Program to Solve by Jacobi's method and the Guass- Seidal method and display the code and the output for the following Linear System (10 Iterations)

$$
\begin{aligned}
4x_1 + x_2 + x_3 + x_5 &= 6,\\
-x_1 - 3x_2 + x_3 + x_4 &= 6,\\
2x_1 + x_2 + 5x_3 - x_4 - x_5 &= 6,\\
-x_1 - x_2 - x_3 + 4x_4 &= 6,\\
2x_2 - x_3 + x_4 + 4x_5 &= 6.
\end{aligned}
$$

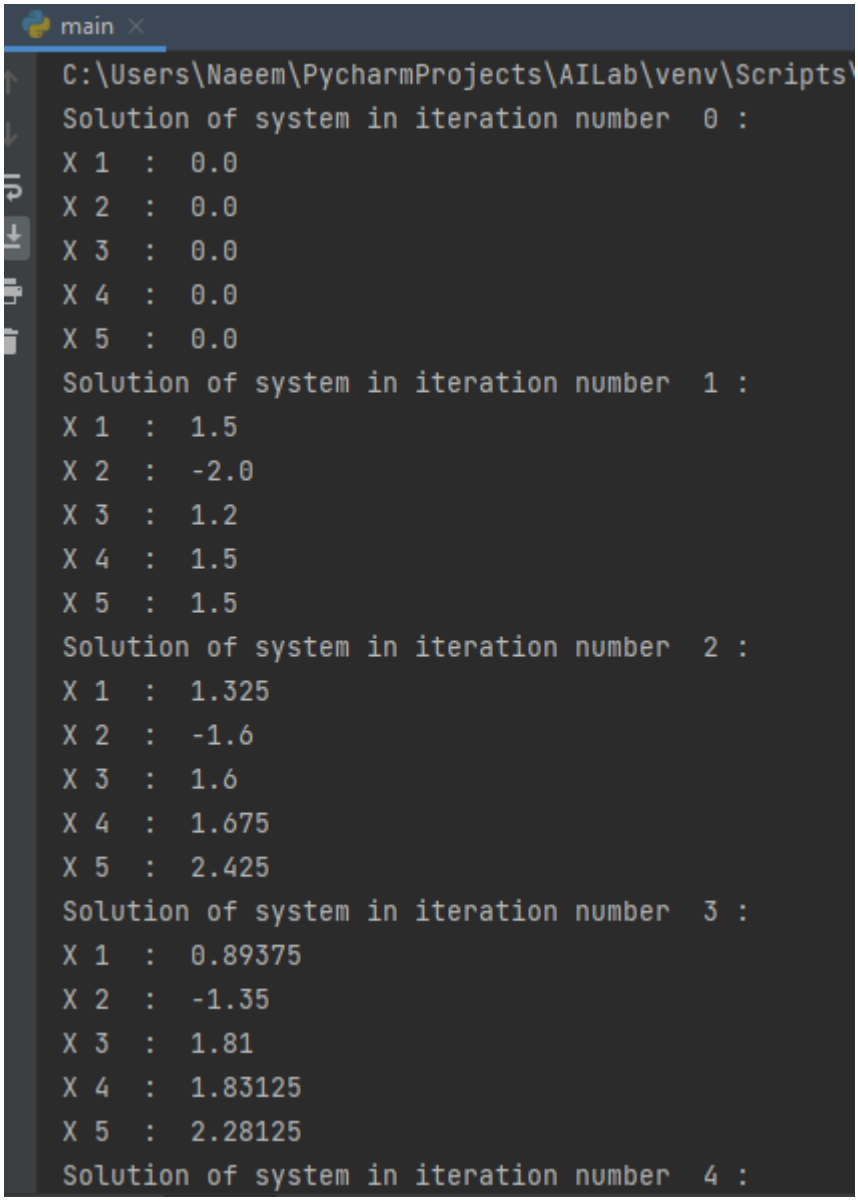
Jacobi:

