MPI Spring21 Lab requirement

Deadline is the midnight of Friday 21th of May 2021

Invertibility is one of the matrix properties; a “square” matrix is invertible iff its determinant is not 0.

- Write a program that calculates the determinant of a 3x3 square matrix, using MPI.
- You have 4 processes, the first one is the root process:
  - Initialize the matrix (read it from console)
  - Root is responsible for broadcasting the matrix to all processes
  - Gather the partial determinants from all processes
  - Sum the determinants and display either the sum and a message that says “An invertible matrix”, or a message that says “A singular matrix”
  - The rest of processes should calculate the determinant of their share of the matrix
- Each process should calculate part of the determinant as the following:

$$\begin{vmatrix} a & b & c \\ d & e & f \\ g & h & i \end{vmatrix} = a\begin{vmatrix} e & f \\ h & i \end{vmatrix} - b\begin{vmatrix} d & f \\ g & i \end{vmatrix} + c\begin{vmatrix} d & e \\ g & h \end{vmatrix}$$

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix}^{-1} = \frac{1}{ad-bc}\begin{bmatrix} d & -b \\ -c & a \end{bmatrix}$$

determinant

Test Case:

[redacted]

Finding the Determinant of a 3x3 Matrix

$$A = \begin{vmatrix} 2 & 1 & 3 \\ 4 & -2 & -1 \\ -5 & 2 & 6 \end{vmatrix} \qquad \det(A) = ?$$

$$\det(A) = +2\begin{vmatrix} -2 & -1 \\ 2 & 6 \end{vmatrix} - 1\begin{vmatrix} 4 & -1 \\ -5 & 6 \end{vmatrix} + 3\begin{vmatrix} 4 & -2 \\ -5 & 2 \end{vmatrix}$$

$$= -45$$

[redacted]