NAG Fortran 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 performs one of the permutation operations

$$B \leftarrow P^T B, \quad B \leftarrow PB, \quad B \leftarrow BP^T \quad \text{or} \quad B \leftarrow BP,$$

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

This routine requires the indices p_i to be supplied in an ***double precision*** array (the routine takes the integer part of the array elements); F06QJF performs the same operation with the indices supplied in an INTEGER array.

2 Specification

```
SUBROUTINE F06QKF (SIDE, TRANS, N, PERM, K, B, LDB)
INTEGER             N, K, LDB
double precision    PERM(*), B(LDB,*)
CHARACTER*1         SIDE, TRANS
```

3 Description

None.

4 References

None.

5 Parameters

1: SIDE – CHARACTER*1 *Input*

2: TRANS – CHARACTER*1 *Input*

On entry: specify the operation to be performed as follows:

if SIDE = 'L' and TRANS = 'T', $B \leftarrow P^T B$;
if SIDE = 'L' and TRANS = 'N', $B \leftarrow PB$;
if SIDE = 'R' and TRANS = 'T', $B \leftarrow BP^T$;
if SIDE = 'R' and TRANS = 'N', $B \leftarrow BP$.

Constraint: 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: $\mathrm{N} \geq 0$.

4: PERM$(*)$ – ***double precision*** array *Input*

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: $1 \leq \mathrm{PERM}(i) \leq m$.

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: $\mathrm{K} \geq 0$.

6: B(LDB,$*$) – ***double precision*** array *Input/Output*

Note: the second dimension of the array B must be at least $\max(1, \mathrm{K})$ if SIDE $=$ 'L' and at least $\max(1, m)$ 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.

Constraint: $\mathrm{LDB} \geq \max(1, m)$ if SIDE $=$ 'L'; $\mathrm{LDB} \geq \max(1, \mathrm{K})$ if SIDE $=$ 'R'.

6 Error Indicators and Warnings

None.