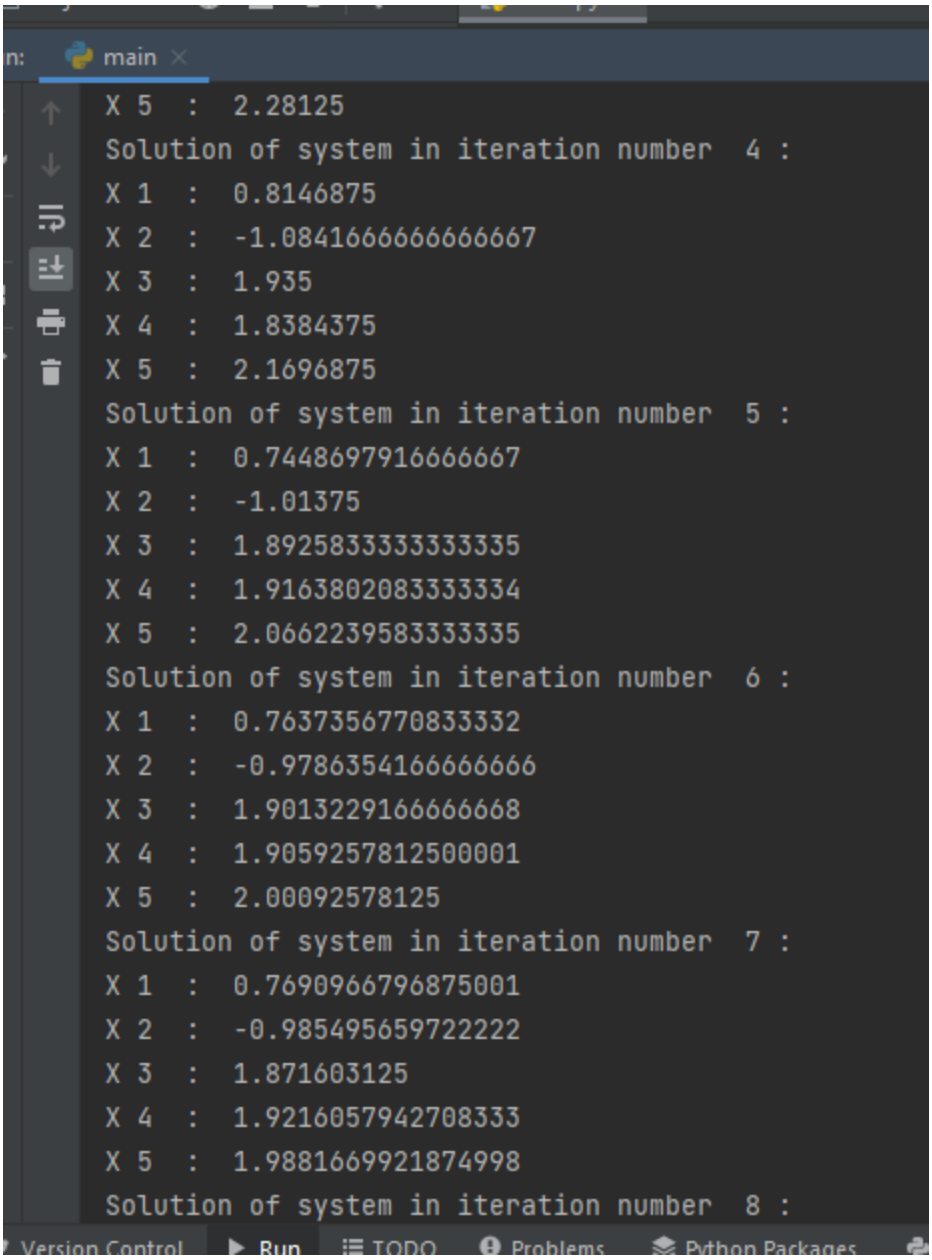
Code:

