Practical-5

Gauss-Jacobi Method

QUES 1:

In[51]:=
```
GaussJacobi[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-Jacobi 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]] * xk[[j]], {j, 1, i - 1}] - Sum[A[[i, j]] * xk[[j]], {j, i + 1, n}])];
    k++;
    OutputDetails = Append[OutputDetails, xk1];
    xk = xk1;];
   colHeading = Table[Subscript[x, s], {s, 1, n}];
   Print[NumberForm[TableForm[OutputDetails, TableHeadings → {None, colHeading}], 6]];
   Print["No. of iterations performed: ", maxiter];];
A = {{5, 1, 2}, {-3, 9, 4}, {1, 2, -7}};
b = {10, -14, -33};
X0 = {0, 0, 0};

GaussJacobi[A, b, X0, 15]
```

x_1	x_2	x_3
0	0	0
2.	−1.55556	4.71429
0.425397	−2.98413	4.55556
0.774603	−3.43845	3.92245
1.11871	−3.04067	3.84253
1.07112	−2.89044	4.00534
0.975953	−2.97867	4.04146
0.979148	−3.02644	4.00266
1.00422	−3.00813	3.98947
1.00584	−2.99391	3.99828
0.99947	−2.99729	4.00257
0.998428	−3.00132	4.0007
0.999985	−3.00083	3.9994
1.00041	−2.99974	3.99976
1.00004	−2.99976	4.00013
0.999898	−3.00004	4.00008

No. of iterations performed: 15

In[61]:=

```
GaussJacobi[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-Jacobi 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]] * xk[[j]], {j, 1, i - 1}] - Sum[A[[i, j]] * xk[[j]], {j, i + 1, n}])];
    k++;
    OutputDetails = Append[OutputDetails, xk1];
    xk = xk1;];
   colHeading = Table[Subscript[x, s], {s, 1, n}];
   Print[NumberForm[TableForm[OutputDetails, TableHeadings → {None, colHeading}], 6]];
   Print["No. of iterations performed: ", maxiter];];
A = {{4, 1, 1}, {1, 5, 2}, {1, 2, 3}};
b = {2, -6, -4};
X0 = {0.5, -0.5, -0.5};

GaussJacobi[A, b, X0, 15]
```

No. of iterations performed: 15

x_1	x_2	x_3
0.5	−0.5	−0.5
0.75	−1.1	−1.16667
1.06667	−0.883333	−0.85
0.933333	−1.07333	−1.1
1.04333	−0.946667	−0.928889
0.968889	−1.03711	−1.05
1.02178	−0.973778	−0.964889
0.984667	−1.0184	−1.02474
1.01079	−0.987037	−0.982622
0.992415	−1.00911	−1.01224
1.00534	−0.993588	−0.9914
0.996247	−1.00451	−1.00605
1.00264	−0.996828	−0.995744
0.998143	−1.00223	−1.00299
1.00131	−0.998431	−0.997894
0.999081	−1.0011	−1.00148