```
% Solve a diagonally dominant system using Succesice-Over_Relaxation method
% HW 2 Problem 2(b)

clear
clc
close all

load('iterative_testproblem.mat')

nit= size(Ait,1);
x0 = zeros(nit,1);
tol=1e-9;
% disp('Verbose Jacobi iterations:  ')
[xit,iterations]=SOR(x0,Ait,bit,tol,true);

disp('Solution with SOR method:  ')
disp(xit);

xmat = Ait\bit;
disp('Matlab built-in solution:  ')
disp(xmat);

err = xmat - xit;
disp('Error: ')
disp(err)

disp('Number of iterations required and tolerance:  ')
disp(iterations);
disp(tol);

table(xit, xmat, err)
```

```
x= 0.000000   0.069755   0.134947   0.191313   0.235164   0.263634   0.274859   0.268105   0.243815   0.203576   0.150022   0.086655   0.017619   -0.052569   -0.119
it=1; difftot = 5.000000e+02
x= 0.019183   0.099890   0.193246   0.273962   0.336758   0.377527   0.393601   0.383930   0.349146   0.291524   0.214833   0.124091   0.025231   -0.075279   -0.170
it=2; difftot = 1.785146e+01
x= 0.025551   0.118184   0.218432   0.309668   0.380648   0.426730   0.444899   0.433968   0.394650   0.329518   0.242833   0.140263   0.028519   -0.085090   -0.193
it=3; difftot = 7.706605e+00
x= 0.029945   0.125032   0.230763   0.325093   0.399609   0.447986   0.467061   0.455584   0.414308   0.345932   0.254929   0.147250   0.029940   -0.089329   -0.202
it=4; difftot = 3.338938e+00
x= 0.031389   0.128947   0.235655   0.332156   0.407800   0.457169   0.476635   0.464923   0.422801   0.353023   0.260154   0.150269   0.030554   -0.091160   -0.206
it=5; difftot = 1.453900e+00
x= 0.032321   0.130298   0.238185   0.335047   0.411449   0.461136   0.480771   0.468958   0.426470   0.356087   0.262412   0.151573   0.030819   -0.091951   -0.208
it=6; difftot = 6.290555e-01
x= 0.032600   0.131115   0.239099   0.336457   0.412970   0.462880   0.482557   0.470701   0.428055   0.357410   0.263387   0.152136   0.030933   -0.092292   -0.209
it=7; difftot = 2.737141e-01
x= 0.032797   0.131361   0.239620   0.336986   0.413685   0.463616   0.483338   0.471454   0.428740   0.357982   0.263809   0.152379   0.030983   -0.092440   -0.209
it=8; difftot = 1.182617e-01
x= 0.032845   0.131533   0.239781   0.337273   0.413961   0.463953   0.483669   0.471781   0.429036   0.358229   0.263991   0.152484   0.031004   -0.092504   -0.209
it=9; difftot = 5.149878e-02
x= 0.032887   0.131574   0.239891   0.337364   0.414105   0.464087   0.483819   0.471921   0.429164   0.358336   0.264069   0.152530   0.031014   -0.092531   -0.210
it=10; difftot = 2.220459e-02
x= 0.032894   0.131612   0.239916   0.337425   0.414153   0.464154   0.483879   0.471983   0.429219   0.358382   0.264103   0.152550   0.031018   -0.092543   -0.210
it=11; difftot = 9.691073e-03
x= 0.032904   0.131617   0.239941   0.337439   0.414183   0.464177   0.483909   0.472009   0.429243   0.358402   0.264118   0.152558   0.031019   -0.092548   -0.210
it=12; difftot = 4.207469e-03
x= 0.032904   0.131626   0.239944   0.337453   0.414190   0.464191   0.483919   0.472021   0.429253   0.358411   0.264124   0.152562   0.031020   -0.092551   -0.210
it=13; difftot = 1.883720e-03
x= 0.032907   0.131626   0.239950   0.337454   0.414197   0.464195   0.483925   0.472025   0.429258   0.358414   0.264127   0.152563   0.031020   -0.092552   -0.210
it=14; difftot = 8.567624e-04
x= 0.032906   0.131628   0.239949   0.337458   0.414198   0.464198   0.483927   0.472028   0.429260   0.358416   0.264128   0.152564   0.031020   -0.092552   -0.210
it=15; difftot = 4.105895e-04
x= 0.032907   0.131628   0.239951   0.337457   0.414200   0.464198   0.483928   0.472029   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=16; difftot = 2.042013e-04
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483928   0.472029   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=17; difftot = 1.081868e-04
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472029   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=18; difftot = 5.966581e-05
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=19; difftot = 3.462561e-05
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472029   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=20; difftot = 2.061943e-05
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=21; difftot = 1.259375e-05
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=22; difftot = 7.752678e-06
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=23; difftot = 4.835616e-06
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=24; difftot = 3.032589e-06
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=25; difftot = 1.912392e-06
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=26; difftot = 1.209786e-06
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=27; difftot = 7.682683e-07
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=28; difftot = 4.887620e-07
```

```
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=29; difftot = 3.114685e-07
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=30; difftot = 1.987014e-07
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=31; difftot = 1.269012e-07