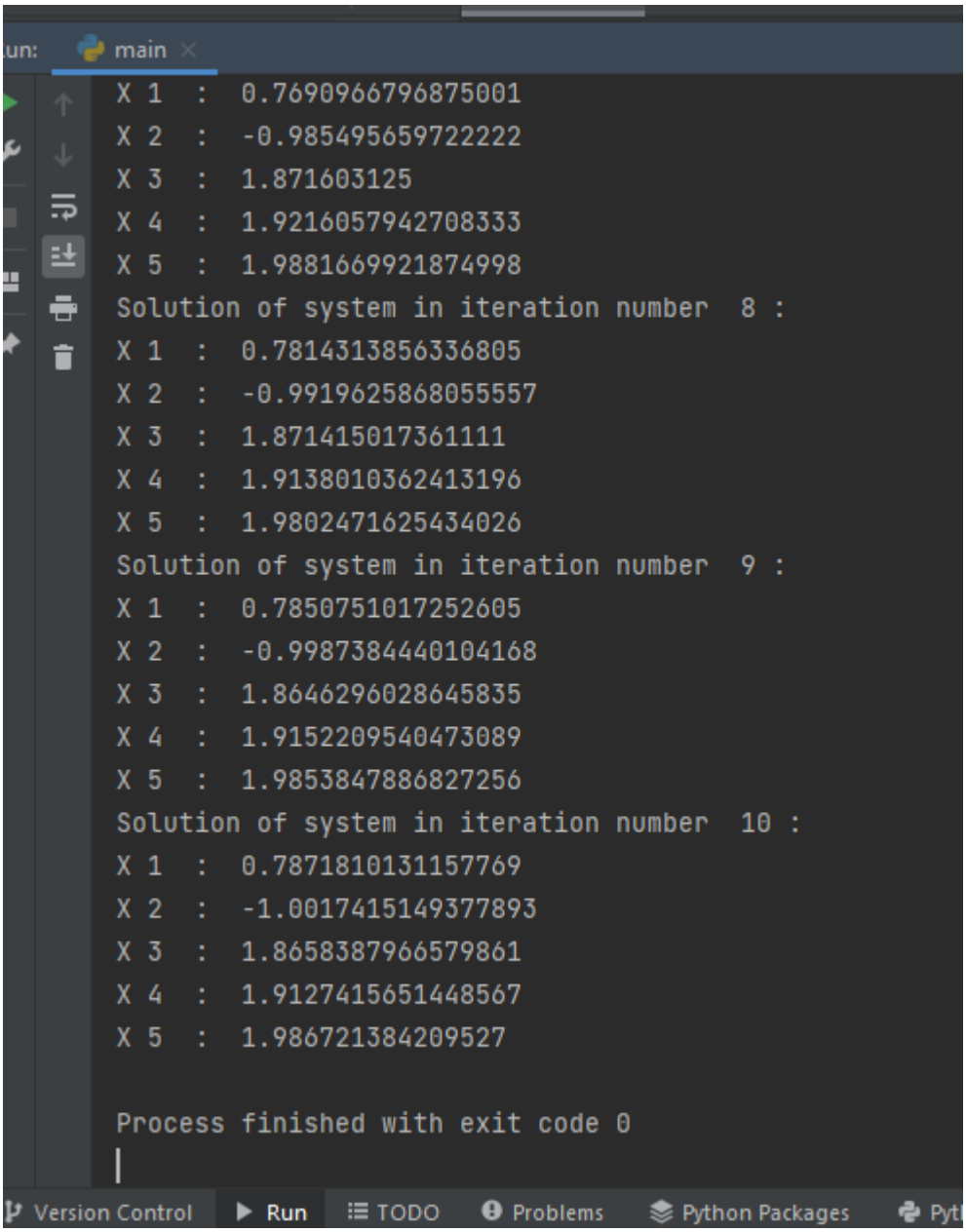
```
problem = [[4.0, 1.0, 1.0, 0.0, 1.0, 6.0],          #The system given in the statement is presented as a 5x6 matrix
        [-1.0, -3.0, 1.0, 1.0, 0.0, 6.0],
        [2.0, 1.0, 5.0, -1.0, -1.0, 6.0],
        [-1.0, -1.0, -1.0, 4.0, 0.0, 6.0],
        [0.0, 2.0, -1.0, 1.0, 4.0, 6.0]]


def jacobi():
   x = [0.0, 0.0, 0.0, 0.0, 0.0]                #previous iteration solution
   nextx = [0.0, 0.0, 0.0, 0.0, 0.0]              #new solution
   iteration = 0

   for i in range(5):                          #These loops take all terms on LHS to RHS (except for leading term)
      for j in range(5):                       #These loops also divide all terms by the coefficient of the leading term
         if i != j:
            problem[i][j] *= -1
            problem[i][j] /= problem[i][i]
      problem[i][5] /= problem[i][i]
      problem[i][i] = 0
```

```
    for q in range(11):                    #These loops print the solution of previous iteration
                                           #These loops also generate solution for new iteration

        print("Solution of system in iteration number ", iteration, ": ")
        for i in range(5):
            print("X", i + 1, " : ", x[i])

        for i in range(5):
            tempsum = 0.0

            for j in range(5):
                tempsum += (problem[i][j] * x[j])
            tempsum += problem[i][5]
            nextx[i] = tempsum

        for i in range(5):
            x[i] = nextx[i]
        iteration += 1


jacobi()
```

