GAUSS ELIMINATION IMPLEMENTATION IN PYTHON

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ASSIGNMENT 3A

NUMERICAL METHODS (CS-406)

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import numpy as np

# Read matrix A and vector b from user input

n = *int*(input("Enter the size of the matrix: "))

A = np.zeros((n,n))

b = np.zeros(n)

for i in range(n):

    row = input(f"Enter the coefficients of row {i+1} of matrix A, separated by spaces: ")

    A[i,:] = np.array([*float*(x) for x in row.split()])

    b[i] = *float*(input(f"Enter the constant term for row {i+1} of vector b: "))

def gauss\_elimination(*A*, *b*):

    n = len(b)

    # Forward elimination

    for k in range(n-1):

        for i in range(k+1, n):

            factor = A[i,k] / A[k,k]

            for j in range(k+1, n):

                A[i,j] -= factor \* A[k,j]

            b[i] -= factor \* b[k]

            # Print intermediate results

            print("Step ", k\*n+i-k\*(k+1)//2+1, ":")

            print(A)

            print(b)

    # Back substitution

    x = np.zeros(n)

    x[n-1] = b[n-1] / A[n-1,n-1]

    for i in range(n-2, -1, -1):

        sum = b[i]

        for j in range(i+1, n):

            sum -= A[i,j] \* x[j]

        x[i] = sum / A[i,i]

    return x

# Call the Gauss Elimination function and print the result

x = gauss\_elimination(A, b)

print("Solution: ", x)

SAMPLE OUTPUT

Enter the size of the matrix : 3

Enter the coefficients of row 1 of matrix A, separated by spaces: 2 1 -1

Enter the constant term for row 1 of vector b: 8

Enter the coefficients of row 2 of matrix A, separated by spaces: -3 -1 2

Enter the constant term for row 2 of vector b: -11

Enter the coefficients of row 3 of matrix A, separated by spaces: -2 1 2

Enter the constant term for row 3 of vector b: -3

Step 2 :

[[ 2. 1. -1. ]

[-3. 0.5 0.5]

[-2. 1. 2. ]]

[ 8. 1. -3.]

Step 3 :

[[ 2. 1. -1. ]

[-3. 0.5 0.5]

[-2. 2. 1. ]]

[8. 1. 5.]

Step 5 :

[[ 2. 1. -1. ]

[-3. 0.5 0.5]

[-2. 2. -1. ]]

[8. 1. 1.]

Solution: [ 2. 3. -1.]