Centre for Data Science
Institute of Technical Education & Research, SOA, Deemed to be University

Practical Discrete Mathematics (CSE 1402)

MINOR ASSIGNMENT-5: COMPUTATIONAL ALGORITHMS IN LINEAR ALGEBRA

1. Plot the following equations on a graph using `matplotlib` and find their point of intersection:
$$x + y = 5$$
$$x - y = 1$$

2. Visualize the 3D linear system using `matplotlib` (as planes):
$$x + y + z = 6$$
$$x - y + z = 2$$
$$2x + y - z = 3$$

3. Write a Python program to determine whether the following system of linear equations is **dependent** (i.e., has infinitely many solutions):
$$2x + 3y = 6$$
$$4x + 6y = 12$$

4. Visualize the system given in Question 3 using `matplotlib`.

5. Generate a 4×3 matrix with random integers using `np.random.randint`. Display its transpose using NumPy.

6. Define a 2×2 matrix. Calculate its determinant using `np.linalg.det()` and find its inverse using `np.linalg.inv()` (if it exists).

7. Input a 3×3 matrix and write a program to check whether it is invertible or not.

8. Using the determinant method, check whether a given system of equations is consistent or inconsistent.

9. Input two matrices and find their element-wise product using NumPy.

10. Plot the line $y = 2x + 1$ using `matplotlib`.

11. Plot the line $y = 3x$ using `matplotlib`. (Note: Correct from "vertical line".)

12. Use NumPy to convert the following system to Row Reduced Echelon Form (RREF):
$$\begin{bmatrix} 1 & 2 & 1 \\ 2 & 4 & 0 \\ 3 & 6 & 3 \end{bmatrix}$$

13. Without using Gaussian elimination directly, solve the following system of equations using NumPy:
$$\begin{bmatrix} 2 & -6 & 6 \\ 2 & 3 & -1 \\ 4 & -3 & -1 \end{bmatrix} \begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} -8 \\ 15 \\ 19 \end{bmatrix}$$

14. Use NumPy to solve a 5×5 linear system generated with random integers using `np.random.randint`. Create a random 5×1 constant vector and solve using `np.linalg.solve()`.

15. Generate a 10×10 linear system using the random module and solve it using NumPy.