Distributed Memory Connected Components

Problem:

Your task in this assignment is to implement efficient C++/MPI function connected_components . We make several assumptions:
1. Undirected graph on which we are operating is too large to be represented in the memory of a single compute node.
2. We have p = q * q ranks available.
3. The graph has n nodes, and we have that q divides n .
4. The graph is represented by the adjacency matrix A , in which 1 indicates edge and 0 means no edge.
5. Adjacency matrix A is 2D-decomposed using q by q row-wise grid of ranks.

Instructions:

Arguments of the connected_components are as follows:

- A adjacency matrix, row-wise block of size n/q by n/q .
- n total number of nodes in the graph.
- q dimension of the rank grid (p = q * q).
- out path to the output file where the assignment of nodes to the connected components should be stored (see below).
- comm communicator with p = q * q ranks to work with.
- Function must return the total number of connected components found.