Kyle Elbaum and Nicholas Lum
CS 440 MP5 Report

a.1) >

$$\begin{bmatrix} x_{1,k-1} \\ x_{2,k-1} \end{bmatrix} = \begin{bmatrix} z_{1,k} \\ z_{2,k} \end{bmatrix} - \begin{bmatrix} u_{1,k-1} \\ u_{2,k-1} \end{bmatrix} - N(0,Q) - N(0,R)$$

$$x_k^- = \begin{bmatrix} x_{1,k} \\ x_{2,k} \end{bmatrix} = \begin{bmatrix} x_{1,k-1} \\ x_{2,k-1} \end{bmatrix} + \begin{bmatrix} u_{1,k-1} \\ u_{2,k-1} \end{bmatrix}$$

$$P_1^- = P_0 + Q = 0 + Q \longrightarrow P_k^- = P_{k-1} + Q$$

Time update

$$K_k = \frac{P_k^-}{P_k^- + R}$$

$$\downarrow$$

$$x_k = x_k^- + K_k(z_k - x_k^-)$$

$$\downarrow$$

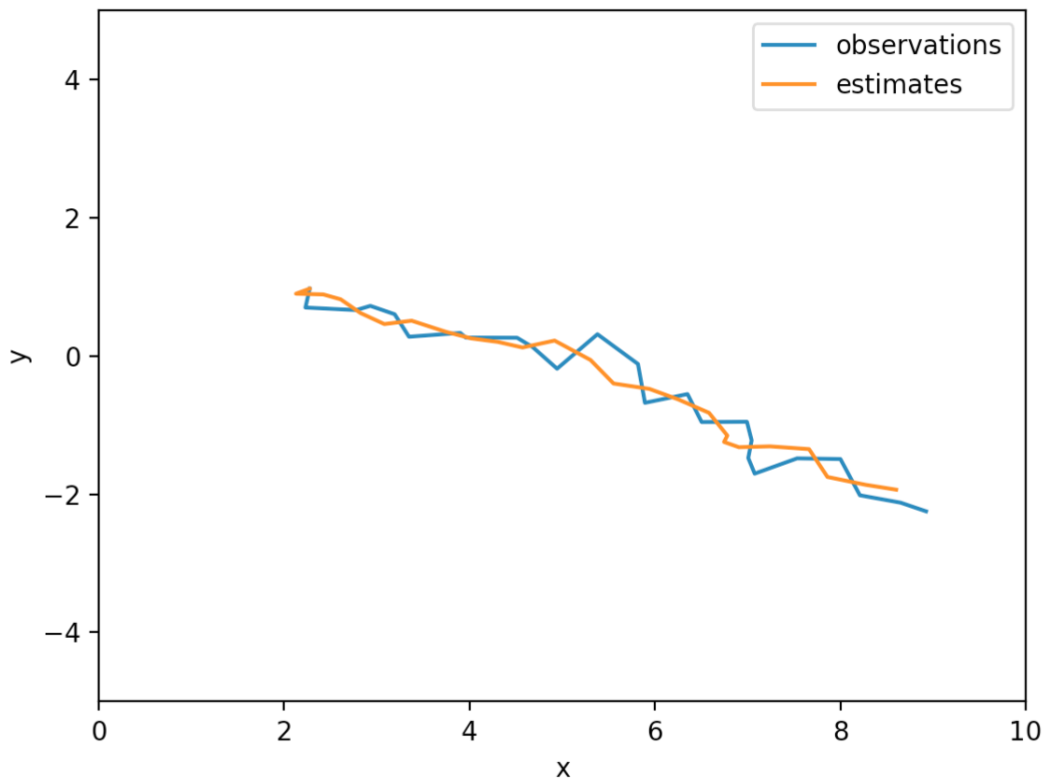
$P_k = (I - K_k)P_k^-$ where I is identity matrix

Measurement Update

$$x_k^- = x_{k-1} + u_{k-1}$$
$$P_k^- = P_{k-1} + Q$$
$$K_k = \frac{P_k^-}{P_k^- + R}$$
$$x_k = x_k^- + K_k(z_k - x_k^-)$$
$$P_k = (I - K_k)P_k^-$$

$$P_{k-1} \leftarrow P_k$$
$$x_{k-1} \leftarrow x_k$$

a.4) Having a higher lambda in P = $\lambda * I$, We went with a lambda of 1,000,000 because we needed a large P capable of getting a better Kalman gain at each iteration. Given the data from the "data.txt" and using this P, we were able to receive accurate results of the filter with the graph below.



b.2) We decided to use the predicted positions from the kalman filter to shoot after 150 iterations.