F01YEFP

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

F01YEFP generates and distributes a real dense vector x of length n conformally to a sparse matrix A on a logical grid of processors (see Section 2.5 of the F11 Chapter Introduction).

This routine distributes vectors in the form required by a number of F11 routines (see the F01 Chapter Introduction). A user-supplied subroutine is required to generate a contiguous part of the vector x.

The routine F11ZAFP must be called prior to F01YEFP to set up auxiliary information about the sparse matrix A in the array IAINFO.

2 Specification

```
SUBROUTINE F01YEFP(ICNTXT, GVEC, N, X, IAINFO, IFAIL)
DOUBLE PRECISION   X(*)
INTEGER            ICNTXT, N, IAINFO(*), IFAIL
EXTERNAL           GVEC
```

3 Data Distribution

3.1 Definitions

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

m_l – the number of vector elements stored on the calling processor (= IAINFO(3), see IAINFO).

3.2 Global and Local Arguments

The input arguments N and IFAIL are 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 return the same value on exit from the routine on each processor. The external procedure GVEC is global. The remaining arguments are local.

3.3 Distribution Strategy

The vector x is distributed conformally to the sparse matrix A, i.e., x is distributed across the logical processor grid in the same way as each of the columns of the matrix A is. This data distribution is described in more detail in Section 2.5 of the F11 Chapter Introduction.

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: GVEC — SUBROUTINE, supplied by the user. *Global External Procedure*

GVEC must return the part $x(i_1 : i_2)$ of the vector to be distributed in the array XL.

Its specification is:

```
SUBROUTINE          GVEC(I1, I2, XL)
DOUBLE PRECISION    XL(*)
INTEGER             I1, I2
```

1: I1 — INTEGER *Local Input*
On entry: i_1, the first element of the part of x to be generated.

2: I2 — INTEGER *Local Input*
On entry: i_2, the last element of the part of x to be generated.

3: XL(∗) — DOUBLE PRECISION array *Local Output*
On exit: XL must contain the part $x(i_1 : i_2)$ of the vector x.

GVEC must be declared as EXTERNAL in the (sub)program from which F01YEFP is called. Arguments denoted as *Input* must **not** be changed by this procedure.

3: N — INTEGER *Global Input*

On entry: n, the order of the vector x. It must contain the same value as the parameter N used in a prior call of F11ZAFP in which the array IAINFO was initialised.

Constraint: $\mathrm{N} \geq 1$.

4: X(∗) — DOUBLE PRECISION array *Local Output*

Note: the dimension of the array X must be at least $\max(1, m_l)$.

On exit: the local part of the vector x.

5: IAINFO(∗) — INTEGER array *Local Input*

Note: the dimension of the array IAINFO must be at least max (2,IAINFO(2)).

On entry: the first IAINFO(2) elements of IAINFO contain auxiliary information about the matrix A. The array IAINFO must be initialised by a prior call of F11ZAFP. The first IAINFO(2) elements of IAINFO **must not** be changed between successive calls to library routines involving the matrix A.
Note: On exit from F11ZAFP, the element IAINFO(3) contains m_l, the number of rows of the matrix assigned to the calling processor.

6: 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 detected 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. For global arguments, this may also be caused by an argument not having the same value on all logical processors. An explanatory message distinguishes between these two cases.

IFAIL $= 1$

IAINFO was not initialised by a prior call of F11ZAFP.

6 Further Comments

This routine may be used to distribute the data in the form required by a number of the routines in Chapter F11 (see the F01 Chapter Introduction).

6.1 Parallelism Detail

The routine generates the vector on each logical processor independently.

7 References

None.

8 Example

See the Example Program for F11BAFP.