CSCE574 – Robotics
Spring 2014 – Homework 11

Assigned: April 10
Due: April 15

name

A robot moves through a one-dimensional state space $X = \mathbb{R}$ by choosing actions from a one-dimensional action space $U = \mathbb{R}$. The state transition function is

$$x_{k+1} = x_k + 2u_k + 3\theta_k,$$

in which the noise value θ_k is selected randomly from a Gaussian distribution with mean 0 and variance 0.5. At each time step, the robot receives an observation from a one-dimensional observation space $Y = \mathbb{R}$, according to the observation function

$$y_k = x_k + 4\psi_k,$$

in which the noise value ψ_k is selected randomly from a Gaussian distribution with mean 0 and variance 1.5. At a certain time step, the robot knows that its most likely state is $\mu_k = 5$, with variance 0.3. The robot receives an observation $y_k = 7$ and executes an action $u_k = 0.5$.

Using the Kalman filter, **compute** the most likely value μ_{k+1} of x_{k+1} and the variance Σ_{k+1} of that estimate. Show your work.

Hint: For a 1×1 matrix $M = [a]$, the transpose is $M^\top = [a]$ and the inverse is $M^{-1} = [1/a]$. The 1×1 identity matrix is $I = [1]$.