Assignment 3

April 6, 2020

Write a parallel program computing the product of two $n \times n$ dense matrices, $C = A \times B$, using a master process and p worker processes. The elements in the matrices are floating-point numbers.

The inputs to the master process program are:

- Size of the matrices, n.
- Number of worker process, p.

The inputs to the worker process program are:

- IP address of the computer where the master is executed, or
- The host name of the computer where the master is executed.

Assumptions:

- We assume n is a multiple of p.
- The master process can fill the matrices A and B in different ways (from files, initialization in the program, etc). We leave it to you.

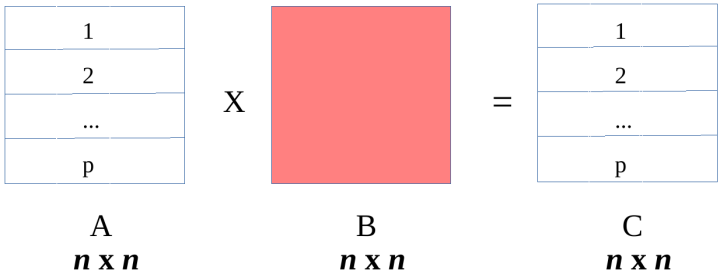

Figure 1: Matrix multiplication of two dense square matrices, A and B. There is one-to-one mapping between slices of A and the p worker processes. Each worker process computes its slice of C.

The matrices are decomposed as shown in the Figure 1. The steps of the program are below:

- Matrices A and B are originally in the memory of the master process.
- The master process horizontally partitions matrix A into p equal slices. Each slice has $\frac{n}{p}$ rows. It sends the slice of A and the whole matrix B to each of the worker processes.
- There is one-to-one mapping between the partitions of A and worker processes.
- Each worker process computes the corresponding slice of the resulting matrix C and sends it back to the master process.
- The master process receives slices of matrix C from the worker processes and forms the resulting matrix C.

Use TCP stream sockets (AF_INET, SOCK_STREAM) for communications. You are also recommended to reuse the codes for TCP (iterative/concurrent) stream socket codes for client and server provided to you as part of the lectures.

To facilitate checking the correctness of the program,

- The master process initializes all the elements of matrices A and B to have a constant value (for example: 2).
- It prints the matrices A and B after initialization to the standard output.
- It prints the matrix C to the standard output before exiting.