Assignment 7 - (25 points)

Your assignment for Monday, November 10th, is to implement routines necessary to estimate the state of a target moving with constant velocity in 2D based on a sequence of 2D observations in the same coordinate frame.

I have provided datasets for two different targets. Both contain observations in the following form:

timestamp *x* *y* R*xx* R*xy* R*yy*

where *timestamp* represents the time (in seconds) at which the observation was made, (*x*, *y*) is the observed position of the target, and the last three values define sqrtm(R) for the observation covariance R.

For the first dataset, `Target1.txt`, you will report the following:

- The state of the target at the time of the final observation. You will provide this information in two forms: the state variables with their associated standard deviations and the full mean and covariance estimate.
- Your prediction of the state of the target one hour after the time of the final observation.
- A plot of the sequence of normalized *x* innovations, i.e., (z-x)(1)/sqrt(S(1,1)), and a separate plot of the normalized *y* innovations.
- The percentage of x innovations that are less than zero, and the same for y. Alternatively, for an extra credit point you may plot (for both datasets) the running percentage of the x and y innovations that are less than zero.

For the second dataset, `Target2.txt`, the motion of the target deviates slightly from true constant velocity in a manner similar to the way an aircraft might deviate from intended constant velocity during mid-course flight. To account for this you will need to add a process noise covariance matrix Q=q*$\mathbf{I}$*Δt to your predictions. You will have to determine the appropriate value of q based on innovation information. In other words, you will run your filter and assess whether the innovations are consistent. If not you will need to adjust q, run the filter again, and repeat until your innovation information suggests that the filter is working correctly.

For the second dataset you will report your chosen value for q and justify it by providing the same information as you did for the first dataset both with and without q.

As always, your report should be in PDF form submitted prior to the beginning of class on the due date. Remember to include your code in an appendix at the end of the report. Also remember to appropriately adjust the scale of your plots and the precision of your numbers.