Set 1 & 2

Lab 7 – OpenMP - Solving System of Linear Equations

1. Write an OpenMP program with C++ that solves the system of linear equations $\boldsymbol{Ax} = \boldsymbol{b}$ using **Gaussian elimination** with **row pivoting**, followed by **backward substitution**. The following components are to be shown.
   (a) Write the **serial version program** to solves the system of linear equations, $\boldsymbol{Ax} = \boldsymbol{b}$**.** Calculate the execution time by using the OpenMP library function.

   Set 1

   Test Case: N=Number of Equations, M=Number of unknowns

   N=3, M=3 → $x - y + z = 4, x - 4y + 2z = 8, x + 2y + 8z = 12$

   Solution: $(x, y, z) = (5/3, -5/6, 3/2)$

   Set 2

   Test Case: N=Number of Equations, M=Number of unknowns

   N=3, M=3 → $x-y+z = 8, 2x+3y-z=-2, 3x-2y-9z=9$

   Solution: $(x, y, z) = (4, -3, 1)$

   (b) Write the **parallel version program** to estimate the same. Test the result with (a). It includes number of threads involved and the result calculated by which thread number. Calculate the execution time by using the OpenMP library function.

   (c) Identify the line of statement which leads the **Race condition**. Race condition occurs when the multiple threads accessing a shared variable. If it exists how will you handle this problem? Use appropriate **OpenMP directives/clauses** and find the solution. Test the result with value obtained in (a) and (b). Calculate the execution time by using the OpenMP library function.

   (d) After completed the execution and gets verified from the faculty within submission deadline, then do the Documentation as discussed.