F06QJF performs the same operation with the indices supplied in an integer array.

### 4 References

None.

### 5 Parameters

1: SIDE – CHARACTER(1) *Input*  
 2: TRANS – CHARACTER(1) *Input*

*On entry:* specifies the operation to be performed.

SIDE = 'L' and TRANS = 'T'  
 $B \leftarrow P^T B.$

SIDE = 'L' and TRANS = 'N'  
 $B \leftarrow PB.$

SIDE = 'R' and TRANS = 'T'  
 $B \leftarrow BP^T.$

SIDE = 'R' and TRANS = 'N'  
 $B \leftarrow BP.$

*Constraints:*

SIDE = 'L' or 'R';  
 TRANS = 'N' or 'T'.

- 3: N – INTEGER *Input*  
*On entry:*  $n$ , the number of interchanges in the representation of  $P$ .  
*Constraint:*  $N \geq 0$ .
- 4: PERM(\*) – REAL (KIND=nag\_wp) array *Input*  
**Note:** the dimension of the array PERM must be at least  $\max(1, N)$ .  
*On entry:* the  $n$  indices  $p_i$  which define the interchanges in the representation of  $P$ . It is usual to have  $p_i \geq i$ , but this is not necessary.  
*Constraint:*  $1 \leq \text{PERM}(i) \leq m$ .
- 5: K – INTEGER *Input*  
*On entry:*  $k$ , the number of columns of  $B$  if SIDE = 'L', or the number of rows of  $B$  if SIDE = 'R'.  
*Constraint:*  $K \geq 0$ .
- 6: B(LDB,\*) – REAL (KIND=nag\_wp) array *Input/Output*  
**Note:** the second dimension of the array B must be at least  $\max(1, K)$  if SIDE = 'L' and at least  $\max\left(1, \max_k \{\text{int PERM}(k)\}\right)$  if SIDE = 'R'.  
*On entry:* the original matrix  $B$ ;  $B$  is  $m$  by  $k$  if SIDE = 'L', or  $k$  by  $m$  if SIDE = 'R'.  
*On exit:* the permuted matrix  $B$ .
- 7: LDB – INTEGER *Input*  
*On entry:* the first dimension of the array B as declared in the (sub)program from which F06QKF is called.  
*Constraints:*  
 if SIDE = 'L',  $\text{LDB} \geq \max(1, m)$ ;  
 if SIDE = 'R',  $\text{LDB} \geq \max(1, K)$ .

## 6 Error Indicators and Warnings

None.

## 7 Accuracy

Not applicable.

## 8 Further Comments

None.

## 9 Example

None.