Matlab and Number Systems

DUE: Tuesday, January 21, Start of class

Part I – Matlab

Preamble

I don't expect that you come into this class with mastery of Matlab, but I do assume that you have used it in a previous class or lab. This homework exercise is to give me (and you) confidence that you can use Matlab to accomplish basic signal acquisition, analysis, and presentation of data.

Objective

Verify competence with Matlab.

To Do

1) Vertical motion under gravity

   If a stone is thrown upward with an initial speed of v_0, its vertical displacement s after an elapsed time t is given by the formula

   $$s = v_0 t - g t^2 / 2$$

   Assuming a non-zero value for v_0, compute the value of s over a period of 15 seconds at intervals of 0.1 seconds, and plot the distance-time graph. Use appropriate scale, axes labels, and plot title.

2) Create an array of time vs. position. Make the x-axis 100 data points at 1 second intervals. Make the y-axis position data reflecting your approximate personal walking step size (in inches).
   a. Making sure that your y-coordinates are position with respect to the starting point, make a plot in Matlab with appropriate labels. Your plot should be linear.
   b. Add random noise to your step size, i.e. have your step size vary randomly by ± 10%. Plot.
   c. From your position vs. time data, create a velocity vs. time graph. Plot.
   d. From your velocity vs. time data, create an acceleration vs. time graph. Plot.
   e. Answer this question thoughtfully: What did you expect to see on the velocity and acceleration graphs and what did you get in your actual plots?

3) From your data in 2.b above, determine linear calibration coeeficients (slope and y-intercept) to apply to the generated data.

Part II – Number Systems

1. Convert the following binary numbers to decimal numbers:

   a) 101101   b) 11101010   c) 1000000000

2. Convert the following decimal numbers to binary numbers:

   a) 201   b) 4013   c) 65335

3. How many binary digits are required to represent the following decimal numbers?

   a) 17   b) 254   c) 9999

4. Convert the following binary numbers to hexadecimal numbers:

   a) 101101011111   b) 101101101   c) 111111111111

To Turn In

- **This page** stapled to printouts of your Matlab code and your Matlab plots, and your answers to the other questions. Do this in accordance with the School of Engineering guidelines found on the course web page.