Assignment 4 - (15 points)

Due before the beginning of class on Wednesday the 8th

Your assignment is to implement a filter to process the 3d sensor observations from the previous assignment (`A3-MeasurementData.bin`). Recall that the sensor's error covariance matrix is:

$$\begin{matrix} \mathbf{1} & \mathbf{1} & \mathbf{1} \\ \mathbf{1} & \mathbf{2} & \mathbf{2} \\ \mathbf{1} & \mathbf{2} & \mathbf{3} \end{matrix}$$

You will maintain your estimate in mean and covariance (i.e., *state space* rather than *information*) form using the innovation form of the fusion equations. In your code you will use the variables x and P for your filter's running mean and covariance estimate (the system estimate) and z and R for each observation mean and covariance (the *observation estimate*).

DELIVERABLE

Submit a report (PDF form, as always) containing the following:

1. The first observation mean vector z and the square root of its covariance matrix R.

2. Your final mean x and the square root of your final covariance P after processing the 100k measurements.

3. Three plots showing the innovations in x, y, and z, respectively, with the +/- square roots of their respective innovation variances (i.e., diagonal elements of the innovation covariance S).

4. A plot of the Euclidean distance of your mean estimate to the known ground truth position of the beacon (**12.9   130.4   23.5**) and the square root of the sum of the eigenvalues of your covariance matrix. Be sure to label all of your plots. For example, this plot could be labeled something like "*Distance between estimated position and ground truth (red) vs. expected distance (blue)*".

You may choose to only plot results for the first 50 or 100 (or whatever number makes the plots look best) observations – *because plotting all 100k of them probably won't look too good!* Regardless of your choice, your final mean and covariance in #2 above will be the result of filtering all 100k observations.