Introduction to MATLAB

In this lab, we will begin to use MATLAB. You must hand in everything that is underlined.

1. Learn how to invoke MATLAB and familiarize yourself with the `help` command. Typing `help` gives you a list of all help topics. Typing `help` *`topic`* gives help on specific MATLAB function. Use the help command to learn about the `diary` command. Use the `diary` command to produce a text file containing the results of typing `help help`. Hand in a hardcopy of this file.

2. Be sure to try some of the built-in demos in matlab. Type `demo` to see the choices. Try out the ones on basic MATLAB commands such as convolution.

3. Scan the following sections of the MATLAB tutorial (`http://www.isr.umd.edu/~austin/ence202.d/matlab.html`):

   - Getting Started
   - Variables
   - Variable Arithmetic
   - Matrices

4. Perform the following operations in MATLAB:

   (a) Generate the following *column* vectors as MATLAB variables:

   $$x = \begin{bmatrix} 2 \\ 4 \end{bmatrix}, \quad y = \begin{bmatrix} 6 \\ 8 \end{bmatrix}$$

   (b) Using the computer, issue the following MATLAB commands: (Turn in a `diary` of the result of each command).

   i. `x * y'`
   ii. `x' * y`
   iii. `x .* y`

   (c) Answer the following questions:

   i. Justify the dimension of the matrix produced by each of the above commands.
   ii. Illustrate your answer by computing each result by hand.

5. In this exercise, we will learn to plot a continuous-time function by creating a MATLAB vector of *samples* of the function.

   Let $x(t) = A\cos(2\pi f_0 t)$, where $A = 20$ volts and $f_0 = 1$ MHz. We wish to form the MATLAB vector of *samples* of $x(t)$ as

   $$y[n] = x(nT_s),$$

   where T_s is chosen such that we get exactly 12 samples/period of $x(t)$.

(a) Create a MATLAB vector y containing samples (at 12 samples/period) of 10 periods of $x(t)$. (Therefore, your vector should have a total of 120 elements.)

(b) Plot the vector y. Label both axes and title the plot. *Hint:* read the MATLAB `help` for the commands `plot`, `xlabel`, `ylabel`, and `title`.

6. Generate new vector representing the signal

$$z(t) = x^2(t)$$

Using the MATLAB `subplot` command, produce a single page containing the following two plots:

(a) $x(t)$ (Top plot)

(b) $z(t)$ (Bottom plot)

Again, be sure to label all axes of both plots.

7. One of the strengths of MATLAB is that most of its commands work with complex numbers. Perform the following computations in MATLAB:

(a) Compute the value of j^j. Is the result what you expect?

(b) Using the `polyval` command, evaluate the polynomial

$$P(x) = 4 + 3x^3 - (1 - j)x$$

at $x = j^j$.

The lab assignment should be neatly completed and turned in as a report with all questions answered. The report need not be typed but should be clear and easy to follow. All graphs and other MATLAB results should be annotated (it is acceptable to annotate by simply writing on the printouts) with the question number to which they refer.