T. Henson

Math 7 Elementary Linear Algebra
INTRODUCTION TO MATLAB
1. DEFINING A MATRIX; REDUCED ROW-ECHELON FORM

Commands learned:

- How to define a matrix
- rref
- rats
- format long and format short
- Matrix concatenation

Every object in MatLab is a matrix.

Defining a Matrix. To define the matrix

$$A = \begin{bmatrix} 3 & 1 \\ 5 & 7 \\ 2 & 4 \end{bmatrix}$$

In MatLab, enter

$$A = [3\ \ 1;5\ \ 7;2\ \ 4]$$

It is important to put spaces between the numbers. A semicolon is used to signal the end of a row.

Suppressing Output. If the matrix is very large, you can suppress the output by typing a semi-colon at the end of the line.

Reduced Row-Echelon Form. To obtain a matrix in reduced row-echelon form, use the built-in command **rref**. First define the matrix you want to reduce, then enter

rref(*matrixname*)

Exercise: Enter the matrix

$$A = \begin{bmatrix} 3 & 1/3 & 4/5 & 7 \\ 0.2 & 7 & 0 & 11 \\ 2 & 4/3 & 8 & 0 \end{bmatrix}$$

and use **rref** to obtain the reduced row-echelon form of the matrix. Notice that the entries in the fourth column are in decimal form. You can obtain answers in rational form by using the rats command. Typing

rats(**rref**(*matrixname*))

will produce a matrix with entries in rational form.

You can assign the reduced matrix to a new name by using the command

B=rref(*matrixname*)

(where B is the name of the reduced matrix. Of course, you can use whatever name you want.)

On a separate piece of paper, write down the reduced matrix, with the entries in rational form. Assuming *A* is the augmented matrix of a system of linear equations, what is the solution of the system? Turn in this paper with your name and MatLab1 written on it.

Precision. You can obtain greater decimal accuracy (more significant digits) by using **format long**. You execute this command before entering the **rref** command. Executing the MatLab command **format short** returns you to the standard format.

Concatenation of Matrices. The linear system

$$\begin{array}{ccccccc} x & - & 2y & + & 3z & = & 4 \\ 2x & + & y & - & z & = & -3 \\ 5x & + & 3y & + & z & = & 0 \end{array}$$

Has three matrices associated with it: the coefficient matrix, the constant matrix (right-hand side), and the augmented matrix of the system. When solving a linear system by Gaussian or Gauss-Jordan elimination, we work with the augmented matrix of the system. If the coefficient and constant matrices have been previously defined in MatLab, we can easily form the augmented matrix of the system by matrix concatenation.

Exercise: Define the coefficient matrix, A, and matrix of constants, B, for the linear system above by defining these matrices in MatLab.

$$A = \begin{bmatrix} 1 & -2 & 3 \\ 2 & 1 & -1 \\ 5 & 3 & 1 \end{bmatrix} \qquad B = \begin{bmatrix} 4 \\ -3 \\ 0 \end{bmatrix}$$

Form the augmented matrix *C* of the system by entering

$$C = [A \;\; B]$$