ABOUT THE LAB:

The main goal of this lab is to familiarize you with a Matlab. A number of on-line resources are also given to you as a reference for future labs. We will complete Exercise 1 together. You will need to turn in your responses to Exercise 2 on Moodle.

EXERCISES:

Exercise 1. We will do this exercise together. You will not turn in your work from this exercise.
(a) Getting help in Matlab – online resources, "help" and "lookfor".
(b) Operations on scalars (and order of operations).
(c) Defining vectors and matrices, finding rows, columns and portions of matrices.
(d) Some matrix operations.
(e) Graphing functions and editing graphs.
(f) Writing if- for- and while-loops.
(g) User-defined Matlab functions.
(h) A few words about turning in your work.

Exercise 2. In the paper "Biomechanics of quadrupedal walking: how do four-legged animals achieve inverted pendulum-like movements?" (Journal of Experimental Biology 207, 3545-3558 (2004)) Griffin, Main and Farley derive a model of displacement of the center of mass given by the following formula:

$$z_{com} = M_h \cos(\omega t) + M_f \cos(\omega t - \theta').$$

In this formula, M_h and M_f refer to the fraction (0-1) of the hind and fore pendulum, respectively. The constant, ω denotes the pendulum frequency and θ' is the phase-shift between the hind and fore pendulums.
(a) Plot z_{com} as a function of time of $M_h = 0.7$, $M_f = 0.3$, $\omega = 1$ (1/s) and $\theta' = 2$. Label your axes and give your figure a title.
(b) Vary the phase-shift, θ' between the hind and fore pendulums. Plot 3 figures on the same graph for 3 values of θ'. (Indicate which values of θ' were used. Explain your figure.
(c) Using the baseline value of θ', change the pendulum frequency. Again plot 3 curves on the same graph, label and again explain how z_{com} changes with θ'.
(d) Imagine that the fraction of of the hind and fore pendulum shifts during walking. Find the period of one step (using baseline values of ω and θ'). Assume that during the first half of the period (ie. while z_{com} is decreasing), M_f is decreasing from 1 to 0, then, as z_{com} increases, so does M_f. (Also assume that $M_h + M_f = 1$.) Plot z_{com} using these assumptions.
(e) Write a Matlab function that *for any values of* ω and θ sets $M_f = 0.7$ when z_{com} is decreasing and $M_f = 0.3$ when z_{com} is decreasing and plots z_{com}. Include the function and a figure generated by your script as your response to this question.