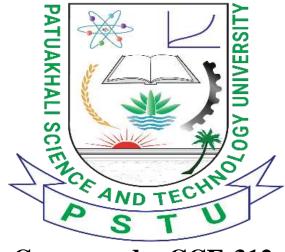
Lab Problem: 03.



Course code: CCE-312.
Course Title: Numerical Methods sSessional.

Name of the Lab Report: Solve Real world problem and Simul equation using Gauss-elimination method.

Remarks & Signature:

Submitted To

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- 1. Consider an online store selling T-shirts (T) and Hoodies (H). The prices are as follows:
 - ✓ A T-shirt costs \$10.
 - ✓ A Hoodie costs \$20.

A customer buys three items (either T-shirts or Hoodies) for a total cost of \$50. How many T-shirts (x) and Hoodies(y) did the customer buy?

Solve Using Gauss-elimination method after that implement it using Python.

• Solve using Gauss-elimination method.

The objective is to find the values of x and y that satisfy the following system of linear equations: 10x + 20y=50 (Total cost)

x + y=3 (Total Number of items)

Converting given equations into matrix form

$$\begin{bmatrix} 10 & 20 & 50 \\ 1 & 1 & 3 \end{bmatrix}$$

 $R_2 < -R_2 - 0.1 \times R_1$

$$\begin{bmatrix} 10 & 20 & 50 \\ 0 & -1 & -2 \end{bmatrix}$$

```
10x+20y=50 -----(i) -y=-2----(ii) Now, use back substitution method from (ii)
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y=2

Using y=2 in (i) we find:

x=1

so, the customer bought x=1 Shirts and y=2 Hoodie

Implement using Python:

```
import numpy as np
coefficients = np.array([[10, 20], [1, 1]])

constants = np.array([50, 3])

augmented_matrix = np.column_stack((coefficients, constants))

n = len(constants)

for i in range(n):
    augmented_matrix[i, :] = augmented_matrix[i, :] /
augmented_matrix[i, i]

for j in range(n):
    if i != j:
        augmented_matrix[j, :] -= augmented_matrix[j, i] *
augmented_matrix[i, :]

solutions = augmented_matrix[:, -1]

print("Number of T-shirts (x):", solutions[0])
print("Number of Hoodies (y):", solutions[1])
```

1. Solve the following system by the Gauss-Elimination method and Implement it using Python.

$$3x_1+.1x_2-.2x_3 = 7.85$$

 $.1x_1+7x_2-.3x_3 = -19.3$
 $.3x_1-2x_2+10x_3 = 71.4$

Solⁿ: We'll create the augmented matrix and perform row operations:

$$\begin{bmatrix} 3 & 0.1 & -0.2 & 7.85 \\ 0.1 & 7 & -0.3 & -19.3 \\ 0.3 & -2 & 10 & 71.4 \end{bmatrix}$$

Step 1: Perform row operations to create zeros below the leading coefficient in the first column.

$$\checkmark$$
 R2 = R2 - (0.1/3) * R1 \checkmark R3 = R3 - (0.3/3) * R1

The augmented matrix becomes:

$$\begin{bmatrix} 3 & 0.1 & -0.2 & 7.85 \\ 0 & 6.99967 & -0.2933 & -19.56167 \\ 0 & -2.01 & 10.02 & 70.615 \end{bmatrix}$$

Step 2: Create zeros below the leading coefficient in the second column.

$$\checkmark$$
 R3 = R3 + (2.01/6.97) * R2

The augmented matrix becomes:

$$\begin{bmatrix} 3 & 0.1 & -0.2 & 7.85 \\ 0 & 6.99967 & -0.2933 & -19.56167 \\ 0 & 0 & 9.935 & 64.99774 \end{bmatrix}$$

Step 3: Solve for x_3 using the last row:

$$9.935x_3 = 64.99774$$

 $x_3 \approx 64.99774/9.935$
 $x_3 \approx 6.54$

Step 4: Substitute the value of x_3 into the second row to solve for x_2 :

$$6.99967x_2 - 0.2933x_3 = -19.56167$$

 $6.99967x_2 - -0.2933(6.54) = -19.56167$
 $6.99967x_2 - 1.98 \approx -19.56167$
 $6.99967x_2 \approx -19.56167 + 1.98$
 $6.99967x_2 \approx -17.5817$
 $x_2 \approx -17.5817 / 6.99967$
 $x_2 \approx -2.51$

Step 5: Substitute the values of x_2 and x_3 into the first row to solve for x_1 :

$$3x_1 + 0.1x_2 - 0.2x_3 = 7.85$$

 $3x_1 + 0.1(-2.51) - 0.2(6.54) \approx 7.85$
 $3x_1 - 0.251 - 1.308 \approx 7.85$
 $3x_1 \approx 7.85 + 1.559$
 $3x_1 \approx 9.409$
 $x_1 \approx 9.409 / 3$
 $x_1 \approx 3.136$
Please check the calculation twice

• Implement using python: