Question: Implement an efficient CUDA program to solve a system of linear equations using LU factorization method. Assume that the system is represented as “AX = B” matrices.

Input file format:

* 1. First line contains a non-zero unsigned integer which specifies size of the system ***N*** (i.e. N unknown variables).
  2. Next (***N x N***) lines contain a double precision floating point number in each line representing row-major values of matrix A.
  3. Next ***N*** lines contain a double precision floating point number in each line representing value of column matrix B.

Output file format:

1. First line should contain the value N.
2. Next (***N x N***) lines should contain values of lower triangular matrix L in row major order.
3. Next (***N x N***) lines should contain values of upper triangular matrix U in row major order.
4. Next ***N*** lines should contain the values of solution matrix X in a row major order.

In a separate file, report the following timing information:

1. Time taken to read A and B matrices from file.
2. Time taken in computing lower triangular matrix L.
3. Time taken in computing upper triangular matrix U.
4. Total time taken in solving system of linear equations for the given size N.

In your report, explain the following:

1. Parallel algorithm used to implement the solution
2. Kernel configuration (grid and block sizes) for each of the kernels called.
3. CGMA value of each kernel called.
4. Discuss different types of synchronizations used in the solution and their impact on the performance.