Screenshots:




n:
main
X 5 : 2.28125
Solution of system in iteration number 4 :
X 1 : 0.8146875
X 2 : -1.0841666666666667
X 3 : 1.935
X 4 : 1.8384375
X 5 : 2.1696875
Solution of system in iteration number 5 :
X 1 : 0.7448697916666667
X 2 : -1.01375
X 3 : 1.8925833333333335
X 4 : 1.9163802083333334
X 5 : 2.0662239583333335
Solution of system in iteration number 6 :
X 1 : 0.7637356770833332
X 2 : -0.9786354166666666
X 3 : 1.9013229166666668
X 4 : 1.9059257812500001
X 5 : 2.00092578125
Solution of system in iteration number 7 :
X 1 : 0.7690966796875001
X 2 : -0.985495659722222
X 3 : 1.871603125
X 4 : 1.9216057942708333
X 5 : 1.9881669921874998
Solution of system in iteration number 8 :
Version Control
Run
TODO
Problems
Python Packages


un:
main
X 1 : 0.7690966796875001
X 2 : -0.985495659722222
X 3 : 1.871603125
X 4 : 1.9216057942708333
X 5 : 1.9881669921874998
Solution of system in iteration number 8 :
X 1 : 0.7814313856336805
X 2 : -0.9919625868055557
X 3 : 1.871415017361111
X 4 : 1.9138010362413196
X 5 : 1.9802471625434026
Solution of system in iteration number 9 :
X 1 : 0.7850751017252605
X 2 : -0.9987384440104168
X 3 : 1.8646296028645835
X 4 : 1.9152209540473089
X 5 : 1.9853847886827256
Solution of system in iteration number 10 :
X 1 : 0.7871810131157769
X 2 : -1.0017415149377893
X 3 : 1.8658387966579861
X 4 : 1.9127415651448567
X 5 : 1.986721384209527
Process finished with exit code 0
Version Control
Run
TODO
Problems
Python Packages

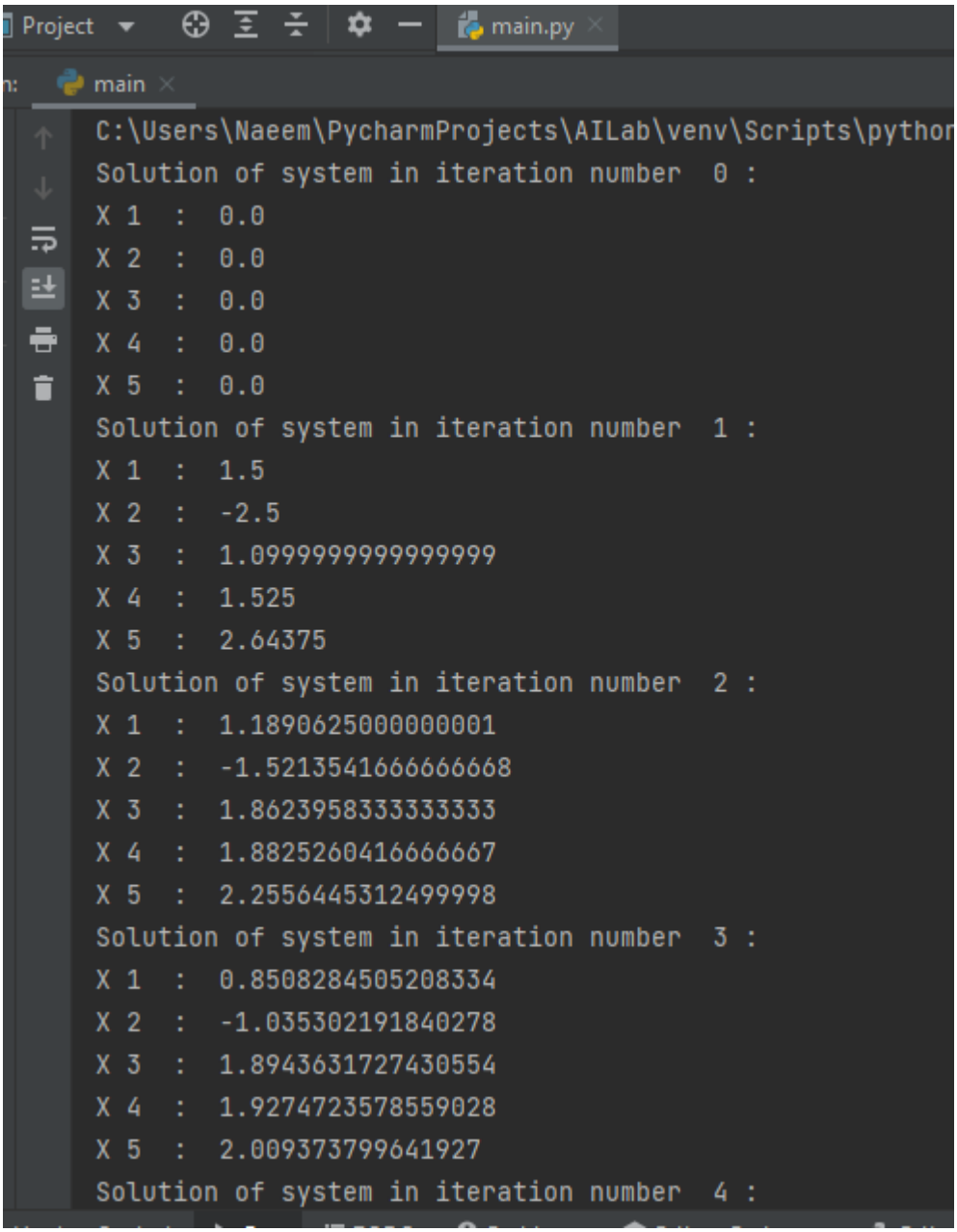
Gauss Seidel:

