

Question 1: Parallel Reduction with MPI (Sum of Squared Differences)

Description: Write an MPI program to compute the **Sum of Squared Differences (SSD)** of an array of numbers in parallel. The program should compute the SSD between two arrays, **A** and **B**, both of size **N**. The formula for SSD is:

$$\text{SSD} = \sum_{i=1}^N (A[i] - B[i])^2$$

Your task is to use MPI to distribute the computation and gather the final result.

Requirements:

- Split the array into chunks, with each chunk being processed by a different MPI process.
- Each process should compute the partial SSD for its chunk and send the result back to the root process.
- The root process should aggregate the results from all processes and compute the final SSD.
- Use an efficient communication pattern like **MPI_Reduce** to aggregate the partial results.

Input (Just for Understanding Purpose):

Two arrays, **A** and **B**, both of size **N = 6** (for simplicity).

- Array **A**: [1, 2, 3, 4, 5, 6]
- Array **B**: [6, 5, 4, 3, 2, 1]

Output:

Total Sum of Squared Differences: 70

Question2

Write an MPI program in C (or Python, if you prefer) where:

Process 0 generates an array of 10 random integers, Process 0 sends this array to Process 1. Process 1 receives the array, sorts it in ascending order, and sends it back to Process 0. Process 0 then prints both the original and the sorted arrays.

Ensure proper initialization and finalization of MPI, and handle all necessary communication operations

Question3

Write an MPI program where:

Process 0 generates an array of 100 random integers. The array is scattered evenly among all processes. Each process finds the maximum value in its portion of the array. All local maximums are then gathered back to Process 0. Process 0 finds the overall maximum from the collected maximums and prints it.

Use MPI_Scatter, MPI_Gather, and appropriate point-to-point communication functions.

Make sure your program correctly handles the cases when the number of processes does not evenly divide 100 (hint: you may pad the array if necessary)