Practical 5(a)

Prakhar Khugshal| BSc(H) Computer Science | Sem - IV | 20211441

Gauss Jacobi method

Question 1 :

```
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

Question 11:

```
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}, {2, 1, 3}};
b = {10, -14, -33};
X0 = {0, 0, 0};
GaussJacobi[A, b, X0, 15]
```

Not a square matrix, cannot proceed with Gauss Jacobi method

Question III :

```
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 Jacobu 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, 9, -7}};
b = {11, -14, -30};
X0 = {0, 0, 0};
GaussJacobi[A, b, X0, 15]
```

X[1]	X[2]	X[3]
0	0	0
2.2	-1.55556	4.28571
0.796825	-2.72698	2.6
1.7054	-2.4455	0.893424
2.33173	-1.38417	1.38512
1.92278	-1.39392	2.83918
1.34311	-2.17648	2.76821
1.52801	-2.33817	1.67925
1.99593	-1.79255	1.49779
1.9594	-1.55593	2.26614
1.60473	-1.9096	2.56515
1.55586	-2.16071	2.05977
1.80824	-1.95239	1.72992
1.89851	-1.72166	2.03382
1.7308	-1.82664	2.34336
1.62798	-2.02011	2.18444

```
No. of iterations performed 15
```