# 311 – Numerical Computations
# Lab 8: Numerical Methods for Solving System of Linear Equations: Gauss-Seidel Method

**The basic formula for a single approximation step of Gauss-Seidel Method to solve the n x n system: Ax = b:**

$$\begin{bmatrix} A_{0,0} & \cdots & \\ \vdots & \ddots & \vdots \\ & \cdots & A_{n-1,n-1} \end{bmatrix} \begin{bmatrix} x_0 \\ \vdots \\ x_{n-1} \end{bmatrix} = \begin{bmatrix} b_0 \\ \vdots \\ b_{n-1} \end{bmatrix} \quad is$$

for i in range (n): # 0 to n-1

$$x_i = \frac{1}{A_{i,i}} \left( b_i - \sum_{j=0, j \neq i}^{j=n-1} A_{i,j} x_j \right)$$

## Spring 2020-2021 Final Exam question:

**Write a (Numpy-based) program (i.e. uses Numpy Arrays) that implements the Gauss-Seidel Method. It prints the first K approximations (K is input) of x using Gauss-Seidel Method to solve an NxN system (inputs are taken from user).**

**Always Use the initial guess (K=0): $x^0$ = [0, 0, … 0]**

**Assume the input matrix a is diagonally dominant.**

# Quiz 3:

# Topic: Numpy Library and Solving Linear Systems

# Sunday 24-April-2022

## Additional Exercise (to prepare for the quiz):

Assume that the user already has a Numpy (one dimensional) array W.

Example: W = np.array( [1,2,3,4,5,6])

Using the Numpy library, write a Python code that prints the elements of W in every possible matrix size.

Example: if W is of length 12 then matrices of size: 1x12, 2x6, 3x4, 4x3, 6x2 and 12x1 should be printed.

If W is of length 5 then matrices of size: 1x5 and 5x1 should be printed.

Remark: The needed functions from Numpy Library are:

- W.reshape(x,y), which will return a matrix of size x by y (if possible), and
- T.print( ), which will print the matrix T in rectangular matrix format.

### Sample Run:

Assuming W=np.array([1,2,3,4])

Output:

```
[[1 2 3 4]]
[[1 2]
 [3 4]]
[[1]
 [2]
 [3]
 [4]]
```