MAE 3210 - Spring 2020 - Homework 3

Homework 3 is due **online** through Canvas in PDF format by 11:59PM on Friday February 7.

You are required to submit code for all functions and/or subroutines built to solve these problems, which is designed to be easy to read and understand, in your chosen programming language, **and which you have written yourself**. The text from your code should both be copied into a single PDF file submitted on canvas. **Your submitted PDF must also include responses to any assigned questions, which for problems requiring programming should be based on output from your code**. For example, if you are asked to find numerical answers to a problem, the numbers should be included in your submission.

1. Given the equations

$$10x_1 + 2x_2 - x_3 = 27$$
$$-3x_1 - 6x_2 + 2x_3 = -61.5$$
$$x_1 + x_2 + 5x_3 = -21.5,$$

   (a) Solve using naive Gauss elimination (by hand). Show all steps of the computation.

   (b) Substitute your results into the original equations to check your answers.

2. Given the equations

$$x_1 + 2x_2 - x_3 = 2$$
$$5x_1 + 2x_2 + 2x_3 = 9$$
$$-3x_1 + 5x_2 - x_3 = 1,$$

   (a) Solve by Gauss elimination with partial pivoting using code you have written yourself (see Figure 9.6 on page 268 of text for pseudocode - beware of typos and/or unneccessary components!).

   (b) Substitute your results into the original equations to check your answers.

3. Given the equations

$$8x_1 + 4x_2 - x_3 = 11$$
$$-2x_1 + 5x_2 + x_3 = 4$$
$$2x_1 - x_2 + 6x_3 = 7,$$

(a) Solve using LU decomposition without pivoting (by hand). Show all steps of the computation.

(b) Determine the matrix inverse using LU decomposition (by hand), and verify that $[A][A]^{-1} = [I]$.

4. Given the equations

$$2x_1 - 6x_2 - x_3 = -38$$
$$-3x_1 - x_2 + 7x_3 = -34$$
$$-8x_1 + x_2 - 2x_3 = -20,$$

(a) Solve using LU decomposition with partial pivoting using code you have written yourself (see Figure 10.2 on page 286 for pseudocode - beware of typos and/or unnecessary components!).

(b) Determine the matrix inverse using code you have written yourself (see Figure 10.5 on page 290 for pseudocode - beware of typos and/or unnecessary components!).