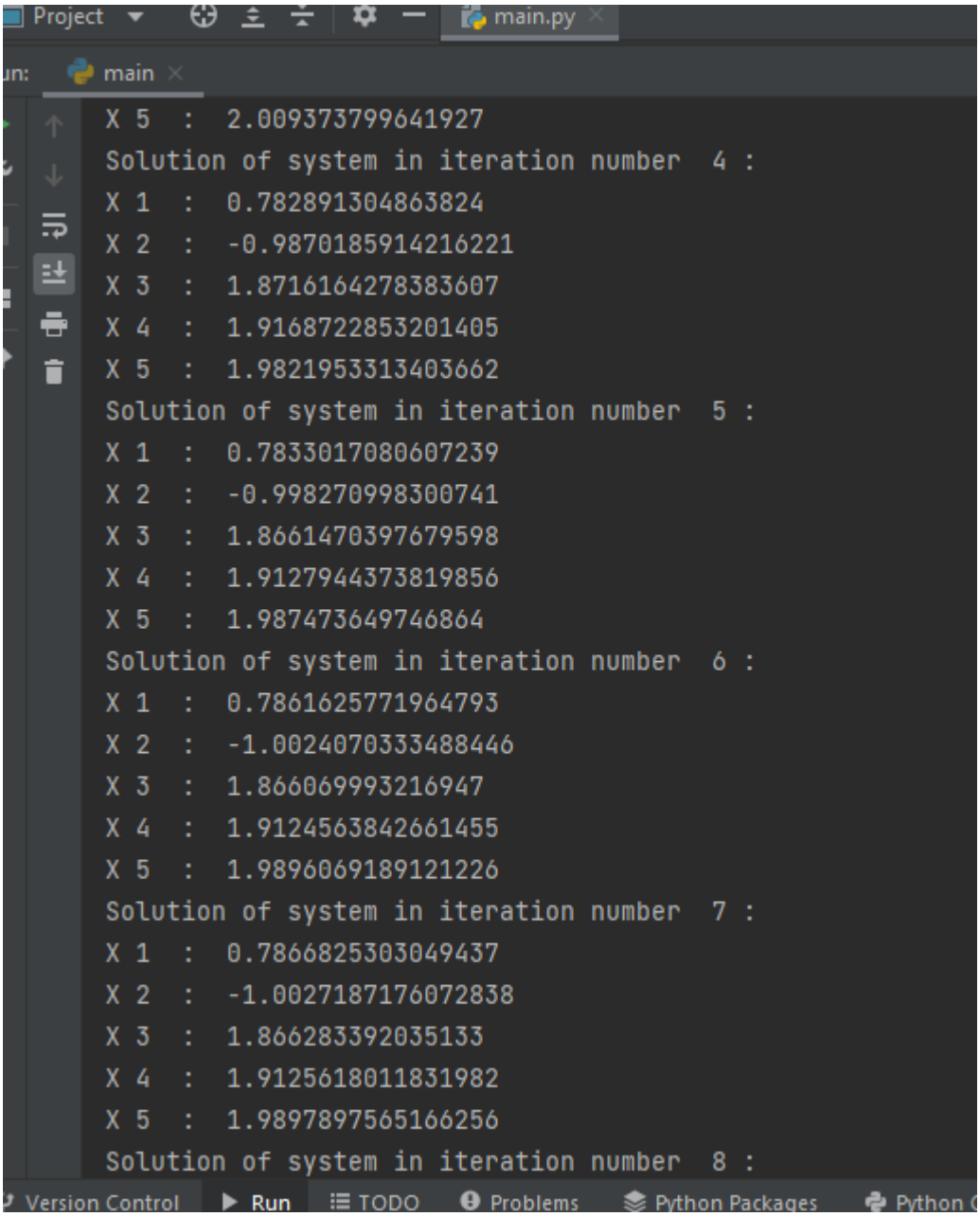
Code:

