Practical 5

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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, coldHeading}], 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]
```

```
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 performed15
```

Question 2:

```
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, coldHeading}], 6]];
   Print["No. of iterations performed", maxiter];];
A = {{3, 1, 6}, {-3, 5, 1}, {-5, 2, -8}};
b = {50, -14, -37};
x0 = {0, 0, 0};
GaussJacobi[A, b, x0, 15]
```

```
0           0          0
16.6667     -2.8       4.625
8.35        6.275      -6.49167
27.5583     3.50833    0.975
13.5472     13.54      -11.7219
35.5971     7.67271    -0.457014
15.0231     18.6497    -15.705
41.8601     9.35487    -0.10204
13.7525     22.3365    -19.1989
47.6189     9.29124    1.61384
10.3419     25.4486    -22.814
53.8118     7.96795    4.52344
4.9638      28.5824    -27.0154
61.17       5.58136    8.66822
-2.53023    32.1683    -32.2109
70.3657     2.12404    14.2485

No. of iterations performed15
```

Question 3

```
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, coldHeading}], 6]];
   Print["No. of iterations performed", maxiter];];
A = {{3, 1, 5}, {-6, 9, 4}, {6, 4, -6}};
b = {-23, 14, -45};
x0 = {0, 0, 0};
GaussJacobi[A, b, x0, 15]
```

0	0	0
−7.66667	1.55556	7.5
−20.6852	−6.88889	0.87037
−6.82099	−12.6214	−17.7778
26.1701	4.90947	−7.73525
3.58893	22.4402	36.9431
−76.7185	−12.471	26.0491
−46.9248	−61.1675	−77.5325
141.943	4.73126	−80.2031
124.428	131.83	152.597
−305.939	16.6865	219.815
−379.587	−300.099	−287.315
571.225	−123.807	−572.153
987.191	636.662	496.187
−1046.87	439.156	1419.13
−2519.27	−1327.08	−746.595

No. of iterations performed15