Abhishek Kumar
Roll No.– 20 222 756
Practical – 6
Gauss Seidel – Method

```
In[16]:= GaussSeidel[A0_, b0_, X0_, maxiter_] := Module[{A = N[A0], b = N[b0],
        xk = X0, xk1, i, j, k = 0, n, m, OutputDetails}, size = Dimensions[A];
       n = size[[1]];
       m = size[[2]];
       If[n ≠ m, Print["Not a square matrix, cannot proceed with Gauss-Seidel method"];
        Return[]];
       OutputDetails = {xk};
       xk1 = Table[0, {n}];
       While[k < maxiter, For[i = 1, i ≤ n, i++, xk1[[i]] = (1 / A[[i, i]]) *
            (b[[i]] - Sum[A[[i, j]] * (If[j < i, xk1[[j]], xk[[j]]]), {j, 1, n}]);];
        k++;
        OutputDetails = Append[OutputDetails, xk1];
        xk = xk1;];
       colHeading = Table[X[s], {s, 1, n}];
       Print[NumberForm[TableForm[OutputDetails, TableHeadings → {None, colHeading}], 6]];
       Print["No. of iterations performed: ", k];];


A = {{4, -1, 0, 0}, {-1, 4, -1, 0}, {0, -1, 4, -1}, {0, 0, -1, 3}};
b = {15, 10, 10, 10};
X0 = {0, 0, 0, 0};
GaussSeidel[A, b, X0, 15]
```

X[1]	X[2]	X[3]	X[4]
0	0	0	0
3.75	3.4375	3.35938	4.45313
0.859375	0.117188	0.283203	−1.02539
2.91992	3.18359	2.75635	5.27751
1.62598	0.411987	1.16603	−1.5555
2.22702	2.93627	1.67917	5.44855
2.25705	0.54778	2.31992	−1.34192
1.6299	2.93967	0.579524	4.86842
2.85502	0.418963	3.24232	−0.454316
0.999719	3.14155	−0.0705149	3.76414
3.53567	0.224741	3.56774	0.758434
0.270518	3.23482	−0.0694221	2.55176
4.28819	0.319869	3.28733	1.87735
−0.458221	2.88741	0.403861	1.5906
4.93007	0.946075	2.73031	2.65283
−0.943554	2.00061	0.933053	0.991517

No. of iterations performed: 15

```
In[31]:= GaussSeidel[A0_, b0_, X0_, maxiter_] := Module[{A = N[A0], b = N[b0],
         xk = X0, xk1, i, j, k = 0, n, m, OutputDetails}, size = Dimensions[A];
        n = size[[1]];
        m = size[[2]];
        If[n ≠ m, Print["Not a square matrix, cannot proceed with Gauss-Seidel method"];
         Return[]];
        OutputDetails = {xk};
        xk1 = Table[0, {n}];
        While[k < maxiter, For[i = 1, i ≤ n, i++, xk1[[i]] = (1 / A[[i, i]]) *
             (b[[i]] - Sum[A[[i, j]] * (If[j < i, xk1[[j]], xk[[j]]]), {j, 1, n}]);];
         k++;
         OutputDetails = Append[OutputDetails, xk1];
         xk = xk1;];
        colHeading = Table[X[s], {s, 1, n}];
        Print[NumberForm[TableForm[OutputDetails, TableHeadings → {None, colHeading}], 6]];
        Print["No. of iterations performed: ", k];];


    A = {{4, -1, 0, 0}, {-1, 4, -1, 0}, {0, -1, 4, -1}, {0, 0, -1, 3}};
    b = {15, 10, 10, 10};
    X0 = {0, 0, 0, 0};
    GaussSeidel[A, b, X0, 5]
```

X[1]	X[2]	X[3]	X[4]
0	0	0	0
3.75	3.4375	3.35938	4.45313
0.859375	0.117188	0.283203	−1.02539
2.91992	3.18359	2.75635	5.27751
1.62598	0.411987	1.16603	−1.5555
2.22702	2.93627	1.67917	5.44855

No. of iterations performed: 5

In[54]:=

In[97]:=
```
GaussSeidel[A0_, b0_, X0_, maxiter_] :=
  Module[{A = N[A0], b = N[b0], xk = X0, xk1, i, j, k = 0, n, OutputDetails}, n = Length[b];
   If[Dimensions[A][[1]] ≠ n,
     Print["Not a square matrix, cannot proceed with Gauss-Seidel method"];
     Return[]];
   OutputDetails = {xk};
   xk1 = Table[0, {n}];
   While[k < maxiter, For[i = 1, i ≤ n, i++, xk1[[i]] = (1 / A[[i, i]]) *
         (b[[i]] - Sum[A[[i, j]] * (If[j < i, xk1[[j]], xk[[j]]]), {j, 1, n}]);];
    k++;
    OutputDetails = Append[OutputDetails, xk1];
    xk = xk1;];
   colHeading = Table[X[s], {s, 1, n}];
   Print[NumberForm[TableForm[OutputDetails, TableHeadings → {None, colHeading}], 6]];
   Print["No. of iterations performed: ", k];]


A = {{4, -1, 2, 0}, {-1, 4, -1, 0}, {0, -1, 4, -1}, {0, 1, -1, 3}};
b = {15, 10, 10, 10};
X0 = {0, 0, 0, 0};
GaussSeidel[A, b, X0, 12]
```

No. of iterations performed: 12

X[1]	X[2]	X[3]	X[4]
0	0	0	0
3.75	3.4375	3.35938	3.30729
−0.820313	−0.302734	−0.108236	0.0908746
4.54875	3.91286	3.60917	3.14123
−1.62512	−0.916849	−0.553075	0.313363
5.42244	4.63419	4.28996	2.90523
−2.65888	−1.72642	−1.49526	0.505158
6.7249	5.53383	5.50501	2.81857
−4.34395	−2.74356	−2.98626	0.433867
8.90119	6.7223	7.2753	3.0838
−7.10826	−4.18054	−5.04948	−0.0401148
12.3379	8.50263	9.66511	3.76094
−11.2948	−6.41005	−7.82739	−0.900055