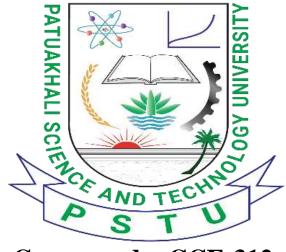
Lab Problem: 05.



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

Name of the Lab Report: Solve Real world problem and Simul equation using Cramer's rule after that implement it by Python.

Remarks & Signature:

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1. A total of 8,500 taka was invested in three interest earning accounts. The interest rates were 2%,3% and 6% if the total simple interest for one year was 380 taka and the amount invested at 6% was equal to the sum of the amounts in the other two accounts, then how much was invested in each account? (Use Cramer's rule) and implement with python.

Let the amounts invested in the three accounts be Tk. x, Tk. y and Tk. z Interest for the three accounts are (2/100)x, (3/100)y and (6/100)z According to the problem,

$$z = x + y \text{ or } x + y - z = 0...$$
 (3)

Now,
$$\Delta = \begin{vmatrix} 1 & 1 & 1 \\ 2 & 3 & 6 \\ 1 & 1 & -1 \end{vmatrix} = 1 (-3 - 6) - 1 (-2 - 6) + 1 (2 - 3)$$

= -9 + 8 - 1
= -2 \neq 0

So there exists a unique solution to the system (1), (2) and (3)

$$\Delta_x = \begin{vmatrix} 8500 & 1 & 1 \\ 38000 & 3 & 6 \\ 0 & 1 & -1 \end{vmatrix} = 8500 (-3 - 6) - 1(-38000) + 1 (38000)$$

$$= -76500 + 76000$$

$$= -500$$

$$\Delta_y = \begin{vmatrix} 1 & 8500 & 1 \\ 2 & 38000 & 6 \\ 1 & 0 & -1 \end{vmatrix} = 1 (-38000) - 8500 (-2 - 6) + 1 (-38000)$$

$$= -38000 + 68000 - 38000$$

$$= -8000$$

$$\Delta_z = \begin{vmatrix} 1 & 1 & 8500 \\ 2 & 3 & 38000 \\ 1 & 1 & 0 \end{vmatrix} = 1 (-38000) - 1 (-38000) + 8500 (2 - 3)$$

$$= -38000 + 38000 - 8500$$

$$= -8500$$

So by Cramer's rule,

$$x = \frac{\Delta_x}{\Delta} = \frac{-500}{-2} = 250, \quad y = \frac{\Delta_y}{\Delta} = \frac{-8000}{-2} = 4000, \quad z = \frac{\Delta_z}{\Delta} = \frac{-8500}{-2} = 4250$$

Thus the amount invested at 2% is Tk. 250, at 3% is Tk. 4000 and at 6% is Tk. 4250.

Implement using Python:

```
coefficients_y[:, 1] = constants

coefficients_z = coefficients.copy()
coefficients_z[:, 2] = constants

det_x = np.linalg.det(coefficients_x)
det_y = np.linalg.det(coefficients_y)
det_z = np.linalg.det(coefficients_z)

solution_x = det_x / det_coefficients
solution_y = det_y / det_coefficients
solution_z = det_z / det_coefficients

print("Solution:")
print(f"x = {solution_x}")
print(f"y = {solution_y}")
print(f"z = {solution_z}")
```

Using Cramer's rule solve the following after that implement it using Python.

$$.3x_1+.52x_2+x_3=0.01$$

 $.5x_1+.3x_2+.5x_3=.67$
 $.1x_1+.3x_2+.5x_3=-.44$

Solⁿ: Let us write these equations in the form AX=B

 $X_3 = Dx_3/D = 0.05054/0.016 = 3.158$

$$\begin{bmatrix} .3 & .52 & 1 \\ .5 & .3 & .5 \\ .1 & .3 & .5 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} .01 \\ .67 \\ -.44 \end{bmatrix}$$

$$D = |A| = \begin{vmatrix} .3 & .52 & 1 \\ .5 & .3 & .5 \\ .1 & .3 & .5 \end{vmatrix} = .3(.5x.3 - .5x.3) - .52(.5x.5 - .5x.1) + 1(.5x.3 - .3x.1) = 0.016$$

$$Dx_1 = \begin{vmatrix} .01 & .52 & 1 \\ ..67 & .3 & .5 \\ -.44 & .3 & .5 \end{vmatrix} = 0.0444$$

$$Dx_2 = \begin{vmatrix} .3 & .01 & 1 \\ .5 & .67 & .5 \\ .1 & -.44 & .5 \end{vmatrix} = -0.1255$$

$$Dx_3 = \begin{vmatrix} .3 & .52 & .01 \\ .5 & .3 & .67 \\ .1 & .3 & -.44 \end{vmatrix} = 0.05054$$

$$X_1 = Dx_1/D = 0.0444/0.016 = 2.775$$

$$X_2 = Dx_2/D = -0.1255/0.016 = -7.84375$$

• Implement using python: