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Course : – Bsc (H) Computer Science

Practical 5 (a)

Gauss jacobi Method

```
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]] =  $\frac{1}{A[[i, i]]} * \left( b[[i]] - \sum_{j=1}^{i-1} A[[i, j]] * xk[[j]] - \sum_{j=i+1}^n A[[i, j]] * xk[[j]] \right);$ ];  
      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

Gauss Jacobi with error

```

GaussJacobiwithErr[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};
  maxNorm = .001;
  xk1 = Table[0, {n}];
  While[maxNorm > error,
    For[i = 1, i ≤ n, i++,
      xk1[[i]] =  $\frac{1}{A[[i, i]]} * \left( b[[i]] - \sum_{j=1}^{i-1} A[[i, j]] * xk[[j]] - \sum_{j=i+1}^n A[[i, j]] * xk[[j]] \right)$ ;];
      k++;
      maxNorm = Max[Abs[xk1 - xk]];
      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 takens to acheive desired accuracy=", k];
  Print["Max norm at", k, "th iterations=", maxNorm];];
A = {{5, 1, 2}, {-3, 9, 4}, {1, 2, -7}};
b = {10, -14, -33};
X0 = {0, 0, 0}
error = 10^-4
GaussJacobiwithErr[A, b, X0, error]

```

{0, 0, 0}

$\frac{1}{10000}$

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
0.999979	-3.00007	3.99997
1.00002	-2.99999	3.99998

No of iterations taken to achieve desired accuracy=17

Max norm at 17th iterations=0.000072592