X04BWFP

NAG Parallel Library Routine Document

Note: Before using this routine, please read the Users' Note for your implementation to check for implementation-dependent details. You are advised to enclose any calls to NAG Parallel Library routines between calls to Z01AAFP and Z01ABFP.

1 Description

X04BWFP outputs an m by n complex matrix A stored in a cyclic 2-d block distribution on a logical grid of processors to an external file (in its natural, non-distributed form).

This routine outputs matrices stored in the form required by some routines in Chapter F04.

2 Specification

```
      SUBROUTINE X04BWFP(ICNTXT, NOUT, M, N, NB, A, LDA, FORMAT, WORK,
     1                   IFAIL)
      COMPLEX*16         A(LDA,*), WORK(N)
      INTEGER            ICNTXT, NOUT, M, N, NB, LDA, IFAIL
      CHARACTER*(*)      FORMAT
```

3 Data Distribution

3.1 Definitions

The following definitions are used in describing the data distribution within this document:

m_p	–	the number of rows in the logical processor grid.
n_p	–	the number of columns in the logical processor grid.
p_r	–	the row grid coordinate of the calling processor.
p_c	–	the column grid coordinate of the calling processor.
N_b	–	the blocking factor for the distribution of the rows and columns of a matrix X.
$\text{numroc}(\alpha, b_\ell, q, s, k)$	–	a function which gives the **num**ber of **r**ows **o**r **c**olumns of a distributed matrix owned by the processor with the row or column coordinate q (p_r or p_c), where α is the total number of rows or columns of the matrix, b_ℓ is the blocking factor used (N_b), s is the row or column coordinate of the processor that possesses the first row or column of the distributed matrix and k is either n_p or m_p. The Library provides the function Z01CAFP (NUMROC) for the evaluation of numroc.

3.2 Global and Local Arguments

The input arguments M, N, NB and IFAIL are all global, and so must have the same value on entry to the routine on each processor. The output argument IFAIL is global and so will have the same value on exit from the routine on each processor. NOUT and FORMAT are only referenced on the root (or {0,0}) processor since it is only the root (or {0,0} processor) which performs output.

3.3 Distribution Strategy

The matrix A should be partitioned into N_b by N_b square blocks and stored in an array A in a cyclic 2-d block distribution. This data distribution is described in more detail in the Essential Introduction of the NAG Parallel Library Manual and in the F04 Chapter Introduction.

This routine assumes that the data has already been correctly distributed, and if this is not the case will fail to produce correct results.

4 Arguments

1: ICNTXT — INTEGER *Local Input*

On entry: the BLACS context used by the communication mechanism, usually returned by a call to Z01AAFP.

2: NOUT — INTEGER *Local Input*

On entry: the unit number to which the output will be directed.

Constraint: $0 \leq \text{NOUT} \leq 99$.

3: M — INTEGER *Global Input*

On entry: the number of rows of the matrix A, m.

Constraint: $\text{M} \geq 0$.

4: N — INTEGER *Global Input*

On entry: the number of columns of the matrix A, n.

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

5: NB — INTEGER *Global Input*

On entry: the blocking factor for distributing the matrix A, N_b.

Constraint: $\text{NB} \geq 1$.

6: A(LDA,$*$) — COMPLEX*16 array *Local Input*

Note: the second dimension of the array A must be at least max(1,numroc(N,NB,p_c,0,n_p)).

On entry: the local part of the matrix A, distributed in a cyclic 2-d block fashion.

7: LDA — INTEGER *Local Input*

On entry: the first dimension of the array A as declared in the (sub)program from which X04BWFP is called.

Constraint: LDA $\geq$ max(1,numroc(M,NB,p_r,0,m_p))

8: FORMAT — CHARACTER*(*) *Global Input*

On entry: the format which will be used for output of the elements of A.

Constraint: any legal Fortran format for the output of floating-point numbers.

Note: X04BWFP automatically encloses each complex number in brackets and inserts a comma between the real and imaginary parts.

9: WORK(N) — COMPLEX*16 array *Local Workspace*

10: IFAIL — INTEGER *Global Input/Global Output*

On entry: IFAIL must be set to 0, -1 or 1. For users not familiar with this parameter (described in the Essential Introduction) the recommended values are:

IFAIL = 0, if multigridding is **not** employed;
IFAIL = -1, if multigridding is employed.

On exit: IFAIL = 0 unless the routine detects an error (see Section 5).

5 Errors and Warnings

If on entry IFAIL = 0 or −1, explanatory error messages are output from the root processor (or processor {0,0} when the root processor is not available) on the current error message unit (as defined by X04AAF).

Errors or warnings specified by the routine:

IFAIL = −2000

The routine has been called with an invalid value of ICNTXT on one or more processors.

IFAIL = −1000

The logical processor grid and library mechanism (Library Grid) have not been correctly defined, see Z01AAFP.

IFAIL = $-i$

On entry, the ith argument had an invalid value. This error occurred either because a global argument did not have the same value on all logical processors, or because its value on one or more processors was incorrect. An explanatory message distinguishes between these two cases.

IFAIL = 1

An error has occurred in writing to unit NOUT. The file may already have been opened for reading only or the user may have run out of disk space.

6 Further Comments

Output is performed by the root processor or processor {0,0} if the root processor is not available. All other processors communicate their local portion of the matrix to the root (or {0,0}) processor.

7 References

[1] Dongarra J J and Whaley R C (1995) A users' guide to the BLACS v1.0. *LAPACK Working Note 94 (Technical Report CS-95-281)* Department of Computer Science, University of Tennessee, 107 Ayres Hall, Knoxville, TN 37996-1301, USA.
URL: http://www.netlib.org/lapack/lawns/lawn94.ps

8 Example

Please refer to the Example Program for X04BVFP.