Middle East Technical University
Department of Mechanical Engineering
ME 310 – Numerical Methods
Fall 2014
Study Problems – II*

Assigned on 18.11.2014
Prepared by İlteriş Berke Harmancı – Eren Demircan
*Will not be collected/graded.

1. Solve the following system of equations using <u>Gauss elimination</u> method with <u>partial pivoting</u> and <u>scaling</u>. Show every step of your solution. *(Answer: [0.2917,19.67,1.15])*

$$25x_1 + x_2 + x_3 = 106.8$$
$$8x_2 + x_3 + 64x_1 = 177.2$$
$$x_3 + 144x_1 + 12x_2 = 279.2$$

2. Solve the following system of equations using Gauss - Jordan elimination method by showing every step of your solution. (Hint: You can check your answer using *rref ( )* command of MATLAB which reduces given matrix into <u>*reduced row echelon form.*</u>)

$$3x_1 - 13x_2 + 9x_3 + 3x_4 = -19$$
$$4x_2 + x_3 - 6x_1 - 18x_4 = -34$$
$$4x_4 + 2x_3 + 6x_1 - 2x_2 = 16$$
$$6x_3 + 12x_1 - 8x_2 + 10x_4 = 26$$

[Adapted from Numerical Mathematics and Computing, Cheney & Kincaid]

3. Solve the following system of equations using Gauss-Seidel iteration method. Check the convergence of the system and rearrange equations if necessary. Apply Gauss-Seidel method with a relaxation of **(a)** λ = 0.5 and **(b)** λ = 1 and **(c)** λ = 1.8 by using a tolerance of $\varepsilon_s = 1 \%$ for all cases. Compare the effect of relaxation on the iterations.

$$x_2 - 2x_3 + 3 = -1$$
$$-2x_2 + x_1 + x_3 = 0$$
$$x_2 - 2x_1 = -1$$