Gauss-Seidel Method

Ques-1

In[ ]:=

```
GaussSeidel[Ao_, bo_, Xo_, maxiter_] :=
  Module[{A = N[Ao], b = N[bo], xk = Xo, 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, Can not proceed with Gauss Seidel 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[k], {k, 1, n}];
   Print[
    NumberForm[TableForm[OutputDetails, TableHeadings → {None, colHeading}], 6]];
   Print["Number of iterations performed ", maxiter];];
A = {{5, 1, 2}, {-3, 9, 4}, {1, 2, -7}};
b = {10, -14, -33};
Xo = {0, 0, 0};
GaussSeidel[A, b, Xo, 12];
```

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.

Number of iterations performed 12

Ques-2

In[ ]:=
```
A2 = {{2, 1, 1}, {3, 5, 2}, {2, 1, 4}};
b2 = {4, 15, 8};
Xo = {1, 2, 3};
GaussSeidel[A2, b2, Xo, 12];
```

x[1]	x[2]	x[3]
1	2	3
−0.5	2.1	1.725
0.0875	2.2575	1.39188
0.175313	2.33806	1.32783
0.167055	2.36864	1.32431
0.153525	2.37816	1.3287
0.146572	2.38058	1.33157
0.143926	2.38102	1.33278
0.1431	2.38103	1.33319
0.14289	2.38099	1.33331
0.142852	2.38097	1.33333
0.142851	2.38096	1.33334
0.142854	2.38095	1.33333

Number of iterations performed 12

Ques-3

In[ ]:=
```
A3 = {{2, -1, 1}, {2, -3, 1}, {1, 3, -4}};
b3 = {5, 3, 4};
Xo = {1, 2, 3};
GaussSeidel[A3, b3, Xo, 12];
```

x[1]	x[2]	x[3]
1	2	3
2.	1.33333	0.5
2.91667	1.11111	0.5625
2.77431	1.03704	0.471354
2.78284	1.01235	0.45497
2.77869	1.00412	0.447758
2.77818	1.00137	0.445573
2.7779	1.00046	0.444818
2.77782	1.00015	0.444569
2.77779	1.00005	0.444486
2.77778	1.00002	0.444458
2.77778	1.00001	0.444449
2.77778	1.	0.444446

Number of iterations performed 12

Ques-4

In[ ]:=
```
A4 = {{3, -6, 2}, {4, -1, 1}, {1, -3, 7}};
b4 = {14, 2, 22};
Xo = {1, 2, 3};
GaussSeidel[A4, b4, Xo, 12];
```

x[1]	x[2]	x[3]
1	2	3
6.66667	27.6667	14.0476
50.6349	214.587	87.8753
375.258	1586.91	629.637
2758.72	11662.5	4607.26
20258.2	85638.1	33811.1
148740.	628769.	248227.
1.09206×10^{6}	4.61646×10^{6}	1.82248×10^{6}
8.01794×10^{6}	3.38942×10^{7}	1.33807×10^{7}
5.8868×10^{7}	2.48853×10^{8}	9.82414×10^{7}
4.32211×10^{8}	1.82709×10^{9}	7.21292×10^{8}
3.17331×10^{9}	1.34145×10^{10}	5.29576×10^{9}
2.32986×10^{10}	9.849×10^{10}	3.88816×10^{10}

Number of iterations performed 12