Programming assignment I
ME685A – APPLIED NUMERICAL METHODS

2nd March 2022

Solve the following system of nonlinear algebraic equations arising in a hydraulic network problem using the Newton-Raphson method along with Gauss-Jordon for solving the linearized system of algebraic equations. Initial guess $Q_i = (5,5,5,5,5,5)$.

Exact solution (1, 2, 3, 3, 2, 1). Set relaxation factor as unity.
Use the Gauss-Jordon method for matrix inversion.

$$F_i = 0, \quad i = 1...6$$
$$F_1 = Q_1^2 + Q_2^2 + Q_3^2 - 14$$
$$F_2 = 2Q_2^2 + Q_3^2 + 2Q_4^2 - 35$$
$$F_3 = Q_3^2 + Q_4^2 - 2Q_5^2 - 10$$
$$F_4 = Q_1 + Q_5 - 3$$
$$F_5 = Q_4 + Q_6 - 4$$
$$F_6 = Q_2 + Q_6 - 3$$

The program output should generate the following table

Iteration index	Guessed values $(Q_1 - Q_6)$	Corrections $(\delta Q_1 - \delta Q_6)$	Updates $(Q_i + \delta Q_i)\ i = 1...6$
1	5,5,5,5,5,5		
2			
3			
4			

The program input will be the functions F_1-F_6 and derivatives with respect to the flow rates should be internally determined by a central difference formula.

Upload your answers as a zipped file with your roll number as the name. The file within will also have your roll number as the filename. File extensions such as *.f, *.C, and *.m are permitted. Our TAs will run the programs and gauge the output that appears on the screen. Initial guesses and all relevant parameters should be built-in. No additional input should be required. Maximum number of iterations = 5; convergence criterion in flow rate, 10^{-5}.