Abhishek Kumar

Roll No.- 20222756

Practical - 5

Gauss-Jacobi Method

In[89]:=
```
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[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[84]:=
```
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[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]
```

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

No. of iterations performed: 15

In[79]:=
```
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[X[s], {s, 1, n}];
  Print[NumberForm[TableForm[OutputDetails, TableHeadings → {None, colHeading}], 6]];
  Print["No. of iterations performed: ", k];];
```

```
A = {{-3, 1, 0}, {2, -3, 1}, {0, 2, -3}};
b = {-2, 0, -1};
X0 = {0, 0, 0};
GaussJacobi[A, b, X0, 15]
```

X[1]	X[2]	X[3]
0	0	0
0.666667	0.	0.333333
0.666667	0.555556	0.333333
0.851852	0.555556	0.703704
0.851852	0.802469	0.703704
0.934156	0.802469	0.868313
0.934156	0.912209	0.868313
0.970736	0.912209	0.941472
0.970736	0.960982	0.941472
0.986994	0.960982	0.973988
0.986994	0.982658	0.973988
0.994219	0.982658	0.988439
0.994219	0.992293	0.988439
0.997431	0.992293	0.994862
0.997431	0.996575	0.994862
0.998858	0.996575	0.997716

No. of iterations performed: 15