Name - Abhishek Verma
Roll No- 2138118
Practical - Gauss Siedel Method

Q .1 Using Gauss Siedel Method solve the system of linear equation

$4 x_1 + x_2 + x_3 = 2$

$x_1 + 5 x_2 + 2 x_3 = -6$

$x_1 + 2 x_2 + 3 x_3 = -4$

$$A = \begin{pmatrix} 4 & 1 & 3 \\ 1 & 5 & 2 \\ 1 & 2 & 3 \end{pmatrix}$$

{{4, 1, 3}, {1, 5, 2}, {1, 2, 3}}

$$d = \begin{pmatrix} 4 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 3 \end{pmatrix}$$

{{4, 0, 0}, {0, 5, 0}, {0, 0, 3}}

$$l = \begin{pmatrix} 0 & 0 & 0 \\ 1 & 0 & 0 \\ 1 & 2 & 0 \end{pmatrix}$$

{{0, 0, 0}, {1, 0, 0}, {1, 2, 0}}

$$u = \begin{pmatrix} 0 & 1 & 1 \\ 0 & 0 & 2 \\ 0 & 0 & 0 \end{pmatrix}$$

{{0, 1, 1}, {0, 0, 2}, {0, 0, 0}}

$$b = \begin{pmatrix} 2 \\ -6 \\ -4 \end{pmatrix}$$

{{2}, {-6}, {-4}}

$$x[1] = \begin{pmatrix} 0.5 \\ -0.5 \\ -0.5 \end{pmatrix}$$

{{0.5}, {-0.5}, {-0.5}}

```
For[n = 1, n ≤ 20, n = n + 1, x[n + 1] = LinearSolve[d + l, -u.x[n] + b];
 Print[x^n, "=", N[MatrixForm[x[n]]]]]
```

$$x = \begin{pmatrix} 0.5 \\ -0.5 \\ -0.5 \end{pmatrix}$$

$$x^2 = \begin{pmatrix} 0.75 \\ -1.15 \\ -0.816667 \end{pmatrix}$$

$$x^3 = \begin{pmatrix} 0.991667 \\ -1.07167 \\ -0.949444 \end{pmatrix}$$

$$x^4 = \begin{pmatrix} 1.00528 \\ -1.02128 \\ -0.987574 \end{pmatrix}$$

$$x^5 = \begin{pmatrix} 1.00221 \\ -1.00541 \\ -0.997129 \end{pmatrix}$$

$$x^6 = \begin{pmatrix} 1.00064 \\ -1.00128 \\ -0.999362 \end{pmatrix}$$

$$x^7 = \begin{pmatrix} 1.00016 \\ -1.00029 \\ -0.999862 \end{pmatrix}$$

$$x^8 = \begin{pmatrix} 1.00004 \\ -1.00006 \\ -0.999971 \end{pmatrix}$$

$$x^9 = \begin{pmatrix} 1.00001 \\ -1.00001 \\ -0.999994 \end{pmatrix}$$

$$x^{10} = \begin{pmatrix} 1. \\ -1. \\ -0.999999 \end{pmatrix}$$

$$x^{11} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$$

$$x^{12} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$$

$$x^{13} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$$

$$x^{14} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$$

$$x^{15} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$$

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$$x^{17} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$$

$x^{18} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$

$x^{19} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$

$x^{20} = \begin{pmatrix} 1. \\ -1. \\ -1. \end{pmatrix}$

```
For[n = 1, n ≤ 20, n = n + 1, x[n + 1] = LinearSolve[d + l, -u.x[n] + b];
 Print[x^n, "=", N[MatrixForm[x[n]]]];
 If[Abs[Norm[x[n + 1], 2] - Norm[x[n], 2]] < 0.0001, Break[]]]
```

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