Instructor: Roman Chomko

# Homework* 1
# **Solving Systems of Equations using Gauss-Jordan Elimination**

**Due Date:** *Thursday, April 7, 2016*

---

**Problem 1** (Chap 1.2, Problem 21)

Determine whether the matrix is in row-echelon form. If it is, determine whether it is also in reduced row-echelon form:

$$\begin{bmatrix} 2 & 0 & 1 & 3 \\ 0 & -1 & 1 & 4 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

**Problem 2** (Chap 1.2, Problem 33)

**a)** Solve by Gauss-Jordan Elimination the following system of equations:

$$\begin{aligned} 2x_1 + \phantom{3x_2 +} 3x_3 &= 3 \\ 4x_1 - 3x_2 + 7x_3 &= 5 \\ 8x_1 - 9x_2 + 15x_3 &= 10 \end{aligned}$$

**b)** Enter the system's augmented matrix (say, `A`) in Matlab and solve the system using Matlab using a command `rref(A)`. This command produces the reduced row-echelon form of a matrix. Use commands of the type `help rref` to find more about any particular commands in Matlab.

**Problem 3** (Chap 1.1, Problem 24)

**a)** Find the solution set of the system of linear equations represented by the augmented matrix:

$$\begin{bmatrix} 1 & 2 & 3 & 0 \\ 0 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 \end{bmatrix}$$

**b)** Solve this system using Matlab's `rref` command.

---

* *Collaboration is allowed*

**Problem 4** (row operations using Matlab)

$$\begin{aligned} 2x_1 + \qquad\quad 3x_3 &= 3 \\ 4x_1 - 3x_2 + \ \ 7x_3 &= 5 \\ 8x_1 - 9x_2 + 15x_3 &= 10 \end{aligned}$$

Repeat **Problem 2** except that now use Matlab to perform row operations using the following procedures shown below.

```
Command Window
>> % Assume an augmented matrix A
>> A = [0 0 0 0; 2 1 0 1; 0 1 2 3; 2 4 6 8]

A =

     0     0     0     0
     2     1     0     1
     0     1     2     3
     2     4     6     8

>> % Exchange rows 1 and 4, that is, perform R1 <-> R4
>> A([1 4],:) = A([4 1],:)

A =

     2     4     6     8
     2     1     0     1
     0     1     2     3
     0     0     0     0

>> % Divide row 1 by 2 and save it in row 1, that is, 1/2*R1 -> R1
>> A(1,:) = 1/2*A(1,:)

A =

     1     2     3     4
     2     1     0     1
     0     1     2     3
     0     0     0     0

>> % Multiply row 1 by 2 and subtract it from row 2: R2 - 2*R1 -> R2
>> A(2,:) = A(2,:) - 2*A(1,:)

A =

     1     2     3     4
     0    -3    -6    -7
     0     1     2     3
     0     0     0     0

>> |
```