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=32; difftot = 8.110749e-08
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=33; difftot = 5.187689e-08
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=34; difftot = 3.319947e-08
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429261   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=35; difftot = 2.125784e-08
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=36; difftot = 1.361774e-08
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=37; difftot = 8.727193e-09
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=38; difftot = 5.595131e-09
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=39; difftot = 3.588459e-09
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=40; difftot = 2.302269e-09
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=41; difftot = 1.477575e-09
x= 0.032907   0.131628   0.239951   0.337458   0.414200   0.464199   0.483929   0.472030   0.429262   0.358417   0.264129   0.152564   0.031021   -0.092552   -0.210
it=42; difftot = 9.485912e-10
Solution with SOR method:
    0.0329
    0.1316
    0.2400
    0.3375
    0.4142
    0.4642
    0.4839
    0.4720
    0.4293
    0.3584
    0.2641
    0.1526
    0.0310
   -0.0926
   -0.2101
   -0.3138
   -0.3971
   -0.4544
   -0.4819
   -0.4780
   -0.4427
   -0.3785
   -0.2896
   -0.1817
   -0.0619
    0.0619
    0.1817
    0.2896
    0.3785
    0.4427
    0.4780
    0.4819
    0.4544
    0.3971
    0.3138
    0.2101
    0.0926
   -0.0310
   -0.1526
   -0.2641
   -0.3584
   -0.4293
   -0.4720
   -0.4839
   -0.4642
   -0.4142
   -0.3375
   -0.2400
   -0.1316
   -0.0329

Matlab built-in solution:
    0.0329
    0.1316
    0.2400
    0.3375
    0.4142
    0.4642
    0.4839
    0.4720
    0.4293
    0.3584
```

```
    0.2641
    0.1526
    0.0310
   -0.0926
   -0.2101
   -0.3138
   -0.3971
   -0.4544
   -0.4819
   -0.4780
   -0.4427
   -0.3785
   -0.2896
   -0.1817
   -0.0619
    0.0619
    0.1817
    0.2896
    0.3785
    0.4427
    0.4780
    0.4819
    0.4544
    0.3971
    0.3138
    0.2101
    0.0926
   -0.0310
   -0.1526
   -0.2641
   -0.3584
   -0.4293
   -0.4720
   -0.4839
   -0.4642
   -0.4142
   -0.3375
   -0.2400
   -0.1316
   -0.0329

Error:
   1.0e-11 *

   -0.0551
    0.1057
   -0.1479
    0.1791
   -0.1977
    0.2038
   -0.1984
    0.1841
   -0.1633
    0.1391
   -0.1138
    0.0897
   -0.0681
    0.0499
   -0.0352
    0.0240
   -0.0158
    0.0100
   -0.0061
    0.0036
   -0.0020
    0.0011
   -0.0006
    0.0003
   -0.0002
    0.0002
   -0.0003
    0.0006
   -0.0011
    0.0020
   -0.0036
    0.0061
   -0.0100
    0.0158
   -0.0240
    0.0352
   -0.0499
    0.0681
   -0.0897
    0.1138
   -0.1391
    0.1633
   -0.1841
    0.1984
   -0.2038
    0.1977
   -0.1791
```

```
    0.1479
   -0.1057
    0.0551

Number of iterations required and tolerance:
    42

   1.0000e-09


ans =

  50×3 table

       xit         xmat          err
    _________    _________    _________

     0.032907     0.032907    -5.5052e-13
      0.13163      0.13163     1.0567e-12
      0.23995      0.23995    -1.4793e-12
      0.33746      0.33746     1.7912e-12
       0.4142       0.4142    -1.9768e-12
       0.4642       0.4642     2.0376e-12
      0.48393      0.48393    -1.9844e-12
      0.47203      0.47203     1.8412e-12
      0.42926      0.42926    -1.6332e-12
      0.35842      0.35842     1.3908e-12
      0.26413      0.26413    -1.1382e-12
      0.15256      0.15256     8.9717e-13
     0.031021     0.031021    -6.8131e-13
    -0.092552    -0.092552     4.9884e-13
     -0.21007     -0.21007    -3.5233e-13
     -0.31385     -0.31385     2.3975e-13
      -0.3971      -0.3971    -1.5765e-13
     -0.45437     -0.45437     9.9587e-14
     -0.48193     -0.48193    -6.1007e-14
     -0.47796     -0.47796     3.5527e-14
     -0.44273     -0.44273    -2.0317e-14
     -0.37854     -0.37854     1.0936e-14
     -0.28958     -0.28958    -5.9952e-15
     -0.18169     -0.18169     3.0531e-15
    -0.061914    -0.061914    -2.0192e-15
     0.061914     0.061914     2.0123e-15
      0.18169      0.18169    -3.1086e-15
      0.28958      0.28958     5.8842e-15
      0.37854      0.37854    -1.0991e-14
      0.44273      0.44273     2.0317e-14
      0.47796      0.47796    -3.5638e-14
      0.48193      0.48193     6.0951e-14
      0.45437      0.45437    -9.9587e-14
       0.3971       0.3971     1.5765e-13
      0.31385      0.31385    -2.3981e-13
      0.21007      0.21007     3.5233e-13
     0.092552     0.092552    -4.9882e-13
    -0.031021    -0.031021     6.813e-13
     -0.15256     -0.15256    -8.9725e-13
     -0.26413     -0.26413     1.1382e-12
     -0.35842     -0.35842    -1.3908e-12
     -0.42926     -0.42926     1.6332e-12
     -0.47203     -0.47203    -1.8411e-12
     -0.48393     -0.48393     1.9844e-12
      -0.4642      -0.4642    -2.0376e-12
      -0.4142      -0.4142     1.9768e-12
     -0.33746     -0.33746    -1.7912e-12
     -0.23995     -0.23995     1.4792e-12
     -0.13163     -0.13163    -1.0567e-12
    -0.032907    -0.032907     5.5052e-13
```

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