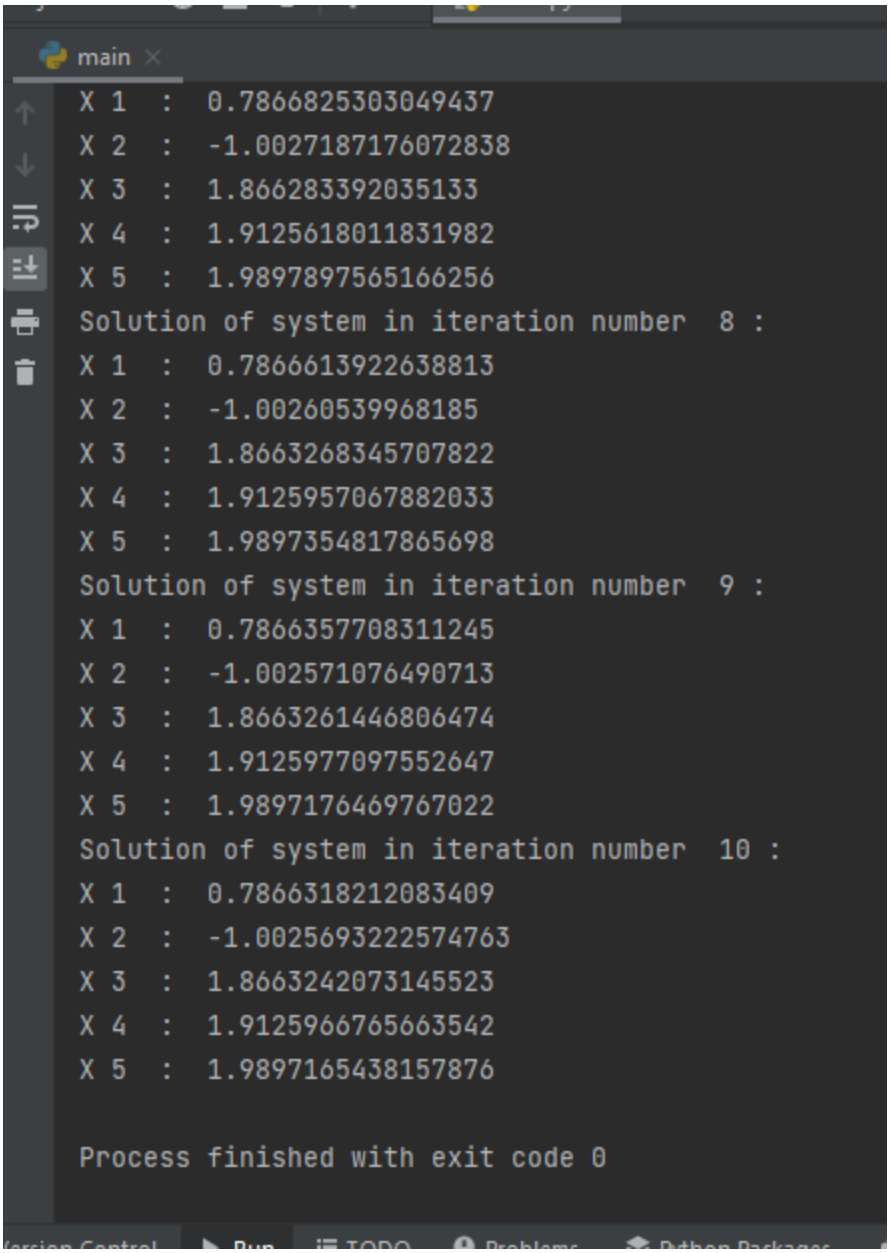
```
problem = [[4.0, 1.0, 1.0, 0.0, 1.0, 6.0],          #The system given in the statement
is presenated as a 5x6 matrix
        [-1.0, -3.0, 1.0, 1.0, 0.0, 6.0],
        [2.0, 1.0, 5.0, -1.0, -1.0, 6.0],
        [-1.0, -1.0, -1.0, 4.0, 0.0, 6.0],
        [0.0, 2.0, -1.0, 1.0, 4.0, 6.0]]


def gaussSeidel():
   x = [0.0, 0.0, 0.0, 0.0, 0.0]                #previous iteration solution
   iteration = 0

   for i in range(5):                           #These loops take all terms on LHS to
RHS (except for leading term)
      for j in range(5):                        #These loops also divide all terms by the
coefficient of the leading term
         if i != j:
            problem[i][j] *= -1
            problem[i][j] /= problem[i][i]
      problem[i][5] /= problem[i][i]
      problem[i][i] = 0

   for q in range(11):                          #These loops print the solution of
previous iteration
                                                #These loops also generate solution for new
iteration

      print("Solution of system in iteration number ", iteration, ": ")
      for i in range(5):
         print("X", i + 1, " : ", x[i])

      for i in range(5):
         tempsum = 0.0
```

```
            for j in range(5):
                tempsum += (problem[i][j] * x[j])
            tempsum += problem[i][5]
            x[i] = tempsum

        iteration += 1


gaussSeidel()
```

