MA5060
NUMERICAL ANALYSIS
Department of Mathematics
IIT Hyderabad
Assignment - 1

SECTION - A
PROBLEMS

1. Let

$$\text{A}=\begin{bmatrix}3/2 & 1/2\\ 1/2 & 3/2\end{bmatrix}.$$

For which value of α does the sequence $\{y_n\}$ defined by $y_{n+1} = (I + \alpha A + \alpha^2 A^2)y_n, n = 0, 1, 2, 3, ...$ converge to 0 as $n \to \infty$ for any initial arbitrary vector y_0.

2. For the system $\begin{bmatrix}-2 & -1 & 2\\ 2 & 1 & 0\\ 0 & 0 & 1\end{bmatrix}$ X = $\begin{bmatrix}7\\ 1\\ 1\end{bmatrix}$, set up (a) Gauss-Jacobi and (b) Gauss-Seidel iteration methods. Perform three iterations for both methods.

SECTION - B
CODING

The system of equations Ax=b, where A is a square matrix and b is a column matrix, can be read by writing a program. Next, could you make a menu to show the available alternatives?

1. Elimination by Gauss
2. Gauss-Jordan
3. LU Decomposition
4. Gauss-Jordan **Jacobi**
5. Gauss-Seidel

Following the display of these options, which allows the user to select the technique to be used, the matching block has to be run. Each method's final matrices have to be shown in the output. Your code must show every iteration step-by-step for iteration methods 4 and 5, along with an error for each iteration until convergence is achieved.

Note:

1. It might be necessary to write a subroutine to obtain a matrix's inverse. This subroutine can then be called as needed. Remember that you need the pivoting strategy in this process.
2. The subroutines that are now available in **MATLAB**, *MATHEMATICA*, or other sources should not be used. You can write programs in **FORTRAN**, **C/C++**, or **Python**.