PRACTICAL-5(b): GAUSS SEIDEL METHOD

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```
GausSeidel[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]] * xk1[[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 = {{2, -1, 0}, {-1, 2, -1}, {0, -1, 2}};
b = {7, 1, 1};
X0 = {0, 0, 0};
GaussJacobi[A, b, X0, 15]
```

X[1]	X[2]	X[3]
0	0	0
3.5	2.25	1.625
4.625	3.625	2.3125
5.3125	4.3125	2.65625
5.65625	4.65625	2.82813
5.82813	4.82813	2.91406
5.91406	4.91406	2.95703
5.95703	4.95703	2.97852
5.97852	4.97852	2.98926
5.98926	4.98926	2.99463
5.99463	4.99463	2.99731
5.99731	4.99731	2.99866
5.99866	4.99866	2.99933
5.99933	4.99933	2.99966
5.99966	4.99966	2.99983
5.99983	4.99983	2.99992

No of iterations performed15

```
GaussSiedalwithErr[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 = 0.001;
   xk1 = Table[0, {n}];
   While[maxNorm
     > error,
    For[i = 1, i ≤ n, i++,
     xk1[[i]] = 1/A[[i, i]] * (b[[i]] - Sum[A[[i, j]] * xk1[[j]], {j, 1, i-1}] - Sum[A[[i, j]] * xk[[j]], {j, i+1, n}]);];
    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 taken to acheive desired accuracy=", k];
   Print["Max norm at", k, "th iteration=", maxNorm];];
A = {{5, 1, 2}, {-3, 9, 4}, {1, 2, -7}};
b = {10, -14, -33};
X0 = {0, 0, 0};
error = 10^(-4);
GaussSiedalwithErr[A, b, X0, error]
```

X[1]	X[2]	X[3]
0	0	0
2.	−0.888889	4.74603
0.279365	−3.57178	3.73369
1.22088	−2.80801	4.08641
0.927039	−3.06272	3.97166
1.02388	−2.97944	4.00929
0.992174	−3.00674	3.99696
1.00256	−2.99779	4.001
0.99916	−3.00072	3.99967
1.00028	−2.99976	4.00011
0.99991	−3.00008	3.99996
1.00003	−2.99997	4.00001
0.99999	−3.00001	4.

No of iterations taken to acheive desired accuracy=12

Max norm at12th iteration=0.0000392312