CS475 Spring 2006
Homework 4

Due Date: Friday April 21 2006

Problem 1

Extend the Kalman Filter example we used in the class with the robot moving around trying to estimate its position. To make it more realistic, include velocities in the state.

Currently, there are two components in a state: x and y position. Include also velocities in these two directions, so the new state space will be $< x, y, v_x, v_y >$. You will have to change the transition matrix (so that it correctly reflects the fact that in each timestep, the robot moves by v in each direction), but let the sensor input still only be its position (the robot has no way of telling its speed). Let the speed be constant during the simulation, but make the initial estimate slightly inaccurate. You will no longer need any control input (which is as of now used to move the robot around).

Use the `sigmaEllipse.m` files to do this (the second is only to draw ellipses, you will not need to change anything in that one). Read the comments in the file, and possibly the Kalman Filter writeup.

Play around with it and see if it's doing what you would expect. Try changing uncertainties (entries in covariance matrices) of various components. Please turn in your code (only the `kal_fil.m` file of course or any other you might add), picture of the simulation run, plot of estimations of the velocities versus timestep, plus some comments about how you did it and what you had to change.

If you need something to get you started in Matlab, there are tons of tutorials: just Google "matab tutorial". This one
`http://www.math.mtu.edu/~msgocken/intro/intro.html` seems to be a nice compromise between brevity and information content (first few sections should be enough)

Problem 2

Problem 15.9 from AIMA book.

Problem 3

Problem 16.2 from AIMA book.

Problem 4

Problem 16.11 from AIMA book.