Bayesian Filtering and Smoothing: Exercise Set 5

1. Consider the simulation and filtering of the Gaussian random walk shown in lecture 5. Using cov, find the empirical covariance of 2000 realisations of the filter error $x_7 - m_7$. (It should be close to P_7.)

2. (continued) Find the empirical covariance of the error $x_7 - m_7$ of the stationary Kalman filter.

3. Consider the simulation and filtering of the discrete random walk velocity model in problems 4–6 of exercise set 3. Using cov, find the empirical covariance matrix of 2000 realisations of the filter error $\mathbf{x}_{17} - \mathbf{m}_{17}$. (It should be close to $\mathbf{P}_{17}$.)

4. Textbook problem 4.6(a)

5. Textbook problem 4.6(b)

6. Show that Joseph's update formula

$$\mathbf{P}_k = (\mathbf{I} - \mathbf{K}_k \mathbf{H}_k) \mathbf{P}_k^- (\mathbf{I} - \mathbf{K}_k \mathbf{H}_k)^\mathsf{T} + \mathbf{K}_k \mathbf{R}_k \mathbf{K}_k^\mathsf{T}$$

is equivalent to the conventional Kalman filter covariance update formula on page 57.