

PRACTICAL-8

Gauss-Siedel Method

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Ques-1

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In[41]:= GaussSiedel[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};  
GaussSiedel[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 performed 15

Ques-2

```
In[46]:= GaussSiedel[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 = {{4, 1, 1}, {1, 5, 2}, {1, 2, 3}};
b = {2, -6, -4};
X0 = {0.5, -0.5, -0.5};
GaussSiedel[A, b, X0, 15]
```

X[1]	X[2]	X[3]
0.5	-0.5	-0.5
0.75	-1.15	-0.816667
0.991667	-1.07167	-0.949444
1.00528	-1.02128	-0.987574
1.00221	-1.00541	-0.997129
1.00064	-1.00128	-0.999362
1.00016	-1.00029	-0.999862
1.00004	-1.00006	-0.999971
1.00001	-1.00001	-0.999994
1.	-1.	-0.999999
1.	-1.	-1.
1.	-1.	-1.
1.	-1.	-1.
1.	-1.	-1.
1.	-1.	-1.
1.	-1.	-1.

No. of iterations performed 15

Ques-3

```

In[51]:= GaussSiedel[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 = {{5, 1, 2}, {-3, 9, 4}, {1, 2, -7}};
b = {10, -14, -33};
X0 = {0, 0, 0};
GaussSiedel[A, b, X0, 15]

```

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.
1.	-3.	4.
0.999999	-3.	4.
1.	-3.	4.

No. of iterations performed 15

