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Practical 6
Gauss-Jacobi method

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

In[1]:=
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GaussJacobi[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 to i-1) A[[i, j]] x Xold[[j]] - Σ(j=i+1 to 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]:=
$$A0 = \begin{pmatrix} 4 & -1 & 0 \\ -1 & 4 & -1 \\ 0 & -1 & 4 \end{pmatrix};$$

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

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

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GaussJacobi A0, B0, X0, 50
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```
X0=  0 ,  0 ,  0

X1=  0.5 ,  1. ,  2.5

X2=  0.75 ,  1.75 ,  2.75

X3=  0.9375 ,  1.875 ,  2.9375

X4=  0.96875 ,  1.96875 ,  2.96875

X5=  0.9921875 ,  1.984375 ,  2.9921875

X6=  0.99609375 ,  1.99609375 ,  2.99609375

X7=  0.9990234375 ,  1.998046875 ,  2.999023438

X8=  0.9995117188 ,  1.999511719 ,  2.999511719

X9=  0.9998779297 ,  1.999755859 ,  2.99987793

X10=  0.9999389648 ,  1.999938965 ,  2.999938965

X11=  0.9999847412 ,  1.999969482 ,  2.999984741

X12=  0.9999923706 ,  1.999992371 ,  2.999992371

X13=  0.9999980927 ,  1.999996185 ,  2.999998093

X14=  0.9999990463 ,  1.999999046 ,  2.999999046

Solution with convergence tolerance of 5x10^ (-6 )=
   0.9999990463 ,  1.999999046 ,  2.999999046
```

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

2 x1 + 4 x2 + x3 = -1

- x1 + x2 + 4 x3 = 1

In[6]:=
$$A0 = \begin{pmatrix} 4 & 2 & -1 \\ 2 & 4 & 1 \\ -1 & 1 & 4 \end{pmatrix};$$

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

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

```
GaussJacobi A0, B0, X0, 50
```

X0= 0 , 0 , 0

X1= 0.25 , −0.25 , 0.25

X2= 0.4375 , −0.4375 , 0.375

X3= 0.5625 , −0.5625 , 0.46875

X4= 0.6484375 , −0.6484375 , 0.53125

X5= 0.70703125 , −0.70703125 , 0.57421875

X6= 0.7470703125 , −0.7470703125 , 0.603515625

X7= 0.7744140625 , −0.7744140625 , 0.6235351563

X8= 0.7930908203 , −0.7930908203 , 0.6372070313

X9= 0.805847168 , −0.805847168 , 0.6465454102

X10= 0.8145599365 , −0.8145599365 , 0.652923584

X11= 0.8205108643 , −0.8205108643 , 0.6572799683

X12= 0.8245754242 , −0.8245754242 , 0.6602554321

X13= 0.8273515701 , −0.8273515701 , 0.6622877121

X14= 0.8292477131 , −0.8292477131 , 0.6636757851

X15= 0.8305428028 , −0.8305428028 , 0.6646238565

X16= 0.8314273655 , −0.8314273655 , 0.6652714014

X17= 0.8320315331 , −0.8320315331 , 0.6657136828

X18= 0.8324441873 , −0.8324441873 , 0.6660157666

X19= 0.8327260353 , −0.8327260353 , 0.6662220936

X20= 0.832918541 , −0.832918541 , 0.6663630176

X21= 0.8330500249 , −0.8330500249 , 0.6664592705

X22= 0.8331398301 , −0.8331398301 , 0.6665250125

X23= 0.8332011682 , −0.8332011682 , 0.666569915

X24= 0.8332430628 , −0.8332430628 , 0.6666005841

X25= 0.8332716774 , −0.8332716774 , 0.6666215314

X26= 0.8332912216 , −0.8332912216 , 0.6666358387

X27= 0.8333045705 , −0.8333045705 , 0.6666456108

X28= 0.8333136879 , −0.8333136879 , 0.6666522852

X29= 0.8333199153 , −0.8333199153 , 0.666656844

X30= 0.8333241686 , −0.8333241686 , 0.6666599576

Solution with convergence tolerance of 5x10^ (−6)=
0.8333241686 , −0.8333241686 , 0.6666599576