Message Passing Programming

//Advanced Use of Collectives

// The Problem

- Given a MxN matrix, we want to calculate the sum of each row and each column

- Results are M values (row sums) and N values (column sums)

// Pseudocode

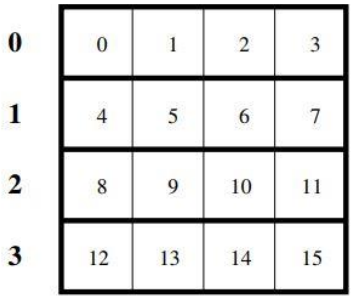
loop over $i = 1, M; j = 1, N$

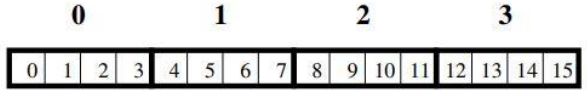
- $rowsum_i = rowsum_i + matrix_{i,j}$
- $columnsum_j = columnsum_j + matrix_{i,j}$

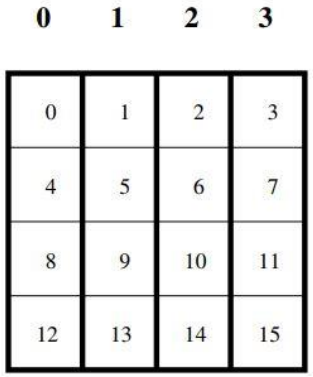
end loop

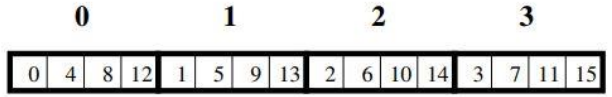
// MPI Implementation

- Matrix is decomposed across procs over one of its dims (Scenario A)
- Matrix is decomposed across procs over both of its dims (Scenario B)









// Scenario A approach (meh)

- Create **Communicator** across all processes (root)
- **Scatter** data based on decomposition (row-wise or column-wise)
- Each process calculates sum locally (row or column)
- Root **gathers** sums
- Root **Reduces** on every array position

// Scenario B approach ()

- Create **Communicator** across all processes (root)
- **Scatter** array decomposed on first of two dims
- Each process calculates the sum locally
- Root **collects** sums
- Communicator **scatters** array decomposed on second dim
- Each process calculates the sum locally
- Root **gathers** sums

Fin