AMS10 HW2

*Note that you do not need to submit proof of having used Matlab

Problem 1 For the systems of linear equations (i-iv) do the following

a. Put into augmented matrix form

b. Put in echelon form

c. Solve for x_3, x_2, x_1 in that order

d. How many pivot points, hence, pivot variables?

e. How many free variables are there?

f. How many solutions are there if any?

g. Put into canonical form. Note, pivot points should be the only non-zero number in its column.

h. Put final solution in decimal form and compare with solution given by Matlab by applying the command **rref** to the original augmented matrix.

i. In Matlab, take an augmented matrix from one of the intermediate steps and apply rref. Is the solution different?

Problem 1. i. Consider the following system of linear equations

$$4x_1 + 2x_2 + x_3 = 1 \tag{1}$$
$$x_1 + x_2 + 2x_3 = 2 \tag{2}$$
$$2x_1 + 2x_2 + x_3 = 5 \tag{3}$$

Problem 1. ii. Consider the following system of linear equations

$$4x_1 + 8x_2 + x_3 = 1 \tag{4}$$
$$x_1 + 2x_2 + 2x_3 = 1 \tag{5}$$
$$x_1 + x_2 + 2x_3 = 2 \tag{6}$$

Problem 1. iii. Consider the following system of linear equations

$$x_1 + 2x_2 + x_3 = 1 \tag{7}$$
$$x_1 + 2x_3 = 2 \tag{8}$$
$$2x_1 + 2x_2 + 3x_3 = 3 \tag{9}$$

Problem 1. iv. Consider the following system of linear equations

$$2x_1 + x_2 = 10 \tag{10}$$
$$x_3 + x_2 = 2 \tag{11}$$
$$2x_1 + 2x_2 + x_3 = 12 \tag{12}$$

Problem 2

For the following matrices, determine if they are in echelon form. If the matrix is not in echelon form, perform row operations until it is in echelon form. Determine if there is one solution, no solution or infinitely many solutions. If there are free variables, which are the free variables? Which variables are the pivot variables?

a. $\left(\begin{array}{cccc:c} 4 & 8 & 1 & 1 & 2 \\ 0 & 2 & 2 & 1 & 1 \\ 0 & 0 & 2 & 2 & 2 \\ 0 & 0 & 0 & 2 & 2 \end{array}\right)$ b. $\left(\begin{array}{cccc:c} 0 & 0 & 2 & 2 & 2 \\ 4 & 8 & 1 & 1 & 2 \\ 0 & 2 & 2 & 1 & 1 \\ 0 & 0 & 0 & 2 & 2 \end{array}\right)$ c. $\left(\begin{array}{cccc:c} 0 & 0 & 2 & 2 & 2 \\ 4 & 8 & 1 & 1 & 2 \\ 0 & 0 & 0 & 1 & 1 \\ 0 & 0 & 0 & 2 & 2 \end{array}\right)$ d. $\left(\begin{array}{cccc:c} 4 & 8 & 1 & 1 & 2 \\ 0 & 1 & 2 & 2 & 2 \\ 0 & 2 & 0 & 0 & 1 \\ 0 & 0 & 0 & 2 & 2 \end{array}\right)$

e. $\left(\begin{array}{cccc:c} 0 & 8 & 1 & 1 & 2 \\ 0 & 2 & 2 & 1 & 1 \\ 0 & 0 & 2 & 2 & 2 \\ 0 & 0 & 0 & 0 & 2 \end{array}\right)$ f. $\left(\begin{array}{cccc:c} 4 & 8 & 1 & 1 & 2 \\ 0 & 0 & 2 & 1 & 1 \\ 0 & 0 & 2 & 2 & 2 \end{array}\right)$ g. $\left(\begin{array}{cccc:c} 0 & 0 & 0 & 1 & 1 \\ 4 & 0 & 1 & 1 & 2 \\ 0 & 0 & 0 & 10 & 10 \\ 0 & 0 & 0 & 2 & 2 \end{array}\right)$ h. $\left(\begin{array}{cccc:c} 0 & 0 & 0 & 2 & 2 \\ 4 & 0 & 1 & 1 & 2 \\ 0 & 8 & 0 & 1 & 1 \\ 0 & 0 & 0 & 2 & 10 \end{array}\right)$