

### HOMEWORK 3

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**Problem 1.** Consider one-dimensional Kalman Filter without process noise to solve the following problem.

Assume that we would like to estimate the height of a building using an imprecise altimeter. We know that building height doesn't change over time, at least during the short measurement process. Thus, the dynamic model is given by

$$\hat{x}_{n+1,n} = \hat{x}_{n,n},$$

$$p_{n+1,n} = p_{n,n}.$$

The true building height is 50 meters. The altimeter measurement error (standard deviation) is 5 meters. The ten measurements are: 49.03m, 48.44m, 55.21m, 49.98m, 50.6m, 52.61m, 45.87m, 42.64m, 48.26m, 55.84m.

Given the initial guess as follows:

$$\hat{x}_{0,0} = 60m,$$

$$p_{0,0} = 225.$$

(a) Write a MATLAB program to find the state estimates and estimate uncertainties.

(b) Fill in the state estimates and estimate uncertainties in the following table.

$n$	1	2	3	4	5	6	7	8	9	10
$z_n$	49.03m	48.44m	55.21m	49.98m	50.6m	52.61m	45.87m	42.64m	48.26m	55.84m
$\hat{x}_{n,n}$										
$p_{n,n}$										

(c) Plot the true value, measured values, estimates, and 95% confidence intervals.

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