Screenshots:




Project
main.py
un:
main
X 5 : 2.009373799641927
Solution of system in iteration number 4 :
X 1 : 0.782891304863824
X 2 : -0.9870185914216221
X 3 : 1.8716164278383607
X 4 : 1.9168722853201405
X 5 : 1.9821953313403662
Solution of system in iteration number 5 :
X 1 : 0.7833017080607239
X 2 : -0.998270998300741
X 3 : 1.8661470397679598
X 4 : 1.9127944373819856
X 5 : 1.987473649746864
Solution of system in iteration number 6 :
X 1 : 0.7861625771964793
X 2 : -1.0024070333488446
X 3 : 1.866069993216947
X 4 : 1.9124563842661455
X 5 : 1.9896069189121226
Solution of system in iteration number 7 :
X 1 : 0.7866825303049437
X 2 : -1.0027187176072838
X 3 : 1.866283392035133
X 4 : 1.9125618011831982
X 5 : 1.9897897565166256
Solution of system in iteration number 8 :
Version Control
Run
TODO
Problems
Python Packages
Python


main
X 1 : 0.7866825303049437
X 2 : -1.0027187176072838
X 3 : 1.866283392035133
X 4 : 1.9125618011831982
X 5 : 1.9897897565166256
Solution of system in iteration number 8 :
X 1 : 0.7866613922638813
X 2 : -1.00260539968185
X 3 : 1.8663268345707822
X 4 : 1.9125957067882033
X 5 : 1.9897354817865698
Solution of system in iteration number 9 :
X 1 : 0.7866357708311245
X 2 : -1.002571076490713
X 3 : 1.8663261446806474
X 4 : 1.9125977097552647
X 5 : 1.9897176469767022
Solution of system in iteration number 10 :
X 1 : 0.7866318212083409
X 2 : -1.0025693222574763
X 3 : 1.8663242073145523
X 4 : 1.9125966765663542
X 5 : 1.9897165438157876
Process finished with exit code 0