**Math 337 – Spring 2008 MATLAB Assignment 1**

In this introductory MATLAB assignment you will review or learn (1) to save a record of a MATLAB session, (2) to enter column vectors, (3) to compute linear combinations in the standard way, (4) create a matrix having a given set of columns, (5) compute linear combinations using matrix-vector multiplication, and (6) invert a digital image using simple matrix operations.

**Getting Started** To begin you should open a MATLAB window. For most MATLAB commands you can get more information with the `help` command. If MATLAB is new to you try entering the commands `help`, `help help`, and `help general`.

To save a record of your MATLAB session enter the command `diary matlab1`. This command will start saving a record of your MATLAB session in the file named "matlab1."

**Project 1: Basics and Linear Combinations**
**Problem 1** Enter the following three column vectors into the MATLAB command window: $\mathbf{x} = (1, 2, 3)$, $\mathbf{y} = (1, 0, 1)$, $\mathbf{z} = (1, -1, 0)$. Hint: You may enter $\mathbf{x}$ as `x=[1 2 3]'` or `x=[1; 2; 3;]`. Once you have entered these column vectors they are stored in the MATLAB system and available for your use. See the `whos` command for more information about the available variables in MATLAB.

**Problem 2** Compute the following linear combinations:
(a) $\mathbf{w} = 3\mathbf{x} + \mathbf{y} - 2\mathbf{z}$ (`w=3*x+y-2*z`)
(b) $\mathbf{u} = \mathbf{x} + \mathbf{y} + \mathbf{z}$
(c) $\mathbf{v} = \mathbf{x} - \mathbf{y} + \mathbf{z}$

**Problem 3** Create a matrix $A$ having $\mathbf{x}$, $\mathbf{y}$ and $\mathbf{z}$ as columns. (`A=[x y z]`)

**Problem 4** Find column vectors $\mathbf{a}$, $\mathbf{b}$ and $\mathbf{c}$ such that $\mathbf{w} = A\mathbf{a}$, $\mathbf{u} = A\mathbf{b}$, $\mathbf{v} = A\mathbf{c}$. Enter each of these vectors into MATLAB. (Hint: $\mathbf{w}$ is a linear combination of columns of $A$.)

**Problem 5** Compute $\mathbf{u} - A\mathbf{b}$.

**Project 2: Digital Image Processing and Linear Algebra**
**Introduction:** Every digital image can be represented as a matrix. The operations that can be applied to a matrix in Linear Algebra can also be applied to an image. A digital image is an image that has been quantized, that is, given a specific numeric value for its intensity for each representative pixel. The intensity is based upon a representative numeric value scale. There are three types of digital images: Black and White, Grayscale, and Color. For a grayscale

image, 0 is black and 255 is white. Any value in between is a shade of gray. Color images can be represented the same way as grayscale images except that instead of dealing with one matrix with values between 0 and 255, there are three matrices (red, blue, and green) with numeric values between 0 and 255. Type `help images` to learn more about image processing in Matlab.

**Problem 6** (1) Download the Matlab M-file "invimage.m" and the JPG file "flower.jpg" into the Matlab working directory. (Note: you may use any other grayscale image file instead of "flower.jpg". But remember to change the name of the JPG file correspondingly in your code.)
(2) Type "invimage" in your matlab command window. (Note: I strongly recommand you also try to type each line of the M-file without semicolon to see the action of each command line. But please do so in another session since otherwise the record would be too long.)
(3) Print out the figure and two JPG image files.

**Finishing Up** Conclude your record with the command `diary off`. Print the record of your session. Submit the printed record and three figures to your instructor for grading.

**Honor Code** You may receive help from other students in completing this assignment. However, you must create the session record submitted for this assignment in one session without coaching or help from others during the session. Write and sign the following statement on your submission: *I created this record in one session without coaching or assistance from others during the session.*