Assignment for Module–4
Due on: Sunday, Feb 14

INSTRUCTIONS

• Submit your work on the course website (https://onlinecourses.nptel.ac.in/noc16_ch01/)
• The assignment deadline is 14th Feb 2016. Please submit your results before the deadline.
• You are required to use the uploaded solver file for Problem 2. Do not edit this file.
• You do not need to upload your MATLAB files.

1. GAUSS–SIEDEL METHOD (2 points)

Please solve the following set of equations using Gauss-Siedel method:

\[4x_1 - x_2 + x_3 = 12\]
\[-x_1 + 4x_2 - 2x_3 = -1\]
\[x_1 - 2x_2 + 4x_3 = 5\]

Using an initial guess as: \(x = [0 \quad 0 \quad 0]^T\), perform 4 iterations and 10 iterations of Gauss-Siedel method. Please report the errors at the end of 4th and 10th iteration.

1, 2. Report the error obtained after 4th and 10th iteration.

Note: You can check that the solution to these equations is \(x = [3 \quad 1 \quad 1]^T\). Please do not report this solution. Please report the iteration errors only.

In n-th iteration, the iteration error is: \(\text{max} \left(\text{abs} \left( x^{(n)} - x^{(n-1)} \right) \right)\), i.e., the highest absolute difference between current and previous iteration values of vector \(x\).

2. TRI-DIAGONAL MATRIX ALGORITHM (2 points)

The TDMA solver myTDMA.m has to be used to solve the problem.

Using the Thomas Algorithm solver uploaded, please solve the following equations:

\[
\begin{bmatrix}
1 & 0 & 0 & 0 & 0 & 0 \\
1 & 1.2 & 1 & 0 & 0 & 0 \\
0 & 1 & 1.4 & 1 & 0 & 0 \\
0 & 0 & 1 & 1.6 & 1 & 0 \\
0 & 0 & 0 & 0.5 & 0.8 & 0.5 \\
0 & 0 & 0 & 0 & 0.2 & 1 \\
\end{bmatrix}
\begin{bmatrix}
x_1 \\
x_2 \\
x_3 \\
x_4 \\
x_5 \\
x_6 \\
\end{bmatrix}
= 
\begin{bmatrix}
25 \\
100.2 \\
132.2 \\
174.8 \\
109.5 \\
87 \\
\end{bmatrix}
\]

3–6. Please report the values of \(x_2\) to \(x_5\).
3. APPLICATION OF LINEAR ALGEBRA

A company produces Transistors, Resistors, and Computer Chips, which are built using materials C, Z and G. Each transistor requires 4 of material–C, 1 of material–Z and 2 of material–G. Likewise the number of materials of each type required in making transistors, resistors and chips is given in the following table:

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>Z</th>
<th>G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transistors</td>
<td>4</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Resistors</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Computer chips</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

If the total amount of materials used today are 960 units of C, 510 units of Z, and 610 units of G, find the number of transistors, resistors and computer chips manufactures in this production run.

You will need to set up the system of equations for this production run, and solve it using a method of your choice.

7–9. Report the number of transistors, resistors and computer chips manufactured in this production run. (Please report integer values only.)

4. LU DECOMPOSITION

The LU decomposition code myLUcode.m from video lectures is uploaded. You have the option of starting with this code, or completely using your own new code.

Write your own code to perform LU decomposition. Given the following set of equations:

\[ 10x_1 + 2x_2 - x_3 + 3x_4 = 27 \]
\[ -3x_1 - 5x_2 + 2x_3 + 5x_4 = -61.5 \]
\[ x_1 + x_2 + 6x_3 + 2x_4 = -21.5 \]
\[ 3x_1 + 8x_2 + 9x_3 + x_4 = 0 \]

perform the LU decomposition of the coefficient matrix, and report the last row of the L matrix.

10–13. Please report the 4th row of the L matrix obtained above.