Project 1, due on 03/20.

Problem 1. Implementing Collective Communication Calls for Undergraduate Students.

The current parallel matrix-vector multiplication algorithm using column-wise decomposition utilizes point-to-point communication to implement functions reading in the vector data from a file and printing out the result respectively. See C functions read_block_vector() and print_block_vector(). Rewrite these two functions to use collective communication to implement the same functionality respectively. The code framework is at the folder:

/afs/crc.nd.edu/user/z/zxu2/Public/ACMS40212-S12/col_decomp_mat_vec_multi

on CRC cluster.

Generate a 1024×1024 matrix and a vector of size 1024 to test your result. The code to generate the data is at:

/afs/crc.nd.edu/user/z/zxu2/Public/ACMS40212-S12/col_decomp_mat_vec_multi/data_gen

Use 8 nodes to run the program. Compare your result with the one computed by the current code. This project must be done individually.

Hand-In.

1. The hardcopy of your source code (Also send the source code to me by email. Please use the email title: Project 2: your name).

2. A report which contains results and a description of your algorithm using the pseudo code language. You need to explain which MPI collective communication function is used and how it is used, and the data structure used to send and receive vector data.

Problem 2. Using Process Topology to Implement Matrix-Vector Multiplication in Parallel for Graduate Students.

Use 2D block decomposition and process topology to implement matrix-vector multiplication in parallel.

The code framework is at the folder:

/afs/crc.nd.edu/user/z/zxu2/Public/ACMS40212-S12/2D_decomp_mat_vec_multi

on CRC cluster.

When distributing the vector among processors, implement the algorithm shown in Figure (b) on page 22 of lecture notes "**Parallel matrix algorithms (part 2)**".

Use row communicators and column communicators to scatter and broadcast the vector.

Use a 4×2 process grid to test the communication scheme shown in Figure (b). Generate a 1024×1024 matrix and a vector of size 1024 to test your result. The code to generate the data is at:

/afs/crc.nd.edu/user/z/zxu2/Public/ACMS40212-S12/col_decomp_mat_vec_multi/data_gen

Hand-In.

1. The hardcopy of your source code (Also send the source code to me by email. Please use the email title: Project 2: your name).

2. A report which contains results and a description of your algorithm using the pseudo code language. You need to explain which MPI collective communication function is used and how it is used, and the data structure used to send and receive vector data.

.