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Practical 8
Gauss-Seidel method

AIM :- To solve the following system of linear equations by using Gauss- Seidal Method within an absolute tolerance of 5*10^(-6):

4 x1 - x2 = 2

- x1 + 4 x2 - x3 = 4

- x2 + 4 x3 = 10

In[1]:=
```
GaussSiedel [A0_, B0_, X0_, max_ ] :=
 Module [A = N [A0 ], B = N [B0 ], i, j, k = 0, n = Length [X0 ], X = X0, Xold = X0 ],
  Print["X", 0, "=", X];
  While[k ) max,
   For[i = 1, i c n, i = i + 1,
    X[[i]] =
     (B[[i]] - Σ_{j=1}^{i-1} A[[i, j]] x X[[j]] - Σ_{j=i+1}^{n} A[[i, j]] x Xold[[j]]) / A[[i, i]]];
   Print["X", k + 1, "=", NumberForm [X, 10 ]];
   If[Max[Abs[X - Xold]] ) 5 x 10^(-6),
    Print["Solution with convergence tolerance of 5x10^(-6)=",
     NumberForm[X, 10]];
    Break[];,
    Xold = X;
    k = k + 1;];];]
```

(i) 4 x1 - x2 = 2
- x1 + 4 x2 - x3 = 4
- x2 + 4 x3 = 10

In[2]:=
$$A0 = \begin{pmatrix} 4 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 4 \end{pmatrix};$$

$$B0 = \begin{pmatrix} 2 \\ 4 \\ 10 \end{pmatrix};$$

$$X0 = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix};$$

```
GaussSiedel A0, B0, X0, 3 ;
X0=  0 ,  0 ,  0
X1=  0.5 ,  1.125 ,  2.78125
X2=  0.78125 ,  1.890625 ,  2.97265625
X3=  0.97265625 ,  1.986328125 ,  2.996582031
```

In[6]:=
```
Clear A0, B0, X0
```

(ii) 4 x1 + x2 - x3 = 1
2 x1 + 4 x2 + x3 = -1
- x1 + x2 + 4 x3 = 1

In[7]:=
$$A0 = \begin{pmatrix} 4 & 2 & -1 \\ 2 & 4 & 1 \\ -1 & 1 & 4 \end{pmatrix};$$

$$B0 = \begin{pmatrix} 1 \\ -1 \\ 1 \end{pmatrix};$$

$$X0 = \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix};$$

```
GaussSiedel A0, B0, X0, 3 ;
X0=  0 ,  0 ,  0
X1=  0.25 ,  -0.375 ,  0.40625
X2=  0.5390625 ,  -0.62109375 ,  0.5400390625
X3=  0.6955566406 ,  -0.7327880859 ,  0.6070861816
```

In[11]:=
```
Clear A0, B0, X0
```