EE-384 **Introduction to MATLAB**

Problem 1:

1.1) What is the result of:

a) a+b
b) a*b
c) a.*b

where ‘a’ and ‘b’ are column vectors

$$a = \begin{bmatrix} 2 \\ 5 \\ 8 \end{bmatrix} \; and \; b = \begin{bmatrix} 3 \\ 13 \\ 8 \end{bmatrix}$$

1.2) Repeat 1.1 but with ‘a’ as a matrix

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

Turn in your answer.

Problem 2:

Plot following functions in the same plot (overlay)

$$y_1 = \cos(t)$$

$$y_2 = \sin(t)$$

where ‘t’ is a vector from 0 to 50 with the increasing step:

a) 1
b) 0.01

Do the signals look smoother when we reduce the increasing step? Turn in your answer, plots, and codes.

Problem 3:

Write a program to solve the system of equations of three variables using the matrix inverse method. The program should include user prompt to input equation coefficients. The general form of a three-variable equation is $ax + by + cz = d$. Assume that the users have to give the coefficients in the order ‘a’, ‘b’, ‘c’, and ‘d’. Test your program with the following system of equations:

$$2x + 3y + z = 3$$

$$x + 3y - z = 6$$

$$2x + 2y = 7$$

Turn in your code and result from the Matlab command window.

Hints: Note that from Linear Algebra theory, you can solve the system of equations using matrix inverse method by the following steps:

Step 1: Rearrange the equations so that all of them have the form of $ax + by + cz = d$

Step 2: Write the equations in matrix form $A * t = b$

Step 3: The result is $t = A^{-1} * b$

A^{-1} is the inverse matrix of A and could be computed in Matlab by using the command inv(A).

Problem 4:

Write an M-file program to calculate:

$$y = \frac{\log(1 + \mu|x|)}{\log(1 + \mu)} * sign(x) \qquad (\mathbf{1.4})$$

where 'log' is the natural logarithm function, 'sign' is the signum function.

The program must include a user prompt to input the parameter 'μ' and input 'x'. Note that 'x' can be either a scalar number or a vector. The above equation shows the input-output characteristic of a μ-law compressor used in pulse-code modulation (PCM).

Test your program by plotting 'y' according to 'x'. Let μ=255 and 'x' is a vector changing from 0 to 1 with the increasing step 0.01. Turn in your code and plot. Keep a copy of your code, you will need it later.