ASSIGNMENT 3C

NUMERICAL METHODS (CS-406)

GAUSS SEIDEL IMPLEMENTATION IN PYTHON

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```python
import numpy as np

# Read matrix A and vector b from user input
n = int(input("Enter the size of the matrix and vector: "))
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: "))

# Read maximum number of iterations and tolerance level from user input
max_iter = int(input("Enter the maximum number of iterations: "))
tolerance = float(input("Enter the tolerance level: "))

def gauss_seidel(A, b, x0, max_iter, tolerance):
    n = len(b)
    x = np.copy(x0)
    iterations = 0
    error = tolerance + 1

    # Iterate until convergence or maximum number of iterations
    while error > tolerance and iterations < max_iter:
        x_new = np.zeros(n)

        for i in range(n):
            s1 = np.dot(A[i,:i], x_new[:i])
            s2 = np.dot(A[i,i+1:], x[i+1:])
            x_new[i] = (b[i] - s1 - s2) / A[i,i]

        error = np.linalg.norm(x_new - x)
        x = np.copy(x_new)
        iterations += 1

        # Print intermediate results
        print("Step ", iterations, ":")
        print(x)
        print("Error: ", error)

    return x, iterations

# Call the Gauss-Seidel function and print the result
x0 = np.zeros(n)
x, iterations = gauss_seidel(A, b, x0, max_iter, tolerance)
print("Solution: ", x)
print("Iterations: ", iterations)
```

SAMPLE OUTPUT

Enter the size of the matrix and vector: 3

Enter the coefficients of row 1 of matrix A, separated by spaces: 4 -1 0

Enter the constant term for row 1 of vector b: 3

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

Enter the constant term for row 2 of vector b: 7

Enter the coefficients of row 3 of matrix A, separated by spaces: 0 -1 4

Enter the constant term for row 3 of vector b: -5

Enter the maximum number of iterations: 20

Enter the tolerance level: 0.0001

Step 1:

[0.75 , 2.41666667 ,-1.0625   ]

Error: 2.92221

Step 2:

[0.66510417 , 2.76753472 ,-1.00729167]

Error: 0.30326

Step 3:

[0.66573893, 2.81601852, -1.00669433]

Error: 0.031

ANSWER [0.66573893 , 2.81601852, -1.00669433]