# Take Home Exam

# CO1020: Computer Aided Numerical Methods – I

Please write C/C++ code for all the questions given in this exam. Write a report that should include:

a) The results from these problems

b) Explain your code by first giving the algorithm used followed by explaining the code by giving snippets of the code and giving a detailed description of that portion of the code. Marks will be deducted if explanation is poor.

c) Please maintain strict ethical standards while doing this exam. Copying and plagiarizing code will lead to harsh penalties, including fail grade.

Q1   Solve all the nodal voltages in the resistance network shown in Figure below. Use Ohm's law to write your set of linear equations.



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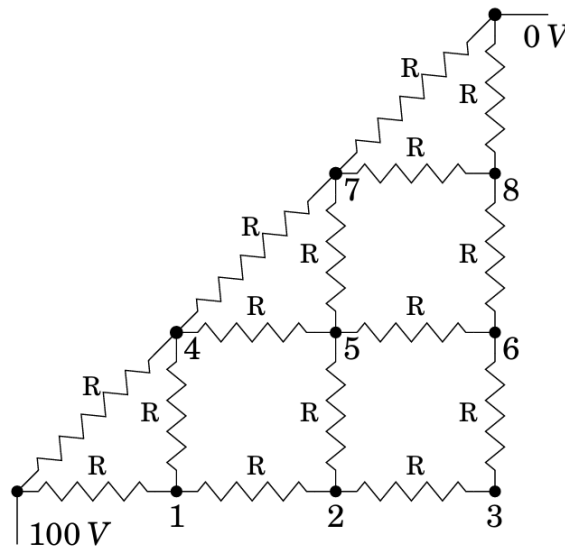
Take R=100 $\Omega$. Dot the following:

1. Write the system of linear equations that makes this resistance network

2. Solve the above equation using
   a. *LU* decomposition
   b. Gauss Siedel
   c. Conjugate Gradient

   methods to solve this linear equation. The resolution for the solution voltages should be accurate to the $3^{rd}$ place after decimal.

3. Using your computer's clock, please estimate the time taken to solve this problem for each of the three methods. Does SOR be used to accelerate the solution from Gauss Siedel? Please show through your computations.

Q2   Please see below the set of linear equations:

$$\begin{bmatrix} 1 & 2 & 4 & 1 \\ 2 & -5 & 3 & -5 \\ 1 & -4 & 4 & 7 \\ 2 & -3 & 2 & -5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} = \begin{bmatrix} 2 \\ 4 \\ 4 \\ 9 \end{bmatrix}$$

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Find the following:

1. The condition number of this matrix
2. Use Grahm Schmidt method to estimate the $Q$ matrix
3. Use Householder transformation to estimate the $Q$ matrix and then find the solution using